Renewable Energy Questions and Answers – Importance of Non-Conventional Energy Sources

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This set of Renewable Energy Multiple Choice Questions & Answers (MCQs) focuses on "Importance of Non-Conventional Energy Sources".

1. World Energy Needs are rising due to _____
a) deforestation
b) increasing population and Industrialization
c) inflation
d) natural calamities

View Answer

Answer: b
Explanation: The increasing world population has caused the world energy needs to rise significantly. Apart from the rapid growth of industries, the formation of new ones has increased the energy needs of the world. Due to these reasons, Conventional sources of energy are not enough, and hence we need alternative energy sources.

2. Which of the following is a disadvantage of Hydro Power?
a) They cause deforestation and affect wildlife
b) They cause harmful emissions
c) They are an unstable source of energy
d) They are not suitable for long-distance electricity transmission

View Answer

Answer: a
Explanation: For building Hydroelectric dams, a large area is required for which deforestation is done to clear the area which affects the local wildlife. Sometimes Dams also cause floods in Forests which damages it. Building a dam also affects the aquatic life.

3. Which of the following statement is true about conventional energy sources?
a) They cause minimum pollution
b) They are available in limited quantity
c) Coal is the most used conventional energy source in the world
d) There are sufficient reserves of Coal, Petroleum and Natural gas for the next 300 years

View Answer

Answer: b
Explanation: Conventional energy sources like Coal, Petroleum, Natural gas, etc, are major causes of pollution and ozone layer depletion. There are limited reserves of conventional energy sources, which are bound to be finished. At the current rate of consumption, the approximate lifetime of the world's petroleum, natural gas, and coal reserves are 50 years, 52.8 years, and 153 years, respectively. Oil is the most used energy source in the world. At present 31 percent of the world energy needs are fulfilled by Oil.

4. All of the conventional energy sources are Non-Renewable.
a) True
b) False

View Answer

Answer: b
Explanation: Apart from Hydro Power, all other Conventional energy sources are Non-renewable. In Hydropower generation flowing water is used to generate electricity. It is considered a renewable energy source because the water cycle is constantly renewed by the sun.

5. To focus on Renewable and Other alternative sources of energy, _____ was established in March 1981 by the Government of India.
a) commission for additional sources of energy
b) commission for alternative sources of energy
c) council of scientific & industrial research
d) centre for science and environment

View Answer

Answer: a
Explanation: Realizing the importance of Non-Conventional energy sources, in March 1981 the government of India established a Commission for Additional Sources of Energy (CASE), in the Department of Science and Technology. Council of Scientific & Industrial Research (CSIR) was established in September 1942 to bring Science and Technology to India. CSE (Centre for Science and Environment) was established in 1980 and works on environment-development issues in India.

6. IREDA was developed by the Government of India _____
a) to implement more efficient methods for using Conventional Energy sources
b) to promote the Development of Non-Conventional Energy Sources
c) to develop Nuclear Energy in India
d) to control pollution

View Answer

Answer: b
Explanation: Indian Renewable Energy Development Agency Ltd (IREDA) was established in 1987 to promote the use of Non-Conventional sources of energy. It is operated by the Ministry of New and Renewable Energy (MNRE).

7. Apart from supplying energy, fossil fuels are used for_____
a) storing energy in solar ponds
b) drying Vegetables
c) rotating turbine in Hydro Power plants
d) manufacture of Organic Chemicals

View Answer

Answer: d
Explanation: Solar pond collects thermal energy from sunlight. The salt content of the pond increases with depth. It doesn't require any fuel for storing energy. Apart from fulfilling energy needs, fossil fuels are also used as feedstock materials for the manufacture of organic chemicals. Solar dryers are used to dry foods i.e. Fruits, Vegetables, etc. In Hydroelectric power plants, turbines are rotated by the Kinetic Energy of water.

a) India
b) Bangladesh
c) USA
d) China

View Answer

Answer: a
Explanation: India is the only country having a full-fledged ministry devoted to Developing New and Renewable Energy Sources. Ministry of New and Renewable Energy or MNRE is a ministry of the Government of India. The ministry was established as the Ministry of Non-Conventional Energy Sources in 1992.

9. CASE was established after the Oil Crisis of 1973.
a) True
b) False

View Answer

Answer: a
Explanation: The Energy Crisis of the 1970s i.e. Oil crisis of 1973 and Energy Crisis of 1979 caused a shortage of petroleum (and other commonly used sources) and elevation in its price. This led to the establishment of the Commission for Additional Sources of Energy (CASE) in the Department of Science & Technology (India) in March 1981. It involved the formulation of policies, their implementation, and Research and Development in the field of New and Renewable energy sources.

c) KUSUM
d) JWALA

View Answer

Answer: c
Explanation: Ministry of New and Renewable Energy(MNRE) launched the Kisan Urja Suraksha evem Utthan Mahabhiyan (KUSUM) scheme for farmers for installation of solar pumps and grid-connected solar and other renewable power plants in the India. This scheme was launched with the aim to promote solar farming in India. Its launch was approved on 19 February 2019 by the Cabinet Committee on Economic Affairs(CCEA).

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Renewable Energy Questions and Answers – Advantages and Disadvantages of Conventional Energy Sources

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This set of Renewable Energy Multiple Choice Questions & Answers (MCQs) focuses on "Advantages and Disadvantages of Conventional Energy Sources".

1. Conventional Energy Sources are cheaper than Non-Conventional Sources.
a) True
b) False

View Answer

Answer: a
Explanation: At present Conventional Energy Sources are cheaper than Non-Conventional sources. Since the Non-Conventional sources are relatively new in terms of usage, the technology for harnessing energy from these sources is not well developed. The cost/kWh of electrical energy obtained from different conventional sources are as follows:
Coal- 1.65 ₹/kWh
Diesel- 3.00 ₹/kWh
Hydropower- 1.00 ₹/kWh
Nuclear – 1.20 ₹/kWh
which is less than the cost/kWh of the non-conventional sources.

2. Which of the following pollutants are emitted by the burning of fossil fuel?
a) Oxides of Carbon, Nitrogen, and Sulphur
b) Oxides of Carbon, Uranium, and Radium
c) Calcium Halides and Oxides of Nitrogen
d) Noble Gases

View Answer

Answer: a
Explanation: Fossil fuels generate Oxides of Carbon like CO and CO_2, Oxides of Nitrogen like NO and NO_2, and Oxides of Sulphur like SO_2 and SO_3. Apart from that particulate matter and heat is also generated by fossil fuels.

3. _____ is a petrochemical and is used as raw material for chemical, pharmaceutical, and paint industry.
a) Plutonium
b) Uranium
c) Coal
d) Protactinium

View Answer

Answer: c
Explanation: Coal is a valuable petrochemical and is used as a raw material in many industries i.e. Chemical, Pharmaceutical, and Paint industry. From a long-term perspective, it is essential to conserve coal for future needs as a raw material.

4. Which of the following statements is not true about radioactive waste?
a) It has radioactivity quotient of dangerous levels.
b) The disposed radioactive waste is to be guarded for a long period
c) It has low radioactivity quotient
d) Its radioactivity decreases with time

View Answer

Answer: c
Explanation: The waste generated in Nuclear power plants has radioactivity quotients of dangerous levels, it remains above the safe limit for a long time, and this is a health hazard. The radioactive waste is to be guarded for a long time until its radioactivity level comes to a safe limit.

5. Which of the following is not a disadvantage of Hydro Power?
a) A large land area submerges into the water leading to deforestation
b) It causes dislocation of a large population and rehabilitation
c) It causes ecological disturbances like earthquake
d) It causes calamities like landslides

View Answer

Answer: d
Explanation: To clear the land area deforestation is done and sometimes it is needed to dislocate the local people to clear areas for dams. Large dams have abilities to trigger earthquakes. The earliest Dam Induced Earthquake was observed in Algeria in 1932.

c) biogas plants
d) mining of fossil fuels

View Answer

Answer: b
Explanation: Due to various hazards associated with Nuclear Energy Sweden banned New Nuclear power plants since 1984 and has plans to dismantle the existing plants.

7. Which Oxides of Nitrogen are generated by burning of fossil fuel?
a) NO and NO_2
b) NO_2, NO_3, and N_2O_5
c) N_2O_5 and N_2O_3
d) NO_3 and N_2O_5

View Answer

Answer: a
Explanation: Burning of fossil fuels cause emission of Nitrogen Oxides. NO and NO_2 are the major Nitrogen oxides produced by the combustion of fossil fuel. These oxides cause smog and contribute to acid rain.

8. 3 percentage of the total greenhouse gas emissions are due to Hydropower plants.
a) True
b) False

View Answer

9. Which Uranium isotope is used in nuclear power plants?
a) U-235
b) U-234
c) U-215
d) U-218

View Answer

Answer: a
Explanation: U-235 and U-238 are naturally occurring isotopes of Uranium. U-235 is ideal for Nuclear energy because it splits easily and gives off a lot of energy. U-238, on the other hand, has a longer half life and takes more time to decay. U-215 and U-218 are artificially produced isotopes of Uranium.

10. Based on the following statements, choose the correct option.
Statement I: The technology for harnessing fossil fuels is well developed.
Statement II: Fossil fuels are a cheap source of energy.
a) Statement -I is true, Statement -II is true and Statement -II is the correct explanation of Statement -I
b) Statement-I is true, Statement -II is true and Statement -II is not the correct explanation of Statement-II
c) Statement -I is true and Statement -II is false
d) Statement -I is false and Statement -II is true

View Answer

Answer: b

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Renewable Energy Questions and Answers – Salient Features of Non-Conventional Energy Sources

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This set of Renewable Energy Questions and Answers for Freshers focuses on “Salient Features of Non-Conventional Energy Sources”.

1. _____ energy sources provide energy in dilute form.
a) Non-Renewable
b) Conventional
c) Nuclear
d) Renewable

View Answer

Answer: d
Explanation: Renewable Energy sources are generally unreliable and dilute. These resources are not available constantly. The efficiency of conversion of these energy sources is low, so a large land area is required to concentrate the energy.

2. Non-Conventional Energy sources have a high gestation period.
a) True
b) False

View Answer

Answer: b
Explanation: Non-conventional energy sources require lower time for setting up the power plant as compared to conventional energy sources. Solar power plants and wind power plants have gestation period of 15 months and 1.5 years respectively. On the other hand, thermal power plants have a gestation period of 5-6 years.

3. Based on the following options, choose the correct option.
Statement I: Non-Conventional energy is available in nature free of cost.
Statement II: Non-Conventional energy is exhaustible in nature.
a) Statement I and Statement II are correct and Statement II is the correct explanation of Statement I
b) Statement I and Statement II are correct and Statement II is not the correct explanation of Statement I
c) Statement I is true and Statement II is false
d) Statement II is true and Statement I is false

View Answer

Answer: c
Explanation: Most of the renewable energy sources such as wind and solar energy are available in nature free of cost. They are inexhaustible and cannot be depleted by human activity.

4. The availability of Renewable energy sources is _____
a) uncertain
b) constant
c) high
d) regular

View Answer

Answer: a
Explanation: Renewable energy sources i.e. wind energy, solar energy, wave energy, tidal energy, etc are intermittent in nature. Most of them are non-dispatchable due to their variable nature.

5. The cost of harnessing energy from Non-Conventional Energy sources is low.
a) True
b) False

View Answer

Answer: b
Explanation: Non-conventional energy plants employ expensive equipment. This increases the cost of harnessing energy from them.

6. Which of the following statements is not true about Renewable Energy?
a) They do not cause pollution
b) Their transportation is difficult
c) They cause ecological imbalance

Answer: c
Explanation: Non Renewable energy sources such as fossil fuels cause emission of greenhouse gases which disturb the ecological balance. Renewable energy sources, on the other hand, do not cause ecological imbalance.

7. Renewable energy-based power plants have _____
a) negligible fuel cost
b) low energy availability
c) negligible production capacity
d) fuel storage tanks

View Answer

Answer: a
Explanation: Renewable energy-based plants require negligible to no fuel for their operation. That's why they cause negligible pollution.

8. Renewable energy plants require _____than traditional generators.
a) more fuel
b) less maintenance
c) higher operating cost
d) more uranium

View Answer

Answer: b
Explanation: Renewable energy plants require very little maintenance after installation. Tl

9.Most of the Renewable energy sources are _____
a) location-specific
b) universally available
c) highly efficient
d) polluting

View Answer

Answer: a
Explanation: One of the major limitations of renewable sources is that they are location specific. States without rivers can't have hydropower dams, and states with wind speed less than 23km/hr at 50 m height can't have wind energy plants. Renewable energy sources are not universally available due to their location specificness. They have low efficiency due to their dilute nature. Most of the Renewable energy sources do not require any fuel and hence cause minimum to low pollution.

10. The storage of renewable energy sources is expensive.
a) True
b) False

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Answer: a
Explanation: Due to their intermittent nature, renewable energy sources are needed to be stored. Currently, the storage systems of renewable energy are expensive.

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Renewable Energy Questions and Answers – Environmental Aspects of Energy – 1

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This set of Renewable Energy Multiple Choice Questions & Answers (MCQs) focuses on "Environmental Aspects of Energy – 1".

1. Which of the following has caused global warming since the past 150 years?
a) Anthropogenic greenhouse gas emissions
b) Ice age greenhouse gas emission
c) Emissions of sulphur
d) Emissions of aerosols

View Answer

Answer: a
Explanation: Anthropogenic greenhouse gas emissions is accused of causing global warming especially due to the expansion of industries since the past 150 years. Sulphur and aerosol emissions cool the planet.

c) Releasing CFCs into the atmosphere
d) Melting metals

View Answer

Answer: b
Explanation: Burning fossil fuels for various industrial and domestic processes since the past 100-150 years has led to global warming. Releasing CFCs into the atmosphere damages the ozone layer.

3. What is the major problem with wind energy?
a) Generates energy from wind
b) It is a renewable source of energy
c) Requires large area of land
d) Compact and does not require large area of land

View Answer

Answer: c
Explanation: The major problems with wind energy is that it requires large area of land. It also poses a threat to wildlife habitat like destruction of birds. It is a renewable source of energy because it generates energy from wind.

4. How does acid rain affect the environment?
a) By precipitating clean and fresh rainwater only in freshwater bodies
b) By precipitating clean and fresh rainwater in all water bodies at once
c) By consuming all polluted water and precipitate clean water from water cycle

Answer: d
Explanation: Acid rain is basically rainwater which is acidic. It is caused by dissolution of harmful gases like sulphur dioxide and carbon monoxide in clouds during precipitation thereby polluting the clean rainwater.

5. What is the pH level of acid rain?
a) Between 3-4
b) Between 6-8
c) 7
d) Between 11-14

View Answer

Answer: a
Explanation: Acid rain is acidic. Any acid has a pH value less than 7. So, the pH level of acid rain lies between 3-4. Practically, substances with pH values lying between 6-8 are considered neutral.

6. Which of the following is/are directly harming the atmosphere?
a) Contamination of water bodies
b) Ozone layer depletion and emission of acidic gas
c) Global climate change and contamination of water bodies
d) Land fills and industrial emissions into water bodies

View Answer

Answer: b

7. Which of the following is/are major contributor(s) of acid rain?
a) Sulphur
b) Sulphur and sulphur dioxide
c) Sulphur dioxide and nitrogen dioxide
d) Nitrogen dioxide and argon

View Answer

Answer: c
Explanation: Sulphur dioxide and nitrogen dioxide are major contributors of acid rain. They are released by smelters for nonferrous ores, industrial boilers and vehicles.

8. Which of the following energy sources is affected when energy crops compete with food production?
a) Solar
b) Wind
c) Hydro
d) Biomass

View Answer

Answer: d
Explanation: Biomass energy generation is strongly affected when energy crops compete with food production. Energy crops are specifically grown to be used as energy sources and not for food. If it competes with food crops then its production may decrease.

9. What is a solar cooling technology?

exchanger
c) Sun’s nuclear energy is transferred to a heat transfer fluid which passes through a cold exchanger
d) Sun’s thermal energy is transferred to a heat transfer fluid which passes through a cold exchanger

View Answer

Answer: a
Explanation: A solar cooling technology is a system that transfers sun’s thermal energy to a heat transfer fluid (also called as working fluid). This fluid then passed through a heat exchanger where the heat is moved from one system to another thereby achieving cooling.

10. What does ozone protect the earth from?
a) Sound waves
b) Harmful UV radiation
c) Visible radiation
d) Greenhouse effect

View Answer

Answer: b
Explanation: Ozone protects the earth and its creatures from the harmful UV radiations. These radiations are known to damage the eye and cause many skin diseases.

11. Wind plants affect the habitat of _____
a) tigers

d) fish

View Answer

Answer: c
Explanation: Win plants affect the habitat of birds and bats. They tend to obstruct the path of birds. In fact, this may even result in killing them.

12. Which of the following is an example of a nuclear accident?
a) Construction of dams
b) Burning of fossil fuels
c) Nuclear fusion
d) Nuclear reactor core melt

View Answer

Answer: d
Explanation: Nuclear reactor core melt is an example of a nuclear accident. Nuclear fusion is a type of nuclear reaction. Construction of dams and burning fossil fuels are not examples of nuclear accidents.

13. What happens when a nuclear reactor core is damaged?
a) Significant amounts of radioactive isotopes are released
b) Significant amounts of radio-inactive isotopes are released
c) Significant amounts of nitrogen oxides are released
d) Greenhouse gases are released

View Answer

Answer: a
Explanation: When a nuclear reactor core is damaged significant amounts of radioactive isotopes are released. These isotopes are extremely harmful to both, humans and environment. In fact, they may cause diseases that last for generations.

14. Aerosols, CFCs and freons damage the ozone layer.
a) True
b) False

View Answer

Answer: a
Explanation: Aerosols, CFCs and freons damage the ozone layer. They react with ozone molecules and reduce the amount of ozone molecules in the stratosphere. This lets harm UV radiation into earth.

b) False

View Answer

Answer: a
Explanation: Dams and reservoirs lead to adverse environmental and sociological impacts. Construction of dams destroys aquatic habitat and affects the life in coastal areas. For instance, migratory fishes are prevented from their journey which immensely affects the population of the species.

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Renewable Energy Questions and Answers – Environmental Aspects of Energy – 2

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This set of Renewable Energy Multiple Choice Questions & Answers (MCQs) focuses on "Environmental Aspects of Energy – 2".

1. Which of the following is the cleanest fossil fuel?
a) Natural gas
b) Petrol
c) Petroleum
d) Coal

View Answer

2. What is IPCC?
a) A government organization that provides scientific information regarding climate change and its effects
b) An intergovernmental body of UN that provides scientific information regarding clim

d) A private company that sells scientific information regarding climate change

View Answer

3. What is the objective of the main international treaty on climate change?
a) To provide scientific information on climate change
b) To destabilise the greenhouse gas concentrations so that anthropogenic actions interfere with the climate system
c) To stabilise the greenhouse gas concentrations so that anthropogenic actions do not interfere with the climate system
d) To bring peace between all countries

View Answer

Answer: c
Explanation: The objective of the main international treaty on climate is to stabilise the greenhouse gas concentrations so that anthropogenic actions do not interfere with the climate system. The treaty itself does not provide information on climate change.

4. What is the aim of Paris Agreement in 2015? Note that C indicates Celsius.
a) To keep the decrease in global average temperature to below 2 degree C
b) To keep the decrease in global average temperature to above 2 degree C
c) To keep the increase in global average temperature to above 2 degree C
d) To keep the increase in global average temperature to below 2 degree C

View Answer

Answer: d

5. Which of the following IPCC assessment reports was a critical input in Paris Agreement?
a) Fifth Assessment Report
b) First Assessment Report
c) Second Assessment Report
d) Tenth Assessment Report

View Answer

Answer: a
Explanation: IPCC's fifth Assessment Report (AR) was a critical scientific input into Paris Agreement held in 2015. The AR5 report was developed through a scoping process involving climate change experts from all relevant disciplines.

6. Where is the ozone hole located?
a) Asia
b) Antarctica
c) Europe
d) America

View Answer

Answer: b
Explanation: The ozone hole is located over Antarctica. It was and still is the largest observed ozone hole. It was caused due continuous emissions of CFCs and freons.

7. What is main potential water pollutant from a geothermal reservoir?
a) Carbon

d) Nitrogen

View Answer

Answer: c
Explanation: The main water pollutant from a geothermal reservoir is sulphur. This is because underground reservoirs contain large amounts of sulphur and other minerals.

8. How does a geothermal plant prevent the leakage of sulphur into environment?
a) By trapping it inside the reservoir during extraction of hot water
b) By trapping it inside the reservoir before extraction of hot water
c) By disposing it into water bodies
d) By using a closed-loop water system

View Answer

Answer: d
Explanation: Most geothermal plants prevent leakage of sulphur and other minerals into the environment by using a closed-loop water system. The spent water is pumped directly back into the geothermal reservoir.

9. Which of the following gases is commonly emitted into the atmosphere from an open-loop geothermal system?
a) Hydrogen sulphide
b) Hydrogen
c) Carbon
d) Silicon

Answer: a
Explanation: Hydrogen sulphide is commonly emitted into the atmosphere from an open-loop geothermal system. Carbon and silicon are not gases. Even if hydrogen is emitted it is not the most common one.

10. How does hydrogen sulphide from geothermal plants contribute towards pollution?
a) By reacting with acidic gases to cleans the precipitating rainwater
b) By forming sulphur dioxide
c) By changing into one of the noble gases
d) By reacting with ozone

View Answer

Answer: b
Explanation: Hydrogen sulphide reacts and changes into sulphur dioxide. Sulphur dioxide contributes to the formation of acid rain which is harmful to the environment.

11. Which of the following is the largest emitter of sulphur dioxide?
a) Geothermal plants
b) Photosynthesis
c) Coal plants
d) Respiration

View Answer

Answer: c
Explanation: If not the coal plants are one of the largest emitters of sulphur dioxi

12. Land requirement of a geothermal plant depends on _____
a) greenhouse gas emissions
b) hydrogen sulphide emissions
c) the wildlife
d) amount of power capacity

View Answer

Answer: d
Explanation: Land requirement of a geothermal plant depends on the amount of power capacity. It also depends on other factors like the substation and the type of energy conversion system.

13. Which of the following is one of the major problems caused by a geothermal plant to land?
a) Land subsidence
b) Land fertilisation
c) Reservoir cleansing
d) Noble gas emissions

View Answer

Answer: a
Explanation: Land subsidence is one of the major problems caused by a geothermal plant to land. It is basically the sinking of land surface due to various activities in the plant and reservoir. Geothermal plants neither fertilise the land nor emit noble gases.

14. Photovoltaic manufacturing requires hazardous materials.
a) True
b) False

View Answer

Answer: a
Explanation: Manufacturing of photovoltaics require hazardous materials like arsenic and cadmium. Consumption of such metals even in small amounts could be deadly for the workers in the factory.

15. Life cycle assessment is a good indicator of the net environmental impact of any technology.
a) True
b) False

View Answer

Answer: a

of the processes involved, materials used to manufacture the technology and the manufacturing processes of the materials.

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Renewable Energy Questions and Answers – Environment-Economy-Energy and Sustainable Development

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This set of Renewable Energy Multiple Choice Questions & Answers (MCQs) focuses on "Environment-Economy-Energy and Sustainable Development".

1. What is "3E"?
a) Energy, economy and environment
b) Reduce, reuse and recycle
c) Energy, economy and envision
d) Ergonomics, evolution and economy

View Answer

Answer: a
Explanation: "3E" is a nomenclature used for energy, economy and environment. It describes the interrelation between them. "3Rs" are used for reduce, reuse and recycle.

b) To ensure environment sustainability
c) To reduce child mortality
d) To develop a global partnership for development

View Answer

Answer: b
Explanation: The seventh goal of the eight millennium development goals of UN is to ensure environment sustainability. The first is to eradicate extreme poverty and hunger. The fourth is to reduce child mortality and the eight is to develop a global partnership for development.

3. Which of the following is relates the three elements of “3E”?
a) Energy from fossil fuels
b) Energy from natural gas
c) Renewable energy sources and technology
d) Economy

View Answer

Answer: c
Explanation: Renewable energy sources and their respective technologies relate the three elements of “3E”. This is because the renewable technology incorporates an environment-centered strategy thereby forcing the economy to adopt it as well.

4. Which of the following ensures sustainable growth?
a) Positive economic growth, deterioration of environment with economic expansion and ene
resource meeting energy demands

growth of energy resource not meeting energy demands
d) Positive economic growth, deterioration of environment with economic expansion and growth of energy resource meeting energy demands

View Answer

Answer: d
Explanation: It is necessary that the environment does not deteriorate with economic expansion for sustainable growth. Also, positive economic growth and growth of energy resource meeting energy demands are key elements of sustainable growth.

5. Sustainable development requires that energy resource _____
a) cannot be exhausted completely
b) can be complete exhausted
c) can destroy the environment
d) cannot meet the growing demand

View Answer

Answer: a
Explanation: Sustainable development requires that energy resource cannot be exhausted completely. If any one resource is at the brink of exhaustion, it has to be substituted by another or a shift to another source has to be made.

6. Which of the following contributes towards growth of economic and energy?
a) Intermittent capital and human resource investment
b) Continuous capital and human resource investment

Answer: b
Explanation: Continuous capital and human resource investment contributes towards the growth of economy and energy. Continuous investments lead to inventions and innovations which can disrupt the economy and make pervasive changes.

7. Which of the following energy resources seems inexhaustible?
a) Natural gas
b) Coal
c) Sun
d) Petrol

View Answer

Answer: c
Explanation: Sun seems an inexhaustible source of energy. Coal, natural gas and petrol are fossil fuels which are already being consumed at an alarming rate.

8. For sustainable development, environment damage rate _____ environment recovery rate.
a) should be greater than the
b) should be exponentially greater than the
c) should be same as the
d) should be lesser than the

View Answer

Answer: d
Explanation: For sustainable development, environment damage rate should be less th

9. Which of the following best describes the aim of sustainable consumption and production?
a) To reduce resource consumption, waste generation and emissions across the full life cycle of processes and products
b) To increase resource consumption, waste generation and emissions across the full life cycle of processes and products
c) To reduce resource consumption, increase waste generation and emissions across the full life cycle of processes and products
d) To increase resource consumption, reduce waste generation and emissions across the full life cycle of processes and products

View Answer

Answer: a
Explanation: Sustainable consumption and production aims to reduce resource consumption. It also aims to reduce waste generation and emissions across the full life cycle of processes and products.

10. Which of the following best describes green economy?
a) A high carbon, resource inefficient and socially inclusive economy
b) A low carbon, resource efficient and socially inclusive economy
c) A low carbon, resource inefficient and socially exclusive economy
d) A high carbon, resource efficient and socially inclusive economy

View Answer

Answer: b
Explanation: A green economy is a low carbon, resource efficient and socially inclus

11. What is the goal of sustainability in any process?
a) To maintain the process finitely
b) To eventually eliminate the process
c) To maintain the process indefinitely
d) To support damaging the environment

View Answer

Answer: c
Explanation: The goal of sustainability is to maintain the process indefinitely without endangering natural biotic system. Damaging the environment or anything else at the cost of maintaining the process goes against the definition.

12. What are the three pillars of sustainable development?
a) Energy, economy and ergonomics
b) Environment, economy and evolution
c) Energy and evolution
d) Energy, economy and environment.

View Answer

Answer: d
Explanation: The three pillars of sustainable development are energy, economy and environment. Ergonomics is the scientific study of understanding human interactions with other elements of a system.

13. What is the main problem with development of countries?
a) Strain on environment to absorb the damage and self-heal
b) Decrement in poverty
c) Higher energy consumption per capita
d) Lower energy consumption per capita

View Answer

Answer: a
Explanation: The main problem with development of countries is the strain it puts on the environment to absorb the damage. It also unarguably assumes that the environment will heat by itself without any cost. Decrement in poverty and high energy consumption per capita are the consequences of development.

14. Sustainable development binds together the concern for natural systems with social and political challenges.
a) True
b) False

Answer: a
Explanation: Sustainable development binds together the concern for natural systems with social, economic and political challenges faced by humans. Ideally, the society grows without destroying the environment. It might even treat the damage that has already been done.

15. Sustainability can be achieved by replacing existing resources with other resources of equal value.
a) True
b) False

View Answer

Answer: a
Explanation: Sustainability can be achieved by replacing existing resources with other resources of equal value or of greater value. However, it should be noted that the replacement or operation of these new resources does not degrade the environment.

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Renewable Energy Questions and Answers – World Energy Status -1

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This set of Renewable Energy Multiple Choice Questions & Answers (MCQs) focuses on “World Energy Status -1”.

1. Which of the following best describes world energy consumption?
a) Total energy produced and used by humanity
b) Total energy consumed by humanity
c) Total energy consumed by humans in the biological pyramid
d) Total energy produced by humans in the biological pyramid

View Answer

Answer: a
Explanation: World energy consumption is the total energy produced and used by humanity. It includes all energy harnessed from every source.

d) Energy from fossil fuels

View Answer

Answer: b
Explanation: Energy from food is not included in world energy consumption. Since the energy consumption from biomass is difficult to calculate, it has not been well-documented.

3. World energy consumption is measured _____
a) quarterly
b) half-yearly
c) yearly
d) every decade

View Answer

Answer: c
Explanation: World energy consumption is generally measured year. It involves all energy harnessed from every possible energy source towards humanity's endeavors.

4. Which of the following energy sources is majorly used?
a) Wind energy
b) Nuclear energy
c) Hydrogen energy
d) Fossil fuels

View Answer

major cause of some of the world's pressing problems like global warming and climate change.

5. Which of the following is perceived to contribute towards world population growth?
a) Uganda
b) USA
c) UK
d) Germany

View Answer

Answer: a
Explanation: Developing countries like Uganda, Botswana, India, China, etc. are perceived to contribute towards immense growth of world population. This is because of poverty and high infant mortality rate.

6. Why is there a demand for renewable sources of energy?
a) Because they emit greenhouse gases
b) Because of low or zero carbon footprint
c) Because of the decreasing global temperatures
d) Because they are more efficient

View Answer

Answer: b
Explanation: Renewable energy sources are required because they have zero or extremely l carbon footprint. Thus, greenhouse gas emissions from such sources are negligible

7. As the population grows, the demand for energy _____
a) decreases
b) remains the same
c) increases
d) becomes volatile

View Answer

Answer: c
Explanation: As world population increases, the demand for energy increases. This is because energy demand and consumption per capita increases.

8. Which of the following countries will experience a major increment in energy demand?
a) USA
b) France
c) UK
d) China

View Answer

Answer: d
Explanation: China will experience a major increment in energy demand. China is the most populated country in the world and its population is expected to increase. Moreover, China is a developing country. Though the Chinese government have taken steps to curb the growth, catering to the demands of the existing population is extremely challenging.

9. Despite significant investments in renewable sector, why are fossil fuels still used?

d) Because global warming is a hoax

View Answer

Answer: a
Explanation: Despite significant investments in renewable energy sector, fossil fuels still dominate and supply 80% of world's energy. This is mainly because of logistic, structural and operational issues. For instance, it is a financial challenge to replace the existing machinery.

10. Which of the following institutions publish energy data?
a) NASA
b) International Energy Agency (IEA)
c) ISRO
d) Microsoft

View Answer

Answer: b
Explanation: Institutions such as the International Energy Agency (IEA), the U.S. Energy Information Administration (EIA) and the European Environment Agency (EEA) publish energy data. NASA and ISRO are space agencies. Microsoft is a for-profit software solution company.

11. What is total primary energy supply?
a) Total energy produced and used by humanity
b) Total energy consumed by humanity
c) Sum of energy production minus storage changes
d) Sum of energy production including storage changes

Answer: c
Explanation: Total primary energy supply (TPES) is the sum of energy production minus storage changes. TPES can be used as an estimator for energy consumption as yearly changes in energy storage are negligible.

12. What is the unit of total primary energy supply?
a) Watts
b) Joules
c) Newtons
d) Watt-hours

View Answer

Answer: d
Explanation: Total primary energy supply (TPES) is measured in watt-hours (Wh). In 2013, IEA estimated that TPES was 157.5 petawatt hours. Watts is the unit of power. Joules is the unit of energy. Newtons is the unit of force.

13. What was the growth in energy demand in the year 2018 as stated by IEA?
a) 2.3%
b) 1.3%
c) 1%
d) 0.5%

View Answer

Answer: a
Explanation: In 2018, the growth in energy demand was 2.3%. This was remarkable because until then the average annual growth rate was 1.3%. Emissions also increase as the demand for energy increases.

14. World energy consumption is a power source metric of civilization.
a) True
b) False

View Answer

Answer: a
Explanation: World energy consumption is a power source metric of civilization. It has deep implications for humanity in terms of policy making and political decisions.

15. It estimated that the world energy consumption will grow by 50% between 2018 and 2050.
a) True

Answer: a
Explanation: It is estimated that the world energy consumption will grow by 50% between 2018 and 2050. Many renowned energy organizations like IEA and EIA agree with this estimate. This is to cater to the demands of growing population.

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Renewable Energy Questions and Answers – World Energy Status – 2

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This set of Renewable Energy Multiple Choice Questions & Answers (MCQs) focuses on “World Energy Status – 2”.

1. Which of the following leads the energy production in low-carbon sources?
a) Photovoltaics
b) Wind energy
c) Solar thermal power systems
d) Nuclear energy

View Answer

Answer: a
Explanation: Solar energy, especially photovoltaics are becoming popular low-carbon energy sources. Photovoltaic systems are installed in both, industries and houses to meet their respective energy demands.

c) USA
d) England

View Answer

3. Which of the following developed enjoys low electricity prices?
a) Belgium
b) Italy
c) Sweden
d) Germany

View Answer

Answer: c
Explanation: Sweden enjoys low electricity prices. It costs about 0.21 USD per KWh in Sweden. Germany is one of the most expensive places in terms electricity prices with a cost of 0.33 USD per KWh.

4. According to EIA, what is the globally projected increase in transportation energy between 2018 and 2050?
a) Less than 10%
b) Between 10 and 20%
c) Greater than 100%
d) Between 30 and 50%

View Answer

Answer: d

5. Which of the following best describes the reason for projected increase in transportation energy in developing countries?
a) Energy demand per capita increases and hence the net energy required in every process increases
b) Energy demand per capita decreases and hence the net energy required in every process increases
c) Energy demand per capita decreases and hence the net energy required in every process decreases
d) Energy demand per capita increases and hence the net energy required in every process decreases

View Answer

Answer: a
Explanation: As developing countries improve their quality of living, the energy demand per capita increases. As energy demand per capita increases, the net energy required in every process increases.

6. Which of the following is the most usable form of energy for future?
a) Solar
b) Electricity
c) Thermal
d) Nuclear

View Answer

Answer: b

7. Which of the following sources are amongst the fastest growing energy sources?
a) Solar and wastewater
b) Wind and hydro
c) Hydro and solar
d) Wind and wastewater

View Answer

Answer: c
Explanation: Solar and hydro are amongst the fastest growing energy sources. Though wind and nuclear may be good competitors but solar and hydro energy have penetrated into the daily lives of common man.

8. What is an energy policy?
a) A method to address issues of energy development
b) A free and liberal methodology towards energy development
c) A manner in which governments decide to stop energy development
d) A manner in which governments decide to address issues related to energy development

View Answer

Answer: d
Explanation: Energy policy is basically a methodology formed by an entity (usually governments) to address issues related to energy development. This includes energy production, distribution and consumption.

9. What is the main aim of implementing eco-energy policies?

d) To prevent illegal energy production

View Answer

Answer: a
Explanation: The main aim of implementing an eco-energy-oriented policy is to tackle global warming and climate change. The idea is to manage energy production, distribution and consumption without damaging the environment.

10. Renewable energy has the potential to mitigate climate change.
a) True
b) False

View Answer

Answer: a
Explanation: Renewable energy has the potential to mitigate climate change. This is because it has a low carbon footprint and is specifically used to prevent further damage to the environment.

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Solar Energy Questions and Answers – Sun, Earth Radiation Spectrums – 1

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Sun, Earth Radiation Spectrums – 1”.

1. What is solar radiation?
a) Energy radiated from the sun in all directions
b) Energy radiated from earth in all directions
c) Radiation travelling in space
d) Energy radiated from sun that travels in ether

View Answer

Answer: a
Explanation: Solar radiation is the energy radiated from sun in all directions. Energy radiated from earth is not solar radiation. Any random radiation traveling in space is called cosmic rays.

d) UV, ultrasonic and near infrared

View Answer

Answer: b
Explanation: The three relevant bands of solar radiation are ultraviolet (UV), infrared and visible bands. Far infrared and near infrared are components of infrared. Ultrasonic is related to sound waves.

3. Which two bands of solar radiation are majority in the total solar radiation reaching earth?
a) UV and visible
b) Visible and ultrasonic
c) Visible and infrared
d) Infrared and UV

View Answer

Answer: c
Explanation: Infrared and UV are the major components of the total solar radiation reaching earth. Infrared radiation makes up 49.4% and visible light makes up 42.3%. Only 8% of the total radiation is in the UV band.

4. Which of the following affects the amount of solar radiation received by a location or water body?
a) Shape of the water body
b) Time at night
c) Rotational speed of earth

Answer: d

Explanation: A variety of factors affect the amount of solar radiation received by a location or water body. Some of them are altitude and latitude of the location, cloud cover over the location and the time of day. No solar radiation is received at night. Rotational speed of earth is constant and doesn't affect the amount of solar radiation received.

5. What is direct solar radiation?

a) Solar radiation directly received by earth's surface from sun

b) Cosmic radiation directly received by earth's surface

c) Solar radiation received by earth's surface after reflection

d) Cosmic radiation received by earth's surface after reflection

View Answer

Answer: a

Explanation: Direct solar radiation is solar radiation directly received by earth's surface from sun. It is called direct because no scattering or reflection occurs. Cosmic radiation is not same solar radiation.

6. What is indirect solar radiation?

a) Solar radiation directly received by earth's surface from sun

b) Solar radiation received by earth's surface after scattering

c) Cosmic radiation directly received by earth's surface

d) Cosmic radiation received by earth's surface after reflection

View Answer

scattering or reflection. It is called indirect because the incident radiation is not directly received by earth's surface. Every cosmic radiation need be radiation from sun.

7. What type of radiation does earth emit?
a) UV
b) Visible
c) Infrared
d) Longitudinal

View Answer

Answer: c
Explanation: Earth emits infrared radiation. This is typically called as outgoing long-wave radiation (OLR) of wavelength between 3 and 100um. They are also called as thermal radiation.

8. What is the electromagnetic spectrum?
a) Radiation spectrum consisting only of UV and visible rays
b) All rays falling in the category of infrared and UV rays
c) All rays falling in the category of gamma and x-rays
d) Radiation spectrum encompassing all types of radiation

View Answer

Answer: d
Explanation: As the name suggests, electromagnetic spectrum is a term used to define types of existing radiation. It ranges from gamma rays to radio waves. Solar radiation recei

9. Which of the following type of UV radiation inhibits photosynthetic reaction in phytoplankton?
a) UV-A
b) UV-C
c) Infrared
d) Gamma rays

View Answer

Answer: a
Explanation: UV-A and UV-B radiation inhibit photosynthetic reaction in phytoplankton. Infrared and gamma rays are not the types of UV radiation.

10. Which of the following is responsible for thermal energy?
a) UV
b) Infrared
c) Gamma
d) UV-A

View Answer

Answer: b
Explanation: Infrared radiation is responsible for thermal and heat energy. They lie on the opposite side of the spectrum from ultraviolet light. This radiation has a wavelength greater than 700nm.

11. How do infrared radiation cause heat?
a) By exciting neutrons of the substance that absorb them

d) By exciting protons of the substance that absorb them

View Answer

Answer: c
Explanation: Infrared radiation cause heat by exciting electrons. When they are absorbed by substances, they interact and excite electrons by transferring energy. This leads to heat as the atom (or electron) is said to be in excited state.

12. Why are surfaces of water bodies warmer than the depths?
a) Because water does not absorb UV radiation
b) Because water does not absorb thermal radiation
c) Because water absorbs visible radiation
d) Because water absorbs thermal radiation

View Answer

Answer: d
Explanation: Surfaces of water bodies are warmer than the depths. This is because most of the infrared radiation is absorbed in the first meter of the water's surface. Hence, they don't make it to the depths.

13. What is photosynthetically active radiation (PAR)?
a) Radiation best suited for photosynthesis
b) All radiation in which photosynthesis occurs
c) Radiation in which photosynthesis does not occur
d) Radiation which deactivates the ongoing photosynthesis

View Answer

Answer: a
Explanation: Photosynthetically active radiation (PAR) is the radiation best suited for photosynthesis. It is basically wavelength range in which photosynthesis occurs with ease. This range is between 400nm and 700nm – visible range.

14. UV-A, UV-B and UV-C are three wavelength ranges of ultraviolet radiation.
a) True
b) False

View Answer

Answer: a
Explanation: UV-A, UV-B and UV-C are three wavelength ranges of ultraviolet radiation. Th wavelengths can directly affect the DNA of water inhabitants as well as harm

15. Energy of the wavelength increases with frequency and decreases with the size of wavelength.
a) True
b) False

View Answer

Answer: a
Explanation: Energy of the wavelength increases with frequency and decreases with the size of wavelength. The more energy a wavelength has, the easier it is to disrupt the molecule that absorbs it.

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Solar Energy Questions and Answers – Sun, Earth Radiation Spectrums – 2

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Sun, Earth Radiation Spectrums – 2”.

1. Which of the following is used to measure the flux of outgoing long-wave radiation?
a) Watt/square meter
b) Watt
c) Joules
d) Watt/cubic meter

View Answer

Answer: a
Explanation: The flux of energy transported by outgoing long-wave radiation is measured in watt/square meter. While Watt is used to measure power, Joule is used to measure energy.

d) Condensation

View Answer

Answer: b
Explanation: In earth's climate system, the processes involved in long-wave radiation are absorption, scattering and emissions. The emissions are from atmospheric gases, aerosols, clouds and the surface. Condensation is the process of gas converting to liquid due to decrease in temperature.

3. How does earth lose its excess solar radiation?
a) By storing the radiation in its core
b) By using the radiation to generate more magma
c) By radiative cooling
d) By conductive cooling

View Answer

Answer: c
Explanation: Earth loses its excess solar radiation by radiative cooling. The outgoing long-wave radiation takes the excess energy from earth back into the space.

4. How do all the living organisms on receive energy?
a) From wind
b) From fossil fuels
c) From earth's heat
d) From sun

Answer: d
Explanation: Sun is the source of energy for all living organisms on earth. It provides energy for photosynthesis which triggers the biological food cycle and food web. Thus, the energy is transferred between organisms as described in the biological energy pyramid.

5. What is earth's energy budget?
a) Balance between received energy and emitted energy after the distribution of energy throughout the five components of earth's climate system
b) Balance between received energy and emitted energy before the distribution of energy throughout the five components of earth's climate system
c) Balance between received energy and emitted energy
d) Balance between received energy and emitted energy without the distribution of energy throughout the five components of earth's climate system

View Answer

Answer: a
Explanation: Earth's energy budget is the balance between received energy and emitted energy after the distribution of energy throughout the five components of earth's climate system. It is important to note the outgoing energy is the energy after distribution.

6. What happens to earth when incoming energy is greater than the outgoing energy?
a) Earth's temperature decreases
b) Earth's temperature increases
c) Earth's temperature is not affected
d) Water level rises

Answer: b

Explanation: When the incoming energy is greater than the outgoing energy, the earth's temperature rises. This results in global heating and the entire planet feels the "heat".

7. What happens to earth when incoming energy is less than the outgoing energy?
a) Earth's temperature is not affected
b) Earth's temperature increases
c) Earth's temperature decreases
d) Entire planet freezes

View Answer

Answer: c

Explanation: When the incoming energy is lesser than the outgoing energy, the earth's temperature decreases. This results in global cooling. If the difference is large and average global temperature decreases even by 1 degree Celsius, the entire planet may be covered with snow.

8. What is solar irradiance?
a) Solar radiation received by earth
b) Solar radiation directly received by earth's surface
c) Solar radiation received by earth's surface after scattering
d) Intensity with which the solar radiation enters the earth's atmosphere

View Answer

Answer: d

9. During night, the net-all-wave radiation is dominated by _____
a) long-wave radiation
b) short-wave radiation
c) visible range
d) gamma rays

View Answer

Answer: a
Explanation: During night, the net-all-wave radiation is dominated by long-wave radiation. The long-wave radiation dominates the net all-wave radiation in polar regions as well. It is important to note that net-all-wave radiation is for a surface.

10. Why is the earth's temperature nearly stable?
a) Because the outgoing radiation dominates the incoming solar radiation
b) Because the incoming short-wave solar radiation nearly equals the outgoing long-wave radiation
c) Because the incoming long-wave solar radiation dominates the outgoing short-wave radiation
d) Because the incoming long-wave solar radiation dominates the outgoing long-wave radiation

View Answer

Answer: b
Explanation: Earth's temperature is nearly stable. This is because the incoming short-wave solar radiation nearly equals the outgoing long-wave radiation. Any variation in the global average temperature is detrimental to the planet.

c) Brightness of glowing bulb
d) Energy the bulb radiates as heat

View Answer

Answer: c
Explanation: Intensity is best described by the brightness of a glowing bulb. Energy the bulb radiates as heat is the power that is wasted by the bulb during its operation.

12. Solar irradiance is measured in _____
a) watts
b) meters/sec
c) newtons
d) watts/square meter

View Answer

Answer: d
Explanation: Solar irradiance is measured in watts/square meter. It is the amount of radiant flux on an area and hence those units. Speed and velocity are measured in meters/s.

13. Which of the following influences solar irradiance?
a) Scattering elements like clouds
b) Shape of the location receiving the radiation
c) Type of the radiation
d) Type of the receiving surface

View Answer

Answer: a
Explanation: Solar irradiance received by a location or water body depends on the elevation above sea level, angle of sun and scattering elements like clouds. It does not depend on the type of radiation and type of receiving surface.

14. Ozone absorbs UV light and hence affects solar irradiance.
a) True
b) False

View Answer

Answer: a
Explanation: Ozone absorbs UV light and hence affects solar irradiance. The lower the angle of the sun, the larger the amount of ozone the light has to pass through.

b) False

View Answer

Answer: a
Explanation: The distance that the solar radiation has to travel will be lowest when the sun is directly overhead. The angle of sun is dependent on latitude, time of year and the time of day.

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Solar Energy Questions and Answers – Extraterrestrial and Terrestrial Radiations

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Extraterrestrial and Terrestrial Radiations”.

1. What is extraterrestrial radiation?
a) Intensity of sun at the top of earth’s atmosphere
b) Intensity of sun at the top of its atmosphere
c) Energy of sun at the top of earth’s atmosphere
d) Force of sun on earth

View Answer

Answer: a
Explanation: Extraterrestrial radiation is the intensity of sun at the top of earth’s atmosphere. The radiation carries energy from sun to the earth. Sun majorly exerts a gravitational force on other celestial bodies of the solar system including earth.

c) Joules/square meter
d) Torque

View Answer

Answer: b
Explanation: Since extraterrestrial radiation is also a radiation, it is measured in Watts/square meter. This unit is used to measure flux or intensity which is essentially energy radiated per unit time per unit area.

3. Extraterrestrial radiation received by earth _____ throughout the year.
a) is constant
b) monotonically decreases
c) varies
d) monotonically increases

View Answer

Answer: c
Explanation: Extraterrestrial radiation received by earth varies throughout the year. It is neither a constant function nor a monotonically increasing or decreasing function of earth's distance from the sun.

4. Why does the extraterrestrial radiation received by earth vary throughout the year?
a) Because earth's orbit is circular
b) Because of radiation losses when travelling through ether
c) Because of radiation losses when travelling through vacuum

Answer: d

Explanation: The extraterrestrial radiation received by earth varies throughout the year. This is primarily because of the earth's elliptical orbit. This results in varying earth-sun distances throughout the year.

5. What is the average extraterrestrial irradiance received by earth (solar constant)?

a) 1361 Watts/square meter

b) 1361 Watts

c) 1250 Watts/square meter

d) 1250 Joules

View Answer

Answer: a

Explanation: The average extraterrestrial irradiance received by earth (solar constant) is approximately 1361 Watts/square meter. It varies by + 3% throughout the year. Note that irradiance is always measured in Watts/square meter.

6. What is all-wave radiation?

a) Sum of shortwave and long-wave-up-dwelling radiation minus sum of shortwave and long-wave-down-dwelling radiation

b) Sum of shortwave and long-wave-down-dwelling radiation minus sum of shortwave and long-wave-up-dwelling radiation

c) Difference of shortwave and long-wave-up-dwelling radiation plus difference of shortwave and long-wave-down-dwelling radiation

d) Difference of shortwave and long-wave-down-dwelling radiation plus difference of shortwa

Answer: b

Explanation: All-wave radiation is the sum of shortwave and long-wave-down-dwelling radiation minus sum of shortwave and long-wave-up-dwelling radiation. As the name suggests, it is the net radiation received where net is calculated by difference between net incoming and net outgoing radiation.

7. Which of the following blocks the outgoing long-wave radiation?

a) Earth

b) Seas

c) Clouds

d) Airplanes

View Answer

Answer: c

Explanation: Clouds tend to block the outgoing long-wave radiation. This results in lower flux of long-wave radiation being emitted into the atmosphere. Earth emits the long-wave radiation. Even if airplanes block or reflect the outgoing long-wave radiation, the amount is negligible.

8. How do clouds block the outgoing long-wave radiation (OLR)?

a) By emission

b) By adsorption and scattering

c) By absorption and adsorption

d) By scattering and absorption

View Answer

absorb the incident OLR and scatter them thereby resulting in reflection of the radiation back to earth.

9. What is albedo?
a) Measure of diffused reflection of solar radiation out of the total amount received by astronomical body
b) Measure of absorption of solar radiation out of the total amount received by astronomical body
c) Measure of diffused reflection of solar radiation out of the total amount received
d) Measure of absorbed of solar radiation out of the total amount received by

View Answer

Answer: a
Explanation: Albedo is the measure of diffused reflection of solar radiation out of the total amount of solar radiation received by an astronomical body. Due to reflection, the amount of outgoing long-wave radiation from earth is affected.

10. Higher the cloud albedo _____
a) less is the amount of solar radiation reflected back to earth
b) more is the amount of solar radiation reflected back to earth
c) less is the amount of solar radiation received from sun
d) more is the amount of solar radiation received from sun

View Answer

Answer: b

11. Which of the following gases absorb outgoing long-wave radiation?
a) Carbon
b) Natural gas
c) Water vapour
d) Argon

View Answer

Answer: c
Explanation: Water vapour, carbon dioxide and ozone absorb the outgoing long-wave radiation. Carbon is not a gas. Natural gas and Argon do not absorb the outgoing long-wave radiation.

12. Greenhouse gases _____ outgoing long-wave radiation.
a) emit
b) transmit
c) are conducive for
d) hinder

View Answer

Answer: d
Explanation: Greenhouse gases hinder outgoing long-wave radiation. They absorb some wavelengths thereby preventing thermal radiation from reaching space and adding heat back to the atmosphere (and earth).

13. If not all, most of the outgoing long-wave radiation is emitted to space _____
a) in the absence of greenhouse gases and cloud cover
b) in the presence of greenhouse gases but absence of cloud cover
c) in the absence of greenhouse gases but presence of cloud cover
d) in the presence of greenhouse gases and cloud cover

View Answer

Answer: a
Explanation: If not all, most of the outgoing long-wave radiation (OLR) is emitted to space in the absence of greenhouse gases and cloud cover. Absence of both, prevents absorption and reflection of OLR back to earth.

14. Presence of greenhouse gases leads to global warming.
a) True
b) False

View Answer

absorb some wavelengths of the outgoing long-wave radiation and re-emit them back into the earth. This increases the net amount of heat in the planet.

15. Outgoing long-wave radiation depends on the temperature of radiating body.
a) True
b) False

View Answer

Answer: a
Explanation: Outgoing long-wave radiation depends on the temperature of radiating body. It is also affected by earth's skin temperature, cloud cover and water vapour profile.

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Solar Energy Questions and Answers – Depletion of Solar Radiation

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1. What would happen if the sun’s radiation reaches the earth’s surface without depletion?
a) Life would cease to exist
b) Life would be more vibrant
c) The earth’s average global temperature would become stable
d) The average global temperature of earth would decrease

View Answer

Answer: a
Explanation: If sun’s radiation reaches the earth’s surface without depletion, the average global temperature would increase to a point that life would cease to exist. Earth would become too hot to sustain any life form.

c) Solar flares
d) Nuclear fusion in sun

View Answer

Answer: b
Explanation: Dispersion, scattering and absorption deplete the incoming solar radiation to an extent that biological and non-biological operations supporting life forms are not hindered. Nuclear fusion is the source of sun's energy. Solar flares and irradiance of incoming solar radiation do deplete the solar radiation.

3. What is the inclination of earth's axis in degrees?
a) 37
b) 53
c) 23.5
d) 10

View Answer

4. How does the inclination of earth's axis affect the incoming solar radiation?
a) All the solar radiation is concentrated around the equator
b) The radiation is distributed along the entire equator
c) All radiation is concentrated at the poles
d) Solar radiation is non-uniformly distributed throughout the earth's surface

View Answer

Answer: d
Explanation: The inclination of earth's axis results in non-uniform distribution of incoming solar radiation throughout the earth's surface. The radiation is received at varying angles of incidence depending on earth's position.

5. What happens to those sun rays which are not perpendicular to earth's surface?
a) Energy of the solar radiation is spread over a greater area
b) Energy of the solar radiation is concentrated on a single spot at the poles
c) Energy of the solar radiation is uniformly distributed along the Tropic of Cancer
d) Energy of the solar radiation depends on the position of prime meridian

View Answer

6. When solar radiation is dispersed over a greater area, what happens to the net temperature?
a) The net temperature increases
b) The net temperature decreases
c) The net temperature is not affected
d) The net temperature monotonically increases forever

View Answer

7. Which of the following latitudes is significantly affected due to dispersion of insolation with seasons?
a) All latitudes are equally affected
b) Temperate zones are significantly affected
c) Polar areas
d) Tropical areas are significantly affected

View Answer

8. What is scattering?
a) Spreading of solar radiation over large areas
b) Absorption of solar radiation by gaseous molecules
c) Absorption of outgoing long-wave radiation and re-emitting it back to the earth
d) Deflection of some wavelengths in all directions when passed through air

View Answer

9. When the solar radiation is scatted by suspended particles in air, they act _____ and produce different colours.
a) like a prism
b) like a rock
c) like a mirror
d) like a solar concentrator

View Answer

c) interference
d) absorption

View Answer

11. What is reflection?
a) Bouncing back some portion of the incident radiation into another medium
b) Slowing down of light on entering another medium
c) Bouncing back some portion of the incident radiation into the same medium from which it came
d) Absorption by particles and re-emission of radiation of different frequencies

View Answer

12. Which among the following is the best reflector?
a) Rock
b) Aluminum
c) Iron
d) Snow

View Answer

13. Which of the following types of clouds has the highest albedo?
a) Stratocumulus
b) Altocumulus
c) Cirrus
d) Cirrocumulus

View Answer

14. Earth reflects about 36% of the incoming radiation.
a) True
b) False

View Answer

15. About quarter of the incoming solar radiation is scattered.
a) True
b) False

View Answer

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Solar Energy Questions and Answers – Measurements of Solar Radiation – 1

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Measurements of Solar Radiation – 1”.

1. What are the two basic ways to measure solar radiation?
a) Ground-based instrumentation and satellite measurement
b) Telephonic measurement and mobile tower measurement
c) Anemometer and voltmeter
d) Ammeter and voltmeter

View Answer

Answer: a
Explanation: Thee two basic ways to measure solar radiation are via ground-based instruments and satellite measurements. Anemometer is an instrument used to measure wind speed. Voltmeter is an instrument used to measure potential difference between two points conducting electric (DC) current. Ammeter is an instrument used to measure the electric (DC) current flowing across two points.

2. What is does an actinometer measure?
a) Wind speed
b) Intensity of radiation
c) Wind direction
d) Direction of radiation

View Answer

Answer: b
Explanation: Actinometer is used to measure the intensity of an incident radiation. Wind speed and wind direction are measured by anemometer and wind vane respectively.

3. Actinometer is primarily used to measure _____ and _____
a) infrared and ultraviolet
b) visible and infrared
c) visible and ultraviolet
d) infrared and UV-A

View Answer

Answer: c
Explanation: Actinometer is primarily used to measure visible and ultraviolet range. It does this by measuring the heating power of the radiation.

4. How does actinometer work?
a) By determining the number of electrons in a beam integrally
b) By determining the number of protons in a beam differentially

Answer: d
Explanation: Actinometer works by determining the number of photons integrally or per unit time. It is commonly applied to devices used in UV and visible range.

5. As a system, actinometer is a _____ or _____
a) chemical system or physical device
b) chemical system or thermal device
c) thermal device or mechanical device
d) thermo-mechanical system or physical device

View Answer

Answer: a
Explanation: As a system, actinometer is a chemical system or physical device. Solutions Iron (III) oxalate is a commonly used example and is a chemical actinometer. Bolometers can be used as physical devices.

6. Which of the following categories does a pyranometer belong to?
a) Voltmeters
b) Actinometers
c) Hall sensors
d) Amplifiers

View Answer

Answer: b
Explanation: A pyranometer belongs to the category of actinometer because it is used

7. Global and diffuse solar radiation can be measured by _____
a) thermal actinometer
b) heat pumps
c) thermoelectric pyranometers
d) oscilloscopes

View Answer

Answer: c
Explanation: Global and diffuse solar radiation can be measured by thermoelectric pyranometers. Heat pumps are used in thermal systems to pump heat from a cooler region to a hotter region. Oscilloscopes are used to observe sinusoidal outputs.

8. To perform irradiance measurement, which of the following is necessary?
a) Beam response varies with sine of the angle of incidence
b) Beam response varies linearly with angle of incidence
c) Beam response is constant with varying angle of incidence
d) Beam response varies with cosine of the angle of incidence

View Answer

Answer: d
Explanation: To perform irradiance measurement, it is necessary that the beam response varies with cosine of the angle of incidence. If the beam response is constant with varying angle of incidence then no measurement is performed.

9. Why should the beam response vary with cosine of the angle of incidence?

d) Because of non-uniform dispersion of solar radiation

View Answer

Answer: a
Explanation: The beam response should vary with cosine of the angle of the incidence. This is to account for perpendicular and parallel rays. Angle of incidence is 0 degrees (i.e. full response) when the solar radiation hits the sensor normally and 90 degrees (i.e. zero response) for parallel rays from the sun when it is at the horizon.

10. Which of the following best describes the working of thermoelectric pyranometer?
a) Solar radiation → thermal e.m.f measured → thin black surface → rise in temperature until equilibrium
b) Solar radiation → thin black surface → rise in temperature until equilibrium → thermal e.m.f measured
c) Thin black surface → solar radiation → rise in temperature until equilibrium → thermal e.m.f measured
d) Solar radiation → rise in temperature until equilibrium → thin black surface → thermal e.m.f measured

View Answer

Answer: b
Explanation: A pyranometer consists of a thin-blackened surface on which the solar radiation falls. As the radiation hits the surface, the temperature rises until an equilibrium is attained. This rise in temperature sets a thermal e.m.f which is then measured.

c) Pyrheliometer
d) IC tester

View Answer

Answer: c
Explanation: Generally, a pyrheliometer is used to measure direct solar radiation. Actinometer are a class of devices/systems that measure intensity of radiation. IC tester is used to test ICs.

12. What technologies are used in pyranometers?
a) Silicon semiconductor technology and routing technology
b) Thermopile technology and doping
c) Doping and routing technology
d) Silicon semiconductor technology and thermopile technology

View Answer

Answer: d
Explanation: Thermopile technology and silicon semiconductor technology are used in pyranometers. Doping is a technique to increase the conductivity of intrinsic semiconductors. Routing is a technique used to navigate packets through an interconnected network of computers.

13. _____ is a physical device that can be correlated to the number of photons detected.
a) Photodiode
b) LEDs
c) CFLs
d) CFCs

View Answer

Answer: a
Explanation: Photodiode is a physical device that can be correlated to the number of photons detected. LEDs and CFLs are devices that emit light (radiation). CFCs are a type of gas that harm the ozone layer.

14. Light sensitivity is known as spectral response.
a) True
b) False

View Answer

Answer: a
Explanation: Light sensitivity is known as spectral response. It talks about how sensitive

15. Pyranometer has a non-directional response.
a) True
b) False

View Answer

Answer: b
Explanation: Pyranometer has a directional response. Since the beam response is required to vary with the cosine of angle of incidence, pyranometer has a directional or cosine response.

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Solar Energy Questions and Answers – Measurements of Solar Radiation – 2

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1. What is the Angstrom compensation pyrheliometer used to measure?
a) Direct solar radiation
b) Indirect solar radiation
c) Diffused solar radiation
d) UV radiation

View Answer

Answer: a
Explanation: Angstrom compensation pyrheliometer is used to measure direct solar radiation. It is one of the standard equipment for the process. UV radiation is generally measured by pyranometer.

c) Pyranometer and pyrheliometer measure global radiation
d) Pyranometer measures solar radiation while pyrheliometer measures global radiation

View Answer

Answer: b
Explanation: The main difference pyranometer and pyrheliometer is the purpose of measurement. Pyranometer is used to measure global solar radiation and hence it is used for both visible and UV. Pyrheliometer is used to measure direct solar radiation.

3. What is the main advantage of sunshine recorder?
a) It is more sophisticated than pyranometers and pyrheliometers
b) It is more expensive than pyranometers and pyrheliometers
c) It is less accurate but inexpensive
d) It is less accurate but extremely expensive

View Answer

Answer: c
Explanation: The main advantage of a sunshine recorder is that it is inexpensive. However, it is less accurate as well. Also, it is not as sophisticated as pyranometers and pyrheliometers.

4. How does a sunshine recorder work?
a) Measures the solar irradiance
b) Measures the solar radiation
c) Measures the number of hours of sunshine
d) Measures the number of hours of sunshine above a certain threshold

Answer: d

Explanation: A sunshine recorder works by measuring the number of hours during which sunshine is above a certain threshold. The threshold is typically set at 200 mW/cm^2. The data collected can be used to determine the solar insolation.

5. Which of the following best describes the measurement process in a pyrheliometer?

a) Sunlight → window in pyrheliometer → thermopile → heat is converted to electrical signal → recorded

b) Sunlight → window in pyrheliometer → heat is converted to electrical signal → thermopile → recorded

c) Window in pyrheliometer → sunlight → thermopile → heat is converted to electrical signal → recorded

d) Sunlight → heat is converted to electrical signal → window in pyrheliometer → thermopile → recorded

View Answer

Answer: a

Explanation: Sunlight enters inside the pyrheliometer through a window. This sunlight is directed onto a thermopile which then converts into an electrical signal. This electrical can be recorded and mapped to a corresponding intensity.

6. Thermopile is a collection of _____

a) thermocouples connected in parallel

b) thermocouples connected in series

c) reflectors connected in series

Answer: b

Explanation: Thermopile is a collection of thermocouples, usually connected in series. It works on the principle of thermoelectric effect – generating a voltage when dissimilar metals are exposed to temperature difference.

7. What is the irradiation proportional to in thermopile technology?

a) Difference between sun exposed area and shadow area

b) Difference between temperature of sun exposed area and shadow area

c) Difference between temperature of sun exposed area and temperature of shadow area

d) Difference between of sun exposed area and temperature of shadow area

View Answer

Answer: c

Explanation: In thermopile technology, irradiation is proportional to the difference between temperature of sun exposed area and shadow area. A thermopile pyranometer consists of a sensor based on thermopiles.

8. Which portion of the solar spectrum can a photodiode-based pyranometer detect?

a) 100 – 200nm

b) 1 – 10um

c) 150 – 200nm

d) 400 – 900 nm

View Answer

Answer: d

9. Photodiode works on the principle of _____
a) photoelectric effect
b) LED
c) thermocouple
d) differential resistance

View Answer

Answer: a
Explanation: Photodiode works on the principle of photoelectric effect. Photoelectric effect is the emission of electrons when electromagnetic radiation hits the surface of a material (generally a metal).

10. What does the net radiometer measure?
a) Measures the incoming solar radiation
b) Measures the difference between incoming and outgoing radiation
c) Measures the sum of incoming and outgoing radiation
d) Measures the outgoing solar radiation

View Answer

Answer: b
Explanation: As the name suggests, a net radiometer measures the difference between incoming and outgoing radiation. Hence, it is used to the “net radiation” (NR) at the earth’s surface.

11. Which of the following technology does a net radiometer work on?

d) Photoelectric effect

View Answer

Answer: c
Explanation: A net radiometer is based on a thermopile sensor which works on Seebeck effect. It basically measures the temperature difference between two receivers. Photodiode based pyranometer uses semiconductor technology.

12. What is a bolometer made up of?
a) A thermal reservoir and a metal layer
b) An electrical reservoir and an insulated layer
c) An absorptive element, thermal reservoir and a thermally insulated material linking both of them
d) An absorptive element, thermal reservoir and a thermal link

View Answer

Answer: d
Explanation: A bolometer is a physical device used to measure power of incident electromagnetic radiation. It consists of an absorptive element such as a metal layer, a thermal reservoir and a thermal link connecting both of them.

13. Which of the following best describes the working of bolometer?
a) Radiation → temperature of absorptive element increases above the thermal reservoir → resistive thermometer to measure temperature change
b) Radiation → resistive thermometer to measure temperature change → temperature of absorptive element increases above the reservoir
c) Temperature of absorptive element increases above the reservoir → radiation → resistive thermometer to measure temperature change
d) Radiation → temperature of absorptive element increases above the electrical reservoir → resistive thermometer to measure temperature change

View Answer

Answer: a
Explanation: When any radiation is incident on a bolometer, the absorptive element absorbs the radiation and raises its temperature above that of the thermal reservoir. The temperature change can be directly measured by connecting a resistive thermometer.

14. In a bolometer, the greater the absorbed power, higher the temperature.
a) True
b) False

Answer: a
Explanation: In a bolometer, the greater the absorbed power, higher the temperature. This is evident because as the absorptive element absorbs more power, it further raises its temperature. The intrinsic thermal time constant sets the speed of the detector.

15. Bolometers are used for ionizing particles, photons and non-ionizing particles.
a) True
b) False

View Answer

Answer: a
Explanation: Bolometers are used for ionizing particles, photons and non-ionizing particles. This is because they are directly sensitive to the energy left inside the absorber.

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Solar Energy Questions and Answers – Solar Time (Local Apparent Time)

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Time (Local Apparent Time)”.

1. What is solar time?
a) Calculation of passage of time based on sun’s position in sky
b) Calculation of passage of time based on moon’s position in sky
c) A unit that measures astronomical time
d) A reference unit for time

View Answer

Answer: a
Explanation: Solar time is the calculation of passage of time based on sun’s position in sky. It is not calculated based on moon’s position. In astronomy, if required, time is measured in terms of speed of light.

c) Hour
d) Meter

View Answer

Answer: b
Explanation: The fundamental unit of time is day. Meter is not a measurement of time. It is a unit and measurement of distance.

3. What are the two types of solar time?
a) Fundamental solar and multi-solar time
b) Apparent and diurnal solar time
c) Apparent solar time and mean solar time
d) Mean solar time and single-solar time

View Answer

Answer: c
Explanation: The two types of solar time are apparent solar time and mean solar time. Fundamental solar time, multi-solar time and single-solar time do not exist.

4. What is apparent time also known as?
a) Clock time
b) Revolution time
c) Lunar time
d) Sundial time

one day on moon with respect to earth. Revolution time depends on the speed of revolving body and the distance between body around which it revolves and itself.

5. Which of the following is the simplest sundial?
a) A tall pole casting a shadow whose length and position varies with sun's position
b) A tall pole
c) A tall pole casting a shadow that varies with moon's position
d) A stone slab

View Answer

Answer: a
Explanation: Among the above options, a tall pole casting a shadow is the simplest sundial. It should be noted that both, the length and position of the shadow must vary with sun's position. A tall pole casting a shadow that varies with moon's position is not a sundial.

6. What is mean solar time also known as?
a) Rotation time
b) Clock time
c) Lunar time
d) Sundial time

View Answer

7. Solar time is _____ clock time in December and ____ clock time in September.
a) same as, same as
b) less, more

Answer: c
Explanation: Solar time is more than clock time in December. However, it is less than clock time in September. It is almost same as the clock time during the other months.

8. Why is does the solar time vary in September and December?
a) Because of earth-moon distance
b) Because of earth-moon gravitational force
c) Because of eccentricity of sun-moon orbit
d) Because of eccentricity of earth-sun orbit

View Answer

Answer: d
Explanation: Solar time varies because of the eccentricity of earth-sun orbit. Earth's orbit around the sun is elliptical and not perfectly circular. The variation in solar time does not depend on sun-moon and earth-moon distance/orbit.

9. The clock running at a constant (say, a pendulum clock) rate _____
a) cannot follow the sun
b) always follows the sun
c) follows the sun randomly
d) follows the moon

View Answer

Answer: a
Explanation: The clock running at a constant (say, a pendulum clock) rate cannot follow

10. What does a clock running at a constant rate follow?
a) Moon
b) Imaginary mean sun
c) Actual sun
d) Real mean sun

View Answer

Answer: b
Explanation: A clock running at constant rate does not and cannot follow the actual sun. Instead, it follows an imaginary mean sun. This imaginary sun moves at a constant rate along a celestial equator. The motion is such that it matches the real sun's average clock over the period of a year.

11. What is apparent solar day?
a) Interval between sunrise and sunset of a normal day
b) Interval between two successive returns of sun on equator
c) Interval between two successive returns of sun on local meridian
d) Imaginary solar day

View Answer

Answer: c
Explanation: The interval between two successive returns of sun on local meridian is called apparent solar day. The apparent motion of the actual sun is governs apparent solar time.

12. Which of the following describes the elliptical nature of earth's orbit?
a) Apparent solar time

d) Kepler’s laws

View Answer

Answer: d
Explanation: Kepler’s laws describe the elliptical nature of earth’s orbit. Maxwell’s laws are related to electrodynamics. Sundial is an instrument used to measure apparent solar time.

13. The hour angle of the mean sun plus 12 hours is _____
a) mean solar time
b) angled solar time
c) offset solar time
d) apparent solar time

View Answer

Answer: a
Explanation: The hour angle of the mean sun plus 12 hours is called the mean solar time. The 12 hour offset is used to ensure that each day starts at midnight for civil purposes. The hour angle or mean sun is measured from local meridian.

14. Solar time is 21 seconds less than clock time in September and 29 seconds more than clock time in December.
a) True
b) False

View Answer

Answer: a
Explanation: Solar time is 21 seconds less than clock time in September and 29 seconds more than clock time in December. This is due to the eccentricity of earth’s orbit around the sun i.e. it is not perfectly circular.

15. The inclination of earth’s axis also contributes towards variation in solar time.
a) True
b) False

View Answer

Answer: a
Explanation: Along with the elliptical nature of earth’s orbit around sun, the inclination of earth’s axis also contributes towards variation in solar time. Earth’s axis is not perpendicular to the plane of orbit.

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Solar Energy Questions and Answers – Solar Radiation Geometry – 1

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Radiation Geometry – 1”.

1. What is angle subtended by sun on earth in degrees?
a) About 0.5 degrees
b) About 1 degree
c) About 35 degrees
d) About 5 degrees

View Answer

Answer: a
Explanation: Sun subtends an angle of 32 minutes at earth’s surface. When converted to degrees, it comes out to be 0.53 degrees.

d) Because sun is about the same size as that of earth

View Answer

Answer: b
Explanation: The angle subtended by sun on earth's surface is about 0.53 degrees. It is so small because of the large distance between the earth and sun.

3. When revolving around the sun, the earth moves in an elliptical cycle _____
a) on the sun's plane
b) above the sun's plane
c) above and below the sun's plane
d) below the sun's plane

View Answer

Answer: c
Explanation: When revolving around the sun, the earth moves in an elliptical path. The earth passes above and below the sun's plane to complete an elliptical cycle.

4. Which month is the earth closes to the sun?
a) February
b) March
c) December
d) January

View Answer

5. What is aphelion?
a) The point where earth is farthest from the sun
b) The point where earth is nearest from the sun
c) The point where earth is on the perpendicular bisector of sun's plane
d) The point when earth subtends an angle of 30 degrees with sun's plane

View Answer

Answer: a
Explanation: Aphelion is the point where earth is farthest from the sun. The point where earth is nearest to the sun is called perihelion.

6. Which month is the earth farthest from the sun?
a) June
b) July
c) August
d) January

View Answer

Answer: b
Explanation: Earth is farthest from the sun in July. Specifically, it is farthest on 4^{th} July. The distance between earth and sun is approximately 152.1 million km.

7. What is solstice?
a) The point where earth is farthest from the sun
b) The point where earth is nearest from the sun

Answer: c
Explanation: Solstice occur when sun's zenith is at its furthest point from celestial equator. It could either be the northerly zenith or the southerly zenith.

8. What is sun declination angle?
a) Angle between sun and earth
b) Angle between ray of the sun touching earth's surface and the equatorial plane
c) Angle between an observer on earth and the celestial equatorial plane
d) Angle between ray of the sun when extended to the earth's center and the equatorial plane

View Answer

Answer: d
Explanation: Sun declination angle is the angle between ray of the sun when extended to the earth's center and the equatorial plane. It is positively oriented when sun's rays reach the center through northern hemisphere and negative when the sun's rays reach through southern hemisphere.

9. What is sun's declination angle during summer solstice?
a) 23.5 degrees
b) 0.53 degrees
c) 32 minutes
d) -23.5 degrees

View Answer

Answer: a

10. What is sun’s declination angle during winter solstice?
a) 25 degrees
b) -23.5 degrees
c) 37 degrees
d) 23.5 degrees

View Answer

Answer: b
Explanation: Sun’s declination angle during summer solstice is -23.5 degrees. Thus, the sun shines down on the Tropic of Capricorn in the southern hemisphere and remains below the horizon everywhere within Arctic Circle.

11. What is an equinox?
a) When earth is farthest from the sun
b) When earth is nearest to the sun
c) When earth’s center lies in the plane of sun
d) When earth’s center does not lie in the plane of sun

View Answer

Answer: c
Explanation: An equinox occurs when the earth’s center lies on the plane of sun. There are two such occasions throughout the year. Perihelion is the point where earth is nearest to the sun. Aphelion is the point where earth is farthest from the sun.

12. Why does earth receive 12 hours of sunshine during equinox?

d) Because earth’s axis is perpendicular to the plane of the sun

View Answer

Answer: d
Explanation: During equinox, earth receives 12 hours of sunshine. This is mainly because earth’s north-south axis of rotation is perpendicular to the plane of the sun.

13. What is the sun’s declination angle during equinox?
a) 0 degrees
b) 1 degree
c) 13 degrees
d) 23.5 degrees

View Answer

Answer: a
Explanation: Sun’s declination angle has a measure of 0 degrees on the days of equinox. The declination angle is 23.5 degrees during summer solstice and -23.5 degrees during winter solstice.

14. The equinoxes are vernal equinox and autumnal equinox respectively.
a) True
b) False

View Answer

Answer: a
Explanation: The equinoxes are vernal equinox and autumnal equinox respectively. The sun has a 0 degree declination angle on these two days of the year.

15. On summer solstice, the sun is above the horizon in northern hemisphere.
a) True
b) False

View Answer

Answer: a
Explanation: On summer solstice, the sun is above the horizon for longest period of time in northern hemisphere. Hence, it is the longest fay for daylight.

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Solar Energy Questions and Answers – Solar Radiation Geometry – 2

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Radiation Geometry – 2”.

1. Which of the following best describes the motion of sun from autumnal equinox to winter solstice?
a) Earth is above the plane of the sun
b) Earth is below the plane of the sun
c) Earth’s center lies on the plane of the sun
d) Earth first escalates above the plane and then transcends below the plane of sun

View Answer

Answer: a
Explanation: Earth is above the plane of the sun during its motion from autumnal equinox and winter solstice. Equinox occurs when the earth’s center lies on the plane of the sun. However, it doesn’t always lie on the plane of the sun throughout the year.

a) Greater than 90 degrees
b) Less than 0 degrees
c) Greater than 0 degrees
d) Between 60 and 90 degrees

View Answer

Answer: b
Explanation: Sun's declination angle during earth's motion from autumnal equinox to winter solstice to vernal equinox is less than 0 degrees. This is because the earth is above the plane of the sun.

3. During which of the following periods is the earth below the plane of sun?
a) Vernal equinox to winter solstice
b) Winter solstice to vernal equinox
c) Vernal equinox to summer solstice
d) Summer solstice to winter solstice

View Answer

Answer: c
Explanation: The earth is below the plane of sun during its motion from vernal equinox to summer solstice and back to autumnal equinox. The earth is above the sun's plane during its motion from winter solstice to vernal equinox.

4. What is the sun's declination during earth's motion from vernal equinox to summer solstice?
a) Greater than 50 degrees

d) Less than 0 degrees

View Answer

Answer: d
Explanation: The sun’s declination angle during earth’s motion from vernal equinox to summer solstice is less than 0 degrees. This is because the earth is below the plane of the sun.

5. How is latitude of a location on earth defined?
a) Angle between line joining the location to earth’s center and earth’s equatorial plane
b) Angle between line joining the location to earth’s center and the meridian plane
c) Angle subtended by sun on earth
d) Angle between sun’s rays extended to earth’s center and earth’s equatorial plane

View Answer

Answer: a
Explanation: Latitude of a location on earth is defined by the angle between line joining the location to earth’s center and earth’s equatorial plane. Sun’s declination angle is the angle between sun’s rays extended to earth’s center and earth’s equatorial plane.

6. The lines joining North and South pole of earth are called _____
a) latitudes
b) longitudes
c) equator
d) semicircle lines

They are semicircular because they run along the curved surface of earth.

7. When does the autumnal equinox occur?
a) January
b) August
c) September
d) December

View Answer

Answer: c
Explanation: Autumnal equinox occurs in the month of September. Specifically, it occurs either on 22nd September or on 23rd September. Winter solstice occurs in December.

8. When does the vernal equinox occur?
a) January
b) December
c) September
d) March

View Answer

Answer: d
Explanation: Vernal equinox occurs in the month of March. Specifically, it occurs on 20th or 21st March. September is the month of autumnal equinox.

d) that of phase response

View Answer

Answer: a
Explanation: Solar radiation spectrum is close to that of a black body. The temperature is about 5800K. Phase response is talks about the delay of a (an electronic) system with frequency. Though it is not related to solar radiation, it is used to analyse many solar energy harvesting systems.

10. Which of the following indicates the position of any point on earth?
a) Rectangular co-ordinate system
b) Latitudes, longitudes
c) Radial co-ordinate system
d) Spherical co-ordinate system

View Answer

Answer: b
Explanation: Latitudes and longitudes are used to indicate the position of any point on the surface of the earth. Usage of spherical co-ordinate system depends on the application. Moreover, earth is not entirely spherical.

11. What is the range of sun's declination angle throughout the year?
a) Between 0 and 90 degrees
b) Between 0 and 23.5 degrees
c) Between -23.5 and 23.5 degrees

Answer: c
Explanation: Sun’s declination angle lies in the range of -23.5 and 23.5 degrees. It is positive when the earth is below the sun and negative when the earth is above the sun.

12. What the hour angle?
a) Angle between ray of the sun when extended to the earth’s center and the equatorial plane
b) Angle between line joining the location to earth’s center and earth’s equatorial plane
c) Angle through which the turns to bring the meridian of a point in line with sun’s rays
d) Angle through which the turns to bring the meridian of a point directly in line with sun’s rays

View Answer

Answer: d
Explanation: Hour angle is the angle through which the turns to bring the meridian of a point directly in line with sun’s rays. Declination angle is angle between ray of the sun when extended to the earth’s center and the equatorial plane. Latitude is angle between line joining the location to earth’s center and earth’s equatorial plane.

13. Altitude angle is the _____
a) vertical angle between projection of sun’s rays on the horizontal plane of earth’s surface
b) horizontal angle between projection of sun’s rays on the horizontal plane of earth’s surface
c) vertical angle between projection of sun’s rays on the vertical plane normal to earth’s surface
d) horizontal angle between projection of sun’s rays on the vertical plane normal to earth’s surface

View Answer

Answer: a
Explanation: Altitude angle is the vertical angle between projection of sun’s rays on the horizontal plane of earth’s surface. It is important to note that the angle is between the project of sun’s rays on the horizontal plane and not the ray its.

14. Hour angle is a measure of time of day with respect to solar noon.
a) True
b) False

View Answer

Answer: a
Explanation: Hour angle is a measure of time of day with respect to solar noon. At noon, the hour angle is 0 degrees and rotates at 15 degree per hour.

15. The altitude angle is maximum at noon.

Answer: a
Explanation: The altitude angle talks about how high the sun appears in the sky. It is maximum at noon. It is zero at sunrise and sunset and is 90 degrees (maximum) at noon.

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Solar Energy Questions and Answers – Solar Day Length

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Day Length”.

1. What is solar noon?
a) Time of the day at which sun’s rays are perpendicular to a given line of longitude
b) Time of the day at which sun’s rays are parallel to a given line of longitude
c) Time of the day at which sun’s rays are perpendicular earth’s surface
d) Time of the day at which sun’s rays are parallel to earth’s surface

View Answer

Answer: a
Explanation: Solar noon is defined as the time of the day at which sun’s rays are perpendicular to a given line of longitude. It is important to note that solar noon does not occur simultaneously at every location on earth. Hence the phrase, “give line of longitude”.

longitude
c) Solar noon occurs does not vary with longitude
d) Solar noon occurs half hour late with every 15 degrees of longitude east of a given longitude

View Answer

Answer: b
Explanation: Solar noon varies with longitude but it is important to mention the reference longitude for correct calculation. It occurs one hour late with every 15 degrees of longitude east of a given longitude. This can be used to estimate the time of different regions.

2. How does the solar noon vary with every 15 degrees of longitude west of a given longitude?
a) Solar noon occurs one hour later with every 15 degrees of longitude west of a given longitude
b) Solar noon occurs one hour earlier with every 15 degrees of longitude east of a given longitude
c) Solar noon occurs one hour later with every 15 degrees of longitude west of a given longitude
d) Solar noon occurs half hour later with every 15 degrees of longitude west of a given longitude

View Answer

Answer: c
Explanation: To calculate solar noon, it is important to mention the reference longitude. Once the reference is known, solar noon occurs one hour later with every 15 degrees of longitude west of a given longitude.

4. What is a solar day?
a) One complete revolution of sun around moon

d) One complete revolution of sun around earth

View Answer

Answer: d
Explanation: Though the earth revolves around the sun and rotates about its own axis, a solar day is measured with respect to an observer on earth. Hence, a solar day is defined as one complete revolution of sun around earth.

5. What is a sidereal day?
a) Time taken by earth to rotate about its axis for distant stars to appear fixed
b) Time taken by earth to rotate about its axis for sun to appear fixed
c) Time taken by earth to rotate about its axis for distant stars to be moved by 1 degree
d) Time taken by earth to rotate about its axis for distant stars to be moved by 0.5 degrees

View Answer

Answer: a
Explanation: Sidereal day is the time taken by earth to rotate about its axis for distant stars to appear fixed. Time taken by earth to rotate about its axis for sun to appear fixed is solar day.

6. Solar day is _____ sidereal day.
a) 4 min shorter than
b) 4 min longer than
c) 10 min shorter than
d) 10 min longer than

taken by earth to complete one rotation about its axis and one revolution about sun.

7. One sidereal day is _____ solar hours and _____ solar minutes long.
a) 26, 57
b) 24, 59
c) 23, 56
d) 24, 60

View Answer

Answer: c
Explanation: One solar day is 24 hours long and one sidereal day is 24 hours long. However, one sidereal day is 24 solar hours and 60 solar minutes long. Thus, there is a difference of 4 minutes between the two.

8. Which of the following solar time duration is not constant throughout the year?
a) Mean solar day
b) Sidereal day
c) Local true solar time
d) Apparent solar day

View Answer

Answer: d
Explanation: Apparent solar day is not constant throughout the year. It can be 20 seconds shorter or 30 seconds longer than a mean solar day. Sidereal day is not a solar time.

c) Solar time on the Greenwich meridian
d) Solar time on the equator

View Answer

Answer: a
Explanation: Local true solar time (LTST) is the equivalent of earth's solar time on other planets. On earth, solar time was used to be measured by sundials.

10. The length of mean solar day is slowly increasing.
a) True
b) False

View Answer

Answer: a
Explanation: The length of a mean solar day is slowly increasing. This is because of the tidal acceleration of the moon by earth and the corresponding slowing of earth's rotation by moon.

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Solar Energy Questions and Answers – Empirical Equations for Estimating Solar Radiation Availability on Horizontal Surface for Cloudy Skies

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This set of Solar Energy Interview Questions and Answers for freshers focuses on “Empirical Equations for Estimating Solar Radiation Availability on Horizontal Surface for Cloudy Skies”.

1. What is the relationship between insolation and cloud cover in sky?
a) Inverse
b) Directly proportional
c) Square
d) Exponential

View Answer

Answer: a
Explanation: From ancient time, people knew the relationship between sunshine and cloud cover. There is an inverse relationship between insolation and the amount of sky covered by clouds.

2. Which of the following is a reason for inverse relationship between insolation and cloud cover in sky?
a) Sunshine duration records are caused by sun being obstructed by transparent cloud cover
b) Sunshine duration records are caused by sun being obstructed by opaque cloud cover
c) Sunshine duration records are caused by sunshine being transmitted through opaque cloud cover
d) Sunshine duration records are caused by sun being obstructed by cloud cover

View Answer

3. Which does Angstrom-Savinov formula tell?
a) Relationship between local solar radiation and global cloudiness
b) Relationship between local solar radiation and local cloudiness
c) Relationship between global solar radiation and mean cloudiness
d) Relationship between global solar radiation and global cloudiness

View Answer

Answer: c
Explanation: Angstrom-Savinov formula is a relationship between global solar radiation (H) and mean cloudiness (C). It is given by mathematical relationship, $H=H_0[1-(1-k)C]$.

4. What does the constant “k” signify in the Angstrom-Savinov formula?
a) Global solar radiation
b) Mean cloudiness
c) Reflection of solar radiation within clouds
d) Transmission of solar radiation within clouds

Answer: d
Explanation: The constant “k” signifies the transmission of solar radiation within clouds. It is defined to account for the partial and practical transmission of solar radiation through clouds.

5. The constant “k” in Angstrom-Savinov formula depends on _____
a) latitude of the location
b) longitude of the location
c) solar radiation
d) cloud opacity

View Answer

Answer: a
Explanation: The constant “k” accounts for transmission of solar radiation through clouds. It depends on the latitude of the location. It does not depend on the solar radiation and cloud capacity.

6. How does the constant “k” in Angstrom-Savinov vary in high and low latitudes?
a) Between 0.55 in high latitudes and 0.22 in low latitudes
b) Between 0.55 in high latitudes and 0.33 in low latitudes
c) Between 0.33 in high latitudes and 0.55 in low latitudes
d) Between 0 in high latitudes and 0.9 in low latitudes

View Answer

Answer: b
Explanation: The constant “k” in Angstrom-Savinov has a range from 0.33 to 0.55. It var

7. Which of the following models uses linear regression to estimate solar radiation from sunshine duration?
a) Angstrom-Savinov
b) Ertekin and Yladtz
c) Anstrom-Prescott
d) Sen

View Answer

Answer: c
Explanation: Anstrom-Prescott model uses linear regression to estimate solar radiation from sunshine duration. $H/H_0=a+b*(S/S_0)$ is the regression equation. H is global radiation and S is the sunshine duration.

8. Akinoglu and Fcevit uses a _____ to estimate solar radiation.
a) linear model
b) power model
c) exponential model
d) quadratic model

View Answer

Answer: d
Explanation: Akinoglu and Fcevit uses a quadratic model to estimate solar radiation. Like Angstom-Savinov, it also estimates solar radiation from sunshine duration.

9. How is an empirical model developed?

d) From trial and error

View Answer

Answer: a
Explanation: Empirical models of any system is developed from data acquired via sensors or measuring instruments. The developers decide the variables and the output and perform various numerical analysis to formulate a relationship.

10. What does the ratio of global solar radiation (H) and estimated daily global radiation for cloudless sky (H_0) indicate?
a) Solar radiation transmission ratio
b) Clearness index
c) Solar radiation reflection percentage
d) Turbidity

View Answer

Answer: b
Explanation: The ratio of global solar radiation (H) and estimated daily global radiation for cloudless sky (H_0) indicates clearness index. It neither indicates solar radiation transmission ratio nor does it indicate turbidity. Solar radiation reflection percentage is indicated by albedo.

11. Which of the following is important during data acquisition from measuring instruments? Assume that details about data to be collected is known.
a) Type of data
b) Materials used to manufacture measuring instruments

Answer: c
Explanation: Assuming that details about the data to be collected is known, location, environment and characteristics of measuring instrument is important. This is because instruments can give different values under different conditions. Basically, data acquisition procedure should be consistent and authentic.

12. Which of the following statistical indicator is used to evaluate any type of model?
a) mean
b) median
c) error
d) root mean square error

View Answer

Answer: d
Explanation: Root mean square error is a commonly used statistical indicator to evaluate any type of model. It basically describes the mean error between simulated/measured/observed values and the true values.

13. Why do ground-based observers overestimate overcast cloud cover?
a) Clouds appear to fill large area of sky when near horizon
b) Clouds appear to fill large area of sky when far from horizon
c) Clouds appear to fill small area of sky when near horizon
d) Clouds appear to fill small area of sky when far from horizon

View Answer

Answer: a
Explanation: Ground-based observers tend to overestimate overcast cloud covers. This is because clouds with vertical extents appear to fill a greater area of sky when located near the horizon than when they are overhead.

14. Reduction of error between simulated values and the true values increases accuracy of the empirical model.
a) True
b) False

View Answer

Answer: a
Explanation: Reduction of error between simulated values and the true values increases accuracy of the empirical model. This is because decrement in error indicates that simulated values are moving closer to true/desired values.

b) False

View Answer

Answer: b
Explanation: Like any other estimation, cloud cover estimation is not free from errors. For instance, a small hole in the cloud could remain open for a long period of time thereby allowing more sunlight to pass through than estimated.

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Solar Energy Questions and Answers – Hourly Global, Diffuse and Beam Radiations on Horizontal Surface Under Cloudless Skies

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This set of Solar Energy Questions and Answers for Experienced people focuses on “Hourly Global, Diffuse and Beam Radiations on Horizontal
Surface Under Cloudless Skies”.

1. Hourly radiation values can be used to evaluate the performance of _____
a) flat plate collectors
b) curved collectors
c) parabolic collectors
d) metallic collectors

View Answer

Answer: a
Explanation: Hourly values of solar radiation provides very precise information about performance of solar energy systems. For example, hourly radiation values can be used to evaluate the performance of flat plate collectors.

2. Why are global and diffuse radiation values not measured?
a) Because of sophisticated measuring instruments
b) Because measuring instruments are not available everywhere
c) Because of unavailability of skilled labour to operate measuring instruments
d) Because measuring instruments are not available everywhere

View Answer

Answer: b
Explanation: Global and diffuse radiation values are not measured mainly because measuring instruments are not available at all locations, in every lab or institute. The major problem is not unavailability of funds or skilled labour.

3. Which of the following is generally used to compute global and diffuse radiation values?
a) Parabolic dish
b) Flat plate collector
c) Theoretical models
d) Pyranometer

View Answer

Answer: c
Explanation: Global and diffuse radiation values are generally computed from theoretical models. This is because of unavailability of measuring instruments at all locations. Pyranometer is used wherever and whenever possible.

4. Which of the following can be used to estimate beam radiation?

d) Zenith angle and altitude

View Answer

Answer: d
Explanation: Zenith angle and altitude of the location can be used to estimate beam radiation transmitted through a clear atmosphere. Though solar insolation constant is used, it is either just a scaling factor or a constant and not a variable. Photoelectric effect is not related to beam radiation.

5. What is zenith angle?
a) Angle between sun and vertical
b) Angle between the line joining the location on earth's surface and the equatorial plane
c) Angle between extended sun's rays to earth's center and equatorial plane
d) Angle between projection of sun's rays on horizontal surface and equatorial plane

View Answer

Answer: a
Explanation: Zenith angle is the angle between sun's ray and the vertical. Latitude is angle between the line joining the location on earth's surface and the equatorial plane. Sun's declination angle is angle between extended sun's rays to earth's center and equatorial plane.

6. Which of the following is **not** used to calculate hourly radiation?
a) Sun's declination angle
b) Material of parabolic dish
c) Solar constant

Answer: b
Explanation: Material of the collector is not used to calculate hourly radiation. The material of the collector affects the values being measured and not theoretically computed values. Sun's declination, hour angle and solar constant play their part in the computation.

7. Solar radiation on a horizontal surface is the summation of _____
a) direct and active solar radiation
b) active and diffuse solar radiation
c) diffuse and direct solar radiation
d) electrons and photons

View Answer

Answer: c
Explanation: Solar radiation on a horizontal surface is the summation of diffuse and direct solar radiation. It is not just a summation of electrons and photons as the option does not specify the source of electrons and photons.

8. What are the two models used to determine diffuse radiation?
a) Rayleigh scattering and Hybrid pi model
b) Parametric model and Rayleigh scattering
c) Decomposition model and Hybrid pi model
d) Parametric and decomposition models

View Answer

Answer: d

9. Which of the following is required as a parameter in a parametric model?
a) Cloud cover
b) Solar insolation constant
c) Material of measuring instrument
d) Type of measuring instrument

View Answer

Answer: a
Explanation: Cloud cover, atmospheric turbidity, fractional sunshine and perceptible water content are necessities of a parametric model. Though solar insolation constant may be required, it is not a parameter. In any theoretical mode, material and type of measuring instrument is irrelevant.

10. Which of the following is an example of parametric model used to compute diffuse radiation?
a) Chandrasekaran and Kumar's model
b) ASHRAE model
c) Erb's model
d) T-model

View Answer

Answer: b
Explanation: ASHRAE model is an example of parametric model used to compute diffuse radiation. Erb's model and Chandrasekaran and Kumar's model are not parametric models. T-model is used to model a transistor and is not related to radiation.

c) From global solar radiation data
d) From ASHRAE model

View Answer

Answer: c
Explanation: Decomposition models use global solar radiation data to estimate and compute diffuse solar radiation. Parametric models require specific information of environmental conditions to compute diffuse solar radiation.

12. Decomposition models are based on correlation between _____
a) global solar radiation and active radiation
b) diffuse and UV radiation on vertical surface
c) diffuse and total radiation on inclined surface
d) diffuse and total radiation on horizontal surface

View Answer

Answer: d
Explanation: Decomposition models are based on correlation between diffuse and total radiation on horizontal surface. UV radiation is a part of the total received solar radiation.

13. Which of the following does the correlation of decomposition models (between diffuse and total radiation on horizontal surface) depend on?
a) Hourly clearness index ratio
b) Daily clearness index ratio
c) Hourly global horizontal radiation
d) Yearly extraterrestrial radiation

View Answer

Answer: a
Explanation: The correlation of decomposition models (between diffuse and total radiation on horizontal surface) depend on hourly clearness index ratio. It is the ratio of hourly global horizontal radiation to hourly extraterrestrial radiation.

14. The clearness index is a measure of atmospheric effects in an isolated place.
a) True
b) False

View Answer

Answer: b
Explanation: The clearness index is a measure of atmospheric effects in an isolated place. I

15. Nijegorodov's model revised the constants of ASHRAE's model.
a) True
b) False

View Answer

Answer: a
Explanation: Nijegorodov's model revised the constants of ASHRAE's model using a computer program. It was used to predict hourly and daily global solar radiation in Botswana.

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Solar Energy Questions and Answers – Solar Collectors – 1

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Collectors – 1”.

1. What is a solar collector?
a) A system to collect heat by absorbing sunlight
b) A system to collect rainwater using sunlight
c) A system to collect electricity by using sunlight
d) A device to reflect sunlight back

View Answer

Answer: a
Explanation: A solar collector is a system to collect heat by absorbing sunlight and use it for various applications. It is neither a system to collect rainwater nor electricity. However, it could be used to perform such processes.

c) Area occupied by the system after installation
d) Cross-sectional area of the receiver

View Answer

Answer: b
Explanation: Aperture area of a receiver is that area which receives the solar radiation. It need not be same as the entire size of the receiver. It is not same as the area occupied by the system after installation.

3. Aperture area of a solar collector is roughly equal to _____
a) Coolant area
b) Generator area
c) Absorber area
d) System area

View Answer

Answer: c
Explanation: In a solar collector, the aperture area is approximately equal to absorber area. This enables absorption of (almost) all the sunlight that is incident on the aperture area.

4. What are the components of a flat plate collector?
a) Flat box, a plate with reflective coating and fluid circulation passageways, an opaque cover, a circulating fluid
b) Flat box, a dark coloured plate with fluid circulation passageways, an opaque, a circulat fluid

fluid

View Answer

Answer: d
Explanation: A flat plate solar collector consists of various components. Firstly, it consists of a flat box or an enclosure to hold the entire setup. A dark coloured plate is fitted with fluid circulation passageways and transparent cover. Finally, a circulating fluid which flows through the entire setup.

5. Why is a transparent cover used in a flat plate collector?
a) To maximize transmission of the incident sunlight into the box
b) To minimize transmission of the incident sunlight into the box
c) To entirely reflect the incident sunlight back
d) To ensure partial transmission of the incident sunlight into the box

View Answer

Answer: a
Explanation: A transparent cover is used in a flat plate collector. This is because it maximizes the transmission of the incident sunlight into the box thereby collecting maximum sunlight for thermal energy.

6. Which of the following is generally used as circulating fluid in tropical and sub-tropical climates?
a) A mixture of ethylene glycol and water
b) Water

Answer: b
Explanation: Water is used as circulating fluid in tropical and sub-tropical climates. This is because it has good properties as a coolant. A mixture of water with ethylene glycol or glycerol or propylene glycol is not used as coolant in tropical and sub-tropical climates.

7. Which of the following is generally used as circulating fluid in freezing climates?
a) Liquid carbon dioxide
b) Water
c) A mixture of propylene glycol and water
d) Liquid nitrogen

View Answer

Answer: c
Explanation: In freezing climates, antifreeze solution like a mixture of water with propylene glycol or ethylene glycol or glycerol is used as coolants. Liquid carbon dioxide, water and liquid nitrogen are not used as coolants in freezing climates.

8. Why are antifreeze solutions (antifreeze agents with water) used as coolants in freezing climates?
a) To increase boiling point of water
b) To decrease boiling point of water
c) To increase freezing point of water
d) To decrease freezing point water

View Answer

9. Adding antifreeze agents to water _____
a) increases its durability as coolant
b) decreases its durability as coolant
c) turns water into a coolant
d) prevents water from acting as a coolant

View Answer

Answer: a
Explanation: Adding antifreeze agents to water increases its durability as coolant. This is because it depresses the freezing point of water and prevents it from becoming ice.

10. Which of the following is a circulating fluid in evacuated flat-plate solar collectors?
a) Water
b) Steam
c) Nitrogen
d) Hydrogen

View Answer

Answer: b
Explanation: Evacuated flat-plate solar collectors are a more recent technology. It uses steam as its circulating fluid. Nitrogen and hydrogen are not used as circulating fluid. Water is mainly used in flat-plat collectors.

11. Evacuated flat-plate solar collectors are a type of _____
a) concentrating collectors

d) solar stills

View Answer

Answer: c
Explanation: Evacuated flat-plate solar collectors are a type of non-concentrating collectors. Solar stills and photovoltaic technology are not solar collectors.

12. Which of the following are used as absorbers in evacuated-tube solar collectors?
a) Carbon tubes
b) Wooden or metallic tubes
c) Plastic or glass tubes
d) Metallic or glass tubes

View Answer

Answer: d
Explanation: Metallic or glass tubes are used as absorbers in evacuated-tube solar collectors. Wood and plastic are thermal insulators and hence, cannot be used to create passageways for the heat carrying circulating fluid.

13. What is a heat pipe?
a) A heat-transfer device
b) A pipe made of heat
c) A pipe that consists of heat
d) A heat pumping device

View Answer

Answer: a
Explanation: A heat pipe is a heat-transfer device. It combines the principles of thermal conductivity and phase transition to effectively transfer heat between two solid interfaces.

14. For better efficiency, solar collectors **do not** coat their transparent cover with an anti-reflective coating.
a) True
b) False

View Answer

Answer: b
Explanation: For better efficiency, solar collectors coat their transparent cover with an anti-reflective coating. The anti-reflective coating reduces the amount of reflection dramatica
Thus, the amount of sunlight collected is increased.

b) False

View Answer

Answer: a
Explanation: Evacuated tube solar collectors use a glass tube to surround absorber with high vacuum. This is used to effectively resist atmospheric pressure and reduce conductive and convective losses.

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Solar Energy Questions and Answers – Solar Collectors – 2

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1. Which of the following is used to make a glass-glass evacuated tubes?
a) Borosilicate glass
b) Carbon
c) Wood
d) Plastic coating

View Answer

Answer: a
Explanation: As the name suggests, glass-glass evacuated tubes is a type of evacuated-tube solar collector. It is made up of two borosilicate glass tubes fused together at one or both ends.

c) Poor absorption of sunlight
d) Poor reception of sunlight

View Answer

Answer: b
Explanation: Overheating is a common problem with evacuated-tube solar collector. This is because of the high temperatures of the circulating fluid caused by collection of large amount of sunlight.

3. Why does flat plate collector perceived to have higher efficiency than evacuated tube solar collector in terms of area?
a) Because flat plate collector has a large installation area
b) Because evacuated tube collector is compact
c) Because of the vacuum gap in evacuated tube collectors
d) Because of the vacuum gap in flat plate collectors

View Answer

Answer: c
Explanation: In terms of area, flat plate solar collectors are generally perceived to have a higher efficiency than evacuated-tube solar collectors. This is because of the vacuum gap in evacuated tube collectors which increases their net occupied area.

4. _____ lose more heat to the environment than evacuated-tube solar collectors.
a) Photovoltaics
b) Solar stills

Answer: d
Explanation: Flat-plate collectors lose more heat to the environment than evacuated-tube solar collectors. Photovoltaics, solar stills and solar air conditioners are not solar collectors.

5. Which of the following are combined to form an evacuated flat plate solar collector?
a) Flat plate solar collectors and evacuated-tube solar collectors
b) Flat plate solar collectors and bowl collectors
c) Bowl collectors and evacuated-tube solar collectors
d) Polymer collectors and bowl collectors

View Answer

Answer: a
Explanation: Evacuated flat plate collectors combine the technologies of both, flat plate solar collectors and evacuated-tube solar collectors. There are not a combination of bowl and polymer type collectors.

6. Which of the following provides highest energy conversion efficiency in non-concentrating solar collectors?
a) Flat plate collectors
b) Evacuated flat plate collectors
c) Evacuated-tube collectors
d) Parabolic collectors

View Answer

Answer: b

7. What is the metal sheet absorber surrounded with in an evacuated flat plate collector?
a) Low volume inside flat envelope
b) Low vacuum inside curved envelope
c) High vacuum inside flat envelope
d) Low vacuum inside thick curved envelope

View Answer

Answer: c
Explanation: In an evacuated flat-plate solar collector, the metal sheet absorber is surrounded with a high vacuum. This is then placed inside a flat envelope made of glass and metal.

8. Which of the following organisations developed first high vacuum insulation?
a) NASA
b) IIT
c) Stanford
d) CERN

View Answer

Answer: d
Explanation: CERN developed the first collector making use of high vacuum insulation. However, the first company to commercialise the technology was TVP SOLAR SA of Switzerland.

9. Why does an evacuated flat plate collector require a glass-metal seal?
a) To join the glass plate to the rest of metal envelope

d) To disconnect the glass plate to the rest of metal envelope

View Answer

Answer: a
Explanation: An evacuated flat plate collector requires a glass-metal seal. This is to join the glass plate to the rest of metal envelope. It also requires an internal structure to support such a plate against atmospheric pressure.

10. Which of the following pumps is used in an evacuated-tube solar collector?
a) Non-evaporable getter
b) Flash getter pump
c) Heat pump
d) Water pump

View Answer

Answer: b
Explanation: Evacuated flat-plate solar collectors use a barium flash getter pump. This pump is used to keep the internal pressure stable throughout the operation. They do not use non-evaporable getter pumps.

11. Evacuated flat-plate solar collectors use _____ pumps.
a) Heat pump
b) Flash getter pump
c) Non-evaporable getter
d) Internal combustion

Answer: c
Explanation: Evacuated flat-plate solar collectors use non-evaporable getter (NEG) pumps to keep the internal pressure stable throughout the operation. This pump enables some regeneration in-situ by exposure to sunlight.

12. What advantage does polymer collector have over metal collector?
a) Better sales as they are produced in Europe
b) Poor sales as they are produced in Europe
c) They cannot be used in cold climate
d) They can be used in cold climate

View Answer

Answer: d
Explanation: The primary advantage of a polymer collector over a metal collector is that they can be used in cold regions with low temperatures. This is because they are freeze-tolerant. Whether they are manufactured in Europe or not does is neither an advantage nor a disadvantage.

13. Bowl collectors operate similarly to _____
a) parabolic dish
b) flat plate collector
c) evacuated-tube collector
d) evacuated flat tube collector

View Answer

Answer: a
Explanation: Bowl collectors operate similarly to a parabolic dish. However, they have a fixed receiver unlike a parabolic dish. This reduces efficiency but is much cheaper to build and operate.

14. Polymer flat plate collectors can use plain water.
a) True
b) False

View Answer

Answer: a
Explanation: Polymer flat plate collectors can use plain water. This is because they are freeze-tolerant and do not require antifreeze agents to prevent water from solidifying.

15. Bowl collectors use a fixed curved receiver.

Answer: a
Explanation: Bowl collectors use a fixed curved receiver. They have a fixed spherical mirror with a tracking receiver.

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Solar Energy Questions and Answers – Solar Water Heater

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Water Heater”.

1. What is solar water heater?
a) Use solar energy to heat water
b) Use solar energy to generate current which is then used to heat water
c) Use water to generate heat
d) Use solar energy to generate steam

View Answer

Answer: a
Explanation: Solar water heater is a system that converts sunlight into heat. This heat is then used to heat water. As the water gets heated, steam may be produced but the purpose of solar water is to heat water and not produce steam. It does not generate current.

c) Chemicals
d) Solar radiation constant

View Answer

Answer: b
Explanation: Changes in ambient temperature during day-night cycle is one of the factors that determines the complexity and size of solar water heating system. Food, chemicals and solar radiation constant does not influence the complexity and size of the system.

3. What is freeze protection in a solar water heating system?
a) Ensures that the system is frozen
b) Prevents the operation of drainback system
c) Prevents damage to system due to freezing of transfer fluid
d) Ensures that the transfer fluid is frozen

View Answer

Answer: c
Explanation: Freeze protection in a solar water system prevents the system being damaged due to freezing of transfer fluid. It does not prevent the operation of drainback system.

4. What are drainback systems in solar water heating system?
a) The system that reverses the direction of flow of transfer fluid
b) The system that tracks the sun
c) The system that pumps excess transfer fluid
d) The system that drains the transfer fluid

Answer: d
Explanation: Drainback systems are systems that drain the transfer fluid particularly to ensure freeze protection. This prevents the freezing of transfer fluid and any unwanted damage to the system.

5. How does freeze-tolerance work?
a) By expansion of pipes carrying transfer fluid
b) By compression of pipes carrying transfer fluid
c) By increasing the temperature of pipes carrying transfer fluid
d) By increasing the pressure inside pipes carrying transfer fluid

View Answer

Answer: a
Explanation: Freeze-tolerance works by expansion of pipes carrying the transfer fluid. The low pressure pipes are made of silicone rubber that expands on freezing.

6. Which of the following metals are used to make pipes of low cost solar water heating system?
a) Gold
b) Copper
c) Polymer
d) Silver

View Answer

Answer: b
Explanation: Copper is used to make pipes of low cost solar water heating systems. Thou

7. Direct solar water heating systems _____
a) offer great overheating protection
b) are called pumped systems
c) offer no overheating protection
d) offer great freeze protection

View Answer

Answer: c
Explanation: Direct solar water heating systems are also called compact systems. They offer little or no overheating protection unless they have a heat export pump.

8. How is the heat transferred from transfer fluid to potable water in indirect solar water heating systems?
a) By directly exposing the substance to sunlight
b) By using an electrical heater
c) By circulating potable water through the collector
d) By using heat exchanger

View Answer

Answer: d
Explanation: An indirect solar water heating system uses a heat exchanger to transfer heat from the transfer fluid to the potable water. It does not expose the transfer fluid directly to the sunlight and does not use an electrical heater.

9. How is water heated in a direct solar water heating system?

d) By using heat exchanger

View Answer

Answer: a
Explanation: In a direct solar water heating system, the potable water is the transfer fluid. Hence, it is heated by circulating through the collector. Indirect solar water heating systems use a heat exchanger.

10. Passive systems rely on heat-driven convection.
a) False
b) True

View Answer

Answer: b
Explanation: Passive systems rely on heat-driven convection. If not, they also use heat pipes to circulate the working fluid through the collector and heat it. Hence, they are cheap and are easily maintained.

11. Which of the following is an example of direct solar water heating system?
a) Pressurised antifreeze system
b) Pumped systems to circulate transfer fluid
c) Convection heat storage system
d) Drainback system

View Answer

12. How is the heat transfer fluid (HTF) heated in bubble pump systems?
a) By subjecting the closed HTF circuit to high pressure
b) By subjecting the closed HTF circuit to high pressure and by increasing the volume
c) By subjecting the closed HTF circuit to low pressure and by decreasing the volume
d) By subjecting the closed HTF circuit to low pressure

View Answer

13. Batch collectors reduce heat loss by thermally insulating the storage tank.
a) True
b) False

View Answer

Answer: a
Explanation: Batch collectors reduce heat loss by thermally insulating the storage tank. This is done by covering the tank in a glass-topped box that allows heat from sun to reach the water tank and traps it – greenhouse effect.

14. Overheat protection is done by passing hot water through collector during night.
a) False
b) True

View Answer

Answer: b
Explanation: Overheat protection is done by passing hot water through collector during night or when there is less sunlight. This is extremely effective in direct or thermal store plumbing and ineffective in evacuated-tube collectors.

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Solar Energy Questions and Answers – Solar Water Heater

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Solar Energy Questions and Answers – Solar Passive Space – Heating and Cooling Systems

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Passive Space – Heating and Cooling Systems”.

1. What is solar heating and cooling?
a) Use solar energy to regulate the internal temperature of a given space
b) Use solar energy to regulate the temperature of environment
c) Use solar energy to monotonically increase the internal temperature of a given space
d) Use solar energy to monotonically decrease the temperature of a given space

View Answer

Answer: a
Explanation: Passive solar heating and cooling, also called as passive solar design uses solar energy to regulate the internal temperature of a given space. The space is essentially some kind of closed/isolated area.

c) Water heaters
d) Room heaters

View Answer

Answer: b
Explanation: Building systems designed specifically for a solar heating and cooling system is used to regulate the temperature of a given space. It could be done with the help of temperature controlling systems like an air conditioner embedded into the building.

3. Which of the following is **not** used in a passive solar heating/cooling system?
a) Building walls
b) Building roofs
c) Air conditioners
d) Building floors

View Answer

Answer: c
Explanation: Air conditioners are not used in a passive solar heating and cooling system. This is simply because the system is passive. Wall, floors and roofs are included in a passive system?

4. What is a passive solar heating and cooling system?
a) Uses building design with mechanical systems to regulate the temperature outside a given space
b) Uses building design with mechanical systems to monotonically increase the temperat

d) Uses building design without any solar heating (and cooling) system to regulate the temperature inside a given space

View Answer

Answer: d
Explanation: As the name suggests, a passive solar heating and cooling system does not use any kind of active system. Instead, it uses building design without any solar heating (and cooling) system to regulate the temperature inside a given space.

5. Which of the following is extremely important with respect to a passive solar heating and cooling system?
a) Materials used to construct the building
b) Electrical systems used to perform heating/cooling operation
c) Mechanical systems used to perform heating/cooling operation
d) Material used to build heating/cooling systems

View Answer

Answer: a
Explanation: A passive solar heating and cooling system does not consist of any active element. Hence, materials used to construct the building plays a major role in regulating the amount of heat trapped within the room.

6. Which of the following is an example of passive solar technology?
a) Photovoltaic
b) Solar furnace

Answer: b
Explanation: Solar furnace is a well known example of passive solar technology. It uses concentrated solar power to generate high temperatures for industrial purposes. Active solar water heating systems and solar thermo-mechanical systems are active systems.

7. What is a sunroom?
a) A room with a sun fitted inside it
b) A room that does not allow sunlight to pass through it
c) A room that transmits a lot of sunlight and has a scenic view
d) A room that does not pass sunlight and has a scenic view

View Answer

Answer: c
Explanation: A sunroom, also known as a solarium is a room that permits a lot of sunlight through it. It also has a beautiful scenic view for recreational purposes. This is an example of a passive solar technology.

8. Which of the following process is involved in heat transfer through building?
a) Seebeck effect
b) Peltier effect
c) Hall effect
d) Conduction

View Answer

Answer: d

9. Which part of a house receives majority of solar radiation?
a) Roof
b) Side walls
c) Floor
d) Doors

View Answer

Answer: a
Explanation: When compared to side walls, floor and doors, roofs receive majority of solar radiation. The heat from sun flows into the building mainly through radiation and supported by convection and conduction.

10. Which of the following is a site-specific design consideration for a passive solar heating and cooling system?
a) Orientation of the building
b) Latitude
c) Building window size
d) Placement of rooms

View Answer

Answer: b
Explanation: Site specific design considerations are dependent on the location of the site. Hence, latitude, sun path and insolation are some examples of site-specific design considerations.

b) Diurnal variations in temperature
c) Using thermal mass to store excess solar energy during winter
d) Obstacles

View Answer

Answer: c
Explanation: Using thermal mass to store excess solar energy during winter is a design element for residential buildings in temperate and tropical climates. Thermal mass is a property of the mass of a building to store heat. Latitude, obstacles and diurnal variations in temperature are site-specific design considerations.

12. A building with excessive glass cover _____
a) results in freezing
b) results in a pleasant temperature within the building
c) damages the building material
d) results in overheating

View Answer

Answer: d
Explanation: A building with excessive glass cover results in overheating. This is basically due to trapping of heat within the building and is explained by greenhouse effect. It will not result in freezing.

13. A solar roof constructed on a building uses water stored _____ to temper hot and cold internal temperatures of the building.
a) on building roofs
b) on building walls
c) beneath building floors
d) on an auxiliary building

View Answer

Answer: a
Explanation: A solar roof constructed on a building uses water stored on building roofs to temper hot and cold internal temperatures of the building. It is also called as roof pond passive solar heating system and is usually deployed in desert environments.

14. A “cool roof” uses reflective surfaces.
a) False
b) True

View Answer

incident solar radiation is reflected back and the temperature within the building is maintained. Green roof is another variation that uses vegetation instead of reflective surfaces.

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Solar Energy Questions and Answers – Solar Industrial Heating Systems

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Industrial Heating Systems”.

1. Which of the following is/are applications of solar heating systems?
a) Pasteurisation and drying
b) Wetting
c) Rainfall
d) Battery and capacitor technology

View Answer

Answer: a
Explanation: Pasteurisation and drying are applications of solar heating systems. Battery and capacitor technology are used to store energy from various sources like wind, sun, geothermal, etc. Wetting and raining are not applications of solar heating systems.

c) A system which uses earth’s heat to generate sunlight
d) A system which uses earth’s heat to generate electricity

View Answer

Answer: b
Explanation: A solar heating system is a system which uses sunlight to generate heat. This heat can either be directly used or converted to other usable forms of energy like electricity. Geothermal energy is using earth’s heat to generate usable forms of energy.

3. What solar thermal technologies are useful for industrial processes?
a) Photovoltaics and solar air collectors
b) Solar air collectors and geothermal energy
c) Solar air collectors and solar water systems
d) Geothermal and photovoltaics

View Answer

Answer: c
Explanation: Solar air collectors, solar water systems and solar concentrators are three well known solar thermal technologies used in industrial processes. Geothermal energy and photovoltaics are not solar thermal processes.

4. Which industry primarily uses solar air collectors?
a) Industries manufacturing plastic
b) Industries melting metals
c) Semiconductor industry

Answer: d
Explanation: Food processing industry primarily uses solar air collectors. They replace traditional gas or oil-based drying in the industry. Melting metals requires extremely high temperatures that are not provided by solar air collectors.

5. How does using a solar air collector benefit food processing industry?
a) Reduce gas-or-oil-based drying and/or reduce food spoilage
b) Reduce food spoilage and increase gas-or-oil base drying
c) Increase food spoilage
d) Increase gas-or-oil-based drying and/or increase food spoilage

View Answer

Answer: a
Explanation: Solar air collectors benefit food processing industry in many ways. They primarily reduce gas-or-oil-based drying and/or reduce food spoilage due to open air drying. Also, they can be built locally and their cost depends on local building materials and labour.

6. Which of the following is a conventional solar water system?
a) Solar air collectors
b) Flat-plate collectors
c) Parabolic dish collectors
d) Linear Fresnel collectors

View Answer

Answer: b

7. Which application is best suited for a solar water system?
a) Food industry
b) Semiconductor industry
c) Residential applications
d) Liquid adsorption

View Answer

Answer: c
Explanation: Solar water systems are best suited for residential applications and if required can be installed on rooftops to meet temperature demands upto 125 degree Celsius. Solar air collectors are mainly used in food industries.

8. Which of the following are types of solar concentrators?
a) Solar air collectors
b) Flat-plate collectors
c) Parabolic flat plate collectors
d) Linear Fresnel collectors

View Answer

Answer: d
Explanation: Solar concentrators include parabolic dish collectors, linear Fresnel collectors and linear parabolic trough collectors. Solar air collectors are not a type of solar concentrators. There is no such thing as parabolic flat plate collector because the shape can either be parabolic or flat.

b) Sun’s thermal energy is transferred to a heat transfer solid which passes through a heat exchanger
c) Sun’s nuclear energy is transferred to a heat transfer fluid which passes through a cold exchanger
d) Sun’s thermal energy is transferred to a heat transfer fluid which passes through a cold exchanger

View Answer

Answer: a
Explanation: A solar cooling technology is a system that transfers sun’s thermal energy to a heat transfer fluid (also called as working fluid). This fluid then passed through a heat exchanger where the heat is moved from one system to another thereby achieving cooling.

10. Which of the following is an example of solar air heating/collection technology?
a) Drying food using hair dryer
b) Drying food under direct sun
c) Heating the food in oven
d) Grilling food in a barbeque

View Answer

Answer: b
Explanation: Drying food under direct is one of the simplest and naturally occurring techniques of solar air heating. Drying food using hair dryer is not a solar air heating technology as electricity is used to run the hair dryer.

c) Indirect, direct and active, passive
d) Indirect, passive and active, direct

View Answer

Answer: c
Explanation: Solar drying technology can broadly be grouped into indirect/ direct and active/passive technologies. Directly drying under the sun is an example of direct drying. Photovoltaic is not a solar drying technology.

12. Active solar drying systems control _____ by fans.
a) water flow rate
b) food flow rate
c) electricity
d) air flow rate

View Answer

Answer: d
Explanation: Active solar drying systems control air flow rate by fans. They can reduce drying time by a third and are compact. However, they require more electricity to operate machines like fans.

13. Solar air collectors transfer sun’s thermal energy to air via _____
a) conduction
b) convection
c) Seebeck effect
d) Peltier effect

View Answer

Answer: a
Explanation: Solar air collectors transfer sun’s thermal energy to air via conduction. Convection is the transfer of heat by movement of fluid between areas of different temperature. For this to happen, some region of air must first have a higher temperature which is achieved by conduction.

14. Solar concentrators are used for temperatures beyond 500 degree Celsius.
a) True
b) False

View Answer

Answer: a

15. Solar heat industrial systems are used for desalination.
a) True
b) False

View Answer

Answer: a
Explanation: Solar heat industrial systems are used for desalination. They are thermally driven systems with operating temperatures around 110 degree Celsius. Desalination is the process of removing minerals from saline water.

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Solar Energy Questions and Answers – Solar Refrigeration and Air-Conditioning Systems – 1

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Refrigeration and Air-Conditioning Systems – 1”.

1. Which of the following are types of photovoltaic refrigeration?
a) Vapour compression refrigeration and thermoelectric refrigeration
b) Vapour compression refrigeration and vapour jet refrigeration
c) Photovoltaics and concentrated solar power systems
d) Rankine cycle and vapour jet refrigeration

View Answer

Answer: a
Explanation: Vapour compression refrigeration and thermoelectric refrigeration are types of photovoltaic refrigeration. Photovoltaic is used to perform solar refrigeration. Like Rankine Cycle and concentrated power systems, it is not a type of refrigeration.

c) A refrigerator that is sourced by wind and sun
d) A refrigerator that is sourced by biomass and sun

View Answer

Answer: b
Explanation: A solar powered refrigerator is a refrigerator that is sourced by solar energy. Photovoltaics or solar thermal energy is used to convert solar energy into a usable form (electricity) for refrigeration.

3. What is refrigeration?
a) A process where is work is done is to add heat from one system to another
b) A process where heat is used by the system to do work
c) A process where work is done to move heat from one system to another
d) A process where work is done to add cold air into the system

View Answer

Answer: c
Explanation: Refrigeration is a process in which work is done to (re)move heat from one system and add it to another. This results in temperature decrement in the system from which heat was (re)moved.

4. What are the types of popular refrigeration systems?
a) Vapour compression and vapour adsorption
b) Vapour adsorption and vapour absorption
c) Vapour compression and liquid compression

Answer: d
Explanation: Refrigeration systems are broadly classified into vapour compression (VCR) and vapour absorption systems (VAR). Liquids are not compressed in refrigerating systems.

5. Vapour compression refrigeration systems use _____ energy to perform compression.
a) mechanical
b) thermal
c) gravitational
d) nuclear

View Answer

Answer: a
Explanation: Vapour compression refrigeration systems use mechanical energy. The electrical energy is converted into mechanical energy to perform the process of compression.

6. What type of energy does vapour absorption refrigeration system use?
a) mechanical
b) thermal
c) nuclear
d) electrodynamic

View Answer

Answer: b
Explanation: Vapour absorption refrigeration systems use thermal energy. The electr energy is converted into thermal energy to perform the process of absorption.

b) Vapour jet
c) Vapour compression
d) Liquid adsorption

View Answer

Answer: c
Explanation: Vapour absorption refrigeration systems are used in air-conditioning systems. It is also used in domestic and commercial refrigerators, large-scaled warehouses for storing food items by freezing.

8. Which of the following best describes the process of vapour compression refrigeration?
a) Warm air → compressor → condenser → expansion valve → evaporator → colder air
b) Evaporator → compressor → condenser → expansion valve → evaporator → colder air
c) Warm air → compressor → expansion valve → evaporator → colder air
d) Warm air → evaporator → compressor → condenser → expansion valve → evaporator → colder air

View Answer

Answer: d
Explanation: In vapour compression refrigerator, warm air is first evaporated and then passed into a compressor. This compresses the vapour which is then passed through a condenser to obtain a liquid. The liquid is expanded through an expansion valve to form a combination of liquid and vapour which is then passed through an evaporator to obtain cold air.

9. What does a refrigerant do in a vapour compression refrigeration system?

d) Converts thermal energy into electrical energy

View Answer

Answer: a
Explanation: A refrigerant in a vapour compression refrigeration system removes heat from one system and empties it into another system. It is a circulating liquid that basically performs operation of “refrigeration”.

10. Which of the following is an example of a refrigerant?
a) Platinum
b) CFCs
c) Argon
d) Nitrogen

View Answer

Answer: b
Explanation: CFCs are common examples of refrigerants. Freons like R-11, R-12, R-21, R-22 and R-502 are also used. Platinum, Argon and Nitrogen are not used as refrigerants.

11. How does a photovoltaic refrigeration system work?
a) By converting sun’s thermal energy into electricity which is used to drive a motor coupled to a compressor
b) By converting sun’s thermal energy into electricity which is used to drive an AC motor coupled to a compressor of a vapour compression system
c) By converting sunlight into DC current to drive a DC motor which is coupled to a compres

compressor of a vapour compression system

View Answer

Answer: c
Explanation: A photovoltaic refrigeration system works by converting sunlight into DC current. This DC current drives a DC motor which is coupled to a compressor of a vapour compression system.

12. It is important to ensure that _____ characteristics of motor matches that of PV array.
a) mechanical
b) thermal
c) insulating
d) electrical

View Answer

Answer: d
Explanation: It is important to ensure that electrical characteristics of motor matches that of PV array. This is to ensure that the power delivered by the PV array sufficient to drive the motor which in turn drives the system.

13. How does the compression process between vapour compression and vapour absorption systems differ?
a) Vapour compression uses mechanical compression while vapour absorption uses thermal compression
b) Vapour compression and vapour absorption use thermal compression
c) Vapour compression and vapour absorption use thermal compression
d) Vapour compression uses electrical compression while vapour absorption uses mechanical compression

View Answer

Answer: a
Explanation: The compression processes differ in the compression technique and energy conversions. Vapour compression uses mechanical compression while vapour absorption uses thermal compression.

14. Solar thermal energy is used to perform vapour absorption refrigeration.
a) True
b) False

View Answer

vapour absorption refrigeration uses thermal compression, the thermal energy is directly used to extract heat from the working fluid.

15. Freon is a trade for a family of haloalkane refrigerants.
a) True
b) False

View Answer

Answer: a
Explanation: Freon is a trade for a family of haloalkane refrigerants manufactured by DuPont. Haloalkanes are derivatives of alkanes containing one or more halogens like chlorine, fluorine, etc.

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Solar Energy Questions and Answers – Solar Refrigeration and Air-Conditioning Systems – 2

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This set of Solar Energy Interview Questions and Answers for Experienced people focuses on "Solar Refrigeration and Air-Conditioning Systems – 2".

1. Solar air conditioning system uses _____ as its energy source.
a) sun
b) wind
c) electricity
d) motor

View Answer

Answer: a
Explanation: Solar air conditioning system uses sun as its energy source. It is just like any other air conditioning system except that it uses solar power. A motor is not an energy source. Solar energy is converted to electricity to run the system.

d) Wind and solar thermal energy

View Answer

Answer: b
Explanation: Passive solar, solar thermal energy and photovoltaics can be used to source air conditioning systems. Wind and vapour compressor are not types of solar energy.

3. What are the three heat exchangers used in an absorption type refrigeration?
a) Compressor, absorber and generator
b) Absorber, generator and adsorber
c) Absorber, regenerating intermediate heat exchanger and generator
d) Compressor, generator and adsorber

View Answer

Answer: c
Explanation: The three heat exchangers used in an absorption type refrigeration system are absorber, regenerating intermediate heat exchanger and generator. These heat exchangers replace the compressor in a vapour compression refrigeration system.

4. What is the working fluid in vapour absorption type systems?
a) Platinum
b) CFCs
c) Freons
d) Ammonia

Explanation: Ammonia or lithium bromide is the working fluid in vapour absorption type systems. CFCs and freons are used in vapour compression type systems and are called refrigerants. Platinum is not used as a working fluid.

5. Absorption of ammonia in a liquid solution analogous to _____
a) condensation
b) evaporation
c) vapourisation
d) convection

View Answer

Answer: a
Explanation: Absorption of ammonia in a liquid solution is analogous to condensation process. Evaporation and vapourisation concern with liquids turning into gas. Convection is a process of heat flow.

6. Which of the following best describes the process of vapour absorption refrigeration?
a) Absorbing fluid vapour into liquid carrier → producing vapours from solution by heating → thus cooling → pumping into a high pressure cycle
b) Absorbing fluid vapour into liquid carrier → pumping into a high pressure cycle → producing vapours from solution by heating → thus cooling
c) Absorbing fluid vapour into liquid carrier → thus cooling → pumping into a high pressure cycle → producing vapours from solution by heating
d) Absorbing fluid vapour into liquid carrier → producing vapours from solution by heating

Explanation: The working fluid is absorbed into a liquid carrier which is then pumped into a high pressure cycle. This cycle produces vapours from solution by heating thereby cooling.

7. Which of the following use absorption refrigeration system?
a) Heating systems
b) Solar cooker
c) Waste heat from cogeneration
d) Solar stills

View Answer

Answer: c
Explanation: Absorption refrigeration systems are used in large commercial and industrial installations. For instance, waste heat from cogeneration or process steam plants.

8. Which of the following is/are considered for calculating the overall efficiency of solar absorption refrigeration system?
a) Coefficient of performance of absorption system
b) Solar collection efficiency
c) Solar insolation
d) Solar collection efficiency and coefficient of performance of absorption system

View Answer

Answer: d
Explanation: Solar collection efficiency and coefficient of performance of absorption syst

a) Ratio of refrigeration capacity to input solar energy
b) Ratio of input solar energy to refrigeration capacity
c) Product of input solar energy and refrigeration capacity
d) Ratio of refrigeration capacity to input electrical energy

View Answer

Answer: a
Explanation: Coefficient of performance can be defined as the ratio of refrigeration capacity to input solar energy. It basically describes the efficiency of the refrigerating system as it compares the input to output.

10. In solar vapour compression cycle, efficiency of Rankine cycle increases with _____
a) decrease in temperature of heat exchanger
b) increase in temperature of heat exchanger
c) the amount of heat supplied to the evaporator
d) the amount of cold air released from the system

View Answer

Answer: b
Explanation: In solar vapour compression cycle, efficiency of Rankine Cycle increases with increase in temperature of heat exchanger. It does not depend on the amount of heat supplied to the evaporator and the amount of cold air released.

11. Efficiency of solar collector decreases with

View Answer

Answer: c
Explanation: Efficiency of solar collector decreases with increase in temperature. This is because as the temperature of the working fluid increases, the difference between its maximum heating temperature and the current running temperature decreases. This decreases the ability to hold more heat.

12. Absorption refrigeration uses _____ mechanical power input as compared to vapour compression refrigeration.
a) greater
b) the same
c) the same working fluid as
d) negligible

View Answer

Answer: d
Explanation: Absorption refrigeration uses negligible mechanical power input as compared to vapour compression refrigeration. Ammonia is used as working fluid in absorption refrigeration.

13. How is pressurization achieved in absorber refrigeration?
a) By dissolving refrigerant in absorbent in the absorber section
b) By dissolving refrigerant in absorbent in the evaporation section
c) By evaporating refrigerant from absorbent in the absorber section
d) By evaporating refrigerant in absorbent in the evaporation section

View Answer

Answer: a
Explanation: In absorber refrigeration, pressurisation is achieved by dissolving refrigerant in absorbent in the absorber section. Evaporator section is used to evaporate the refrigerant.

14. In absorber refrigeration, the solution of working fluid (ammonia) is pumped to a low pressure with a big pump.
a) True
b) False

View Answer

Answer: b

a) True
b) False

View Answer

Answer: a
Explanation: Vapour compression refrigeration system is less complex than absorber refrigeration system. This is because the absorber refrigeration system uses thermal compression and not mechanical compression.

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Solar Energy Questions and Answers – Solar Cookers – 1

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Cookers – 1”.

1. What is solar cooker?
a) Uses direct sunlight to produce heat and cook food
b) Uses solar energy to evaporate water and collect it within the same closed system
c) Uses solar energy to dry substances
d) Uses concentrated solar power to for industry

View Answer

Answer: a
Explanation: Solar cookers are devices that use direct sunlight to produce heat and cook food. Solar dryers are devices that use solar energy to dry substances. Devices that use solar energy to evaporate water and collect its condensate within the same closed system are called solar stills.

b) Process of treating water by heating it mildly
c) Process of producing water
d) Process of capturing sun’s heat

View Answer

Answer: b
Explanation: Pasteurization is the process of treating water, packaged and non-packaged food by heating it mildly. This is done to eliminated pathogens and extend shelf life.

3. Which of the following principles is used to concentrate sunlight in solar cookers?
a) Rarefaction
b) Evaporation
c) Specular reflection
d) Radiation

View Answer

Answer: c
Explanation: Specular reflection is used to concentrate sunlight in solar cookers. Evaporation is the process of liquid, particularly water turning into gas. Rarefaction is the reduction in density of air or gas.

4. Which of the following majorly affects the phenomenon of concentrating sunlight?
a) Non-reflecting surface
b) Black surface
c) Type of food

Answer: d
Explanation: Geometry of the reflecting structure majorly affects the phenomenon of concentrating sunlight. The amount of sunlight being concentrated can be controlled by the geometry of the reflecting structure.

5. What is the typical temperature (range) used in domestic cooking? Note that C indicates Celsius.
a) 50 – 70 degree C
b) 1000 degree C
c) 3500 degree C
d) 300 – 500 degree C

View Answer

Answer: a
Explanation: The typical temperature used in domestic cooking is around 65 degree C. It falls in the range of 50 – 70 degree C. Temperatures beyond 1000 degree C are used for industrial purposes.

6. What is the maximum temperature used in cooking? Note that C indicates Celsius
a) 100 degree C for boiling water and related dishes
b) 400 degree C for grilling and searing
c) 800 degree C for melting metals
d) 30 degree C for melting food items like butter

View Answer

temperatures beyond 100 degree C. Temperatures beyond 500 degree C are used in industries.

7. The cooking pan used in solar cookers convert _____ energy to _____ energy.
a) electrical, heat
b) heat, light
c) light, heat
d) electrical, light

View Answer

Answer: c
Explanation: The cooking pan used in solar cookers convert light energy to heat energy. After reflecting and concentrating the light onto the cooking pan, the pan conducts heat to cook the required food/substance.

8. Which of the following materials are used to make the cooking pan in a solar cooker?
a) Wood
b) Plastic
c) Rubber
d) Iron

View Answer

Answer: d
Explanation: Iron is a good conductor of heat. It is used to make the cooking pan to heat fc in a solar cooker. Wood, plastic and rubber are thermal insulators.

b) Wood
c) Bakelite
d) Iron

View Answer

Answer: a
Explanation: Parabolic dish (and trough) are made of anodized aluminum (or coated with aluminum) to reflect sunlight and concentrate it onto a receiver. Wood, iron and bakelite are not used as they do not have reflective properties. Moreover, wood and bakelite are thermal insulators.

10. Which of the following pot surfaces are preferred for solar cookers?
a) White coloured
b) Black coloured
c) Red coloured
d) Silver coloured

View Answer

Answer: b
Explanation: Black coloured pot surfaces are best suited to be used on cooking pans of solar cookers. This is because black absorbs most amount of heat as compared to any other colour. White, aluminum and silver coated surfaces are good reflectors of light and heat.

11. Convection should be reduced by isolating air inside the cooker from air outside the cooke
a) True

Answer: a
Explanation: Convection should be reduced by isolating air inside the cooker from air outside the cooker. This is to prevent escape of heat via convection.

12. Covering the pot with a glass lid _____ convection.
a) increases
b) does not affect
c) changes the direction of
d) reduces

View Answer

Answer: d
Explanation: Covering the pot with a glass lid reduces convection. This results in a greenhouse effect thereby trapping heat to cook the food inside the pot.

13. Evacuated tube solar cookers use _____ glass tube for the cooking chamber.
a) highly insulated
b) thermal conducting
c) parabolic
d) cone shaped

View Answer

Answer: a
Explanation: Evacuated tube solar cookers use highly insulated double-wall glass tube for the cooking chamber. They do not require large reflectors to concentrate sunlight.

14. Which of the following best describes the working of a solar cooker?
a) Concentrating sunlight → trapping heat → cooking
b) Concentrating sunlight → converting light to heat energy → trapping heat →cooking
c) Concentrating sunlight → cooking → trapping heat
d) Trapping heat → converting heat to light energy → radiating light → cooking

View Answer

Answer: b
Explanation: Sunlight is concentrated onto a receiver by reflective surfaces of the structure. This light is converted to heat by the receiver. The heat is then trapped by the pots used for cooking.

15. Solar cookers do have operating costs.
a) True

Answer: a
Explanation: Solar cookers have negligible or no operating costs. Since the entire system is built to be self-operating, it does not require any external fuel for initiation and operation.

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Solar Energy Questions and Answers – Solar Cookers – 2

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This set of Solar Energy Quiz focuses on “Solar Cookers – 2”.

1. In terms of cost, solar panel cookers use _____ material.
a) low-cost
b) specially designed expensive
c) low-cost inefficient
d) expensive and extremely efficient

View Answer

Answer: a
Explanation: In terms of cost, solar panel cookers use low-cost material. However, due to their low-cost material they can be easily constructed and are the most commonly used cookers.

2. What type is a solar panel cooker?

d) Convection type

View Answer

Answer: b
Explanation: Solar panel cookers are reflector type cookers. They are the most type available due to their ease of construction and low-cost material.

3. How is sunlight concentrated in solar panel cooker?
a) From below the cooker onto the cooking pan
b) Using photovoltaics
c) From above
d) From right side

View Answer

Answer: c
Explanation: Sunlight is concentrated from above and not from sides in solar panel cookers. This leads to limited cooking power and is not very desirable because of low efficiency. However, the solar panel cookers are some of the cheapest designs in the market.

4. What was CooKit?
a) A solar parabolic cooker
b) A solar box cooker
c) A vapour compressor
d) A solar panel cooker

is manufactured by cardboard and foil. Its main advantage was that it was affordable, convenient and effective.

5. Solar panel cookers are not effective under _____
a) cloudy conditions
b) sunny conditions
c) dry and sunny conditions
d) desert conditions

View Answer

Answer: a
Explanation: Solar panel cookers are not effective under cloudy conditions. Like any other technology using solar energy, it requires the sun to be shining brightly without any hinderance. Any hinderance drastically drops its effectiveness.

6. What type of solar cooker is a sun basket?
a) Solar panel cooker
b) Solar parabolic cooker
c) Solar box cooker
d) Vapour absorption compression

View Answer

Answer: b
Explanation: Sun basket is a solar parabolic cooker. It is neither a solar panel nor a solar b cooker. Vapour absorption compression is a refrigeration technique used in refrigerators a

7. Which of the following materials are used to make sun basket?
a) Paper mache, parabolic mirror, gold and bakelite
b) Parabolic mirror, aluminum foil, paper mache and gold
c) Paper mache, aluminum foil, jute fabric and bamboo frame
d) Bamboo frame, parabolic mirror, gold rod for support and rubber for insulation

View Answer

Answer: c
Explanation: A sun basket is basically a parabolic mirror made from paper mache supported by jute fabric and held in place by a bamboo frame. Aluminum foil is used as the reflecting lining and is glued to the inner side of the basket. Rubber and bakelite are thermal insulators. Gold is an expensive metal and is not used to make solar basket.

8. Solar basket is a/an _____
a) active cooker
b) vapour compression technique
c) vapour absorption technique
d) passive cooker

View Answer

Answer: d
Explanation: Solar basket is a passive cooker. Vapour compression and vapour absorption are compression techniques used in refrigeration. They are not related to solar cookers.

9. What is a solar box type cooker?

c) A thermal conducting box with a transparent glass cover and reflective surface directing sunlight into the box
d) A thermal conducting parabolic mirror which is used to reflect the sunlight onto the insulated pan

View Answer

Answer: a
Explanation: A solar box type cooker is an insulated box with a transparent glass cover and reflective surface directing sunlight into the box. It is not a parabolic mirror type solar cooker.

10. Which of the following colours can be used to paint the insulated box in a solar box cooker?
a) White
b) Black
c) Silver
d) Pink

View Answer

Answer: b
Explanation: The insulated box in a solar box cooker is painted black. This is because black maximizes absorption of sunlight. White is one of the best reflectors of sunlight and is not used for absorption.

11. What type of cooking containers are used to cook food on a solar cooker?
a) Gold
b) Wooden

Answer: c
Explanation: Cooking containers made up of aluminum and/or steel are used to cook food on a solar cooker. Cooking containers made of thermal insulators like wood and plastic are not used. Gold is an expensive metal and is not used for this purpose.

12. To reduce heat loss, where are insulators used in a solar box cooker?
a) On the reflective material
b) On the cooking platform
c) Reflective materials are made of insulators
d) Space between the outer and inner box

View Answer

Answer: d
Explanation: The space between outer and inner box in a solar box type cooker are thermally insulated to prevent any loss of heat. Cooking platform and reflective material are not made up of thermally insulating material.

13. Solar cooker takes _____ to cook as compared to conventional cooking methods.
a) longer
b) less time
c) about the same time
d) more electricity

View Answer

Answer: a
Explanation: Solar cooker takes longer to cook as compared to conventional cooking methods. It need not convert sunlight into electricity. Also, it does not use electricity from the grid.

14. Solar cooking is pollution free.
a) True
b) False

View Answer

Answer: a
Explanation: Solar cooking is pollution free. It does not emit any harmful pollutants into the environment and is entirely self-sustainable.

15. Conventional cooking fuel is required to operate solar cookers.
a) True
b) False

Answer: b
Explanation: Conventional cooking fuel is not required to operate solar cooker. The only source of energy is the sun's heat which is passed onto the food via conduction.

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Solar Energy Questions and Answers – Solar Furnaces

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Furnaces”.

1. What is solar furnace?
a) Uses concentrated solar power to produce high temperatures for industry
b) Uses solar energy to evaporate water and collect it within the same closed system
c) Uses solar energy to dry substances
d) Uses solar energy to dry liquids

View Answer

Answer: a
Explanation: Structures that use concentrated solar power to produce extremely high temperatures for industry and other applications are called solar furnaces. Solar dryers are devices that use solar energy to dry substances. Devices that use solar energy to evaporate water and collect its condensate within the same closed system are called solar stills.

b) Parabolic mirrors
c) Silver coated surface
d) Black surface

View Answer

Answer: b
Explanation: Parabolic mirrors concentrate light onto a focal point. Plane mirrors and silver coated surfaces reflect sunlight but not onto a focal point. Black surface absorbs sunlight.

3. What is the typical range of temperature at the focal point of a parabolic mirror in solar furnaces? Note that C stands for Celsius
a) Between 100 and 150 degree C
b) Upto 20 degree C
c) Between 1000 and 2000 degree C
d) Between 50 and 100 degree C

View Answer

Answer: c
Explanation: The typical range of temperature at the focal point of a parabolic mirror in solar furnaces is between 1000 and 2000 degree C. The temperatures may rise upto 3500 degree C and can be used to generate electricity, melt steel, etc.

4. What are concentrated solar powered systems?
a) Systems that use only a small concentrated portion of sunlight
b) Systems that generate solar power by using photovoltaics

sunlight onto a receiver

View Answer

Answer: d
Explanation: Large area of sunlight is concentrated onto a receiver. This is performed by concentrated solar power systems which then. The receiver then converts the light into heat and transports it to other constituents of the concentrated solar power system that further convert it into usable forms of energy.

5. Which of the following uses concentrated solar power systems?
a) Solar thermo-mechanical power systems
b) Solar stills
c) Solar dryers
d) Solar photovoltaics

View Answer

Answer: a
Explanation: Solar thermo-mechanical power systems use mirrors and lenses to focus the light onto a receiver which is then converted into thermal energy. The thermal energy is then used to drive a heat engine connected to an electrical power generator.

6. Which of the following does a heliostat consist of?
a) Plane mirror
b) Plane mirror and parabolic mirror
c) Fresnel reflector

Answer: b
Explanation: A heliostat is a device that includes a plane mirror. The mirror is turned to keep the reflecting sunlight towards a predetermined target. This compensates for the sun's motion throughout the day.

7. What are the types of concentrating technologies?
a) Parabolic trough and solar stills
b) Parabolic dish and solar furnace
c) Solar power tower and parabolic trough/dish
d) Solar furnace and solar stills

View Answer

Answer: c
Explanation: Concentrating technologies exists in four types, namely, parabolic trough, dish solar power tower and concentrating linear Fresnel reflector. Solar furnace use concentrating solar power technologies. Solar stills are not a type of concentrating technology.

8. What are the types of solar furnaces?
a) Indirect and concentrating solar power technology
b) Active and direct
c) Passive and heliostat
d) Direct and heliostat

View Answer

Answer: d

9. Which of the following is an application of solar furnace?
a) Producing hydrogen fuel
b) Drying food
c) Distilling water
d) Generating concentrating solar power technologies

View Answer

Answer: a
Explanation: Apart from generating electricity and melting steel, producing hydrogen fuel is another major application of solar furnaces. Solar stills are used to distill water. Solar dryers are used to dry food.

10. Archimedes is said to have repelled attacking Roman ships with the help of “burning glass”.
a) False
b) True

View Answer

Answer: b
Explanation: Archimedes is said to have repelled attacking Roman ships with the help of “burning glass”. The ships were set on fire using this so called “burning glass” which may very well have been an array of mirrors.

11. Solar furnaces are used to generate temperatures around _____ to produce hydrogen. Note that C indicates Celsius.
a) 1000 degree C

d) 3500 degree C

View Answer

Answer: c
Explanation: Solar furnaces are used to generate temperatures around 1400 degree C to produce hydrogen. Hydrogen is produced by cracking methane molecules.

12. What is the typical temperature generated by solar furnaces to test materials for extreme environments? Note that C indicates Celsius.
a) 100 degree C
b) 500 degree C
c) 1400 degree C
d) 2500 degree C

View Answer

Answer: d
Explanation: The typical temperature generated by solar furnaces to test materials for extreme environments is around 2500 degree C. Materials are tested for applications like nuclear reactors or space vehicle.

13. What is a major drawback of solar furnaces to be used as a renewable source of energy on earth?
a) Heavily reliant on sun
b) Not reliant on sun
c) Finances
d) Cannot be used as a source of energy

View Answer

Answer: a
Explanation: One of the major drawbacks of solar furnaces particularly if it has to be used a renewable source of energy on earth it is heavily reliant on sun. Another problem is the availability of land to install huge systems to convert energy.

14. Solar furnaces can be used as solar cookers for domestic purposes.
a) False
b) True

View Answer

Answer: a
Explanation: Solar furnaces are not directly used as solar cookers particularly for dome

15. The largest solar furnace is in France.
a) True
b) False

View Answer

Answer: a
Explanation: The largest solar furnace opened in 1970. It is located at Odeillo in the Pyrenees-Orientales in France. Sunlight is gathered and used for applications with the help of an array of plane mirrors.

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Solar Energy Questions and Answers – Solar Dryer

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Dryer”.

1. What is solar dryer?
a) Use solar energy to dry substances
b) Use solar energy to evaporate water and collect it within the same closed system
c) Use solar energy to evaporate water and collect its condensate within the same closed system
d) Use solar energy to dry liquids

View Answer

Answer: a
Explanation: Solar dryer are devices that use solar energy to dry substances. Devices that use solar energy to evaporate water and collect its condensate within the same closed system are called solar stills.

d) Industrial substances

View Answer

Answer: b
Explanation: Popularly, solar dryers are used to dry foods. If not the, it is one of the most common application of solar dryers. Since the question specifies most popular, food is the answer.

3. What are the two general types of solar dryers?
a) Direct and active
b) Indirect and passive
c) Direct and indirect
d) Box like and cone shaped

View Answer

Answer: c
Explanation: The two general types of solar dryers are direct and indirect. Active and passive are types of solar stills. Box like and cone shaped are some of the basic configurations of solar stills.

4. What is the basic working principle of direct solar dryers?
a) Direct exposure of substance to fire
b) Direct use of sunlight to start a heater which is then used to dry the substance
c) Indirect exposure of substance to sunlight
d) Dehydrating the substance by directly exposing to sunlight

Answer: d
Explanation: The basic working principle of direct solar dryers is that they directly expose the substance to sunlight. By directly exposing the substance, they dehydrate the substance. A heater may or may not be used in a solar dryer.

5. Which of the following best indicates an example of direct solar dryer?
a) Drying wet clothes on wired lines
b) Using the dryer of a washing machine
c) Using an electric heater
d) Using a solar heater

View Answer

Answer: a
Explanation: Drying wet clothes on wired lines is an example of direct solar dryer. Many countries including India still use this traditional method to dry clothes as it is cheap and natural. Electric and solar heaters are not solar dryers.

6. How do wet clothes laid on wired lines dry under sunlight?
a) Wind blows to accumulate more air consisting moisture near the clothes
b) Wind blows away the moisture near the wet clothes air exposing them to fresh air and sunlight
c) Sunlight continuously evaporates water in wet clothes without any assistance from wind
d) Wind blows away the moisture near the wet clothes air exposing them to fresh air

View Answer

blows away this moisture saturated air and exposes to the clothes to fresh air and sunlight. The process repeats thereby drying the wet clothes over time.

7. Which of the following surface is best suited to absorb sunlight?
a) White surface
b) Red surface
c) Black surface
d) Silver surface

View Answer

Answer: c
Explanation: A black surface or a black coated surface is best suited to absorb sunlight. This is supported by the concept of black body. A black body is an idealized physical body that absorbs all incident electromagnetic radiation.

8. How does an indirect solar dryer work?
a) By directly exposing the substance to sunlight
b) By using an electrical heater
c) By heating the incoming air with the help of a black surface
d) By using fire

View Answer

Answer: d
Explanation: An indirect solar dyer heats the incoming air with the help of a black surfa
Then this heated air is passed over the substance to be dried thereby drying the substance.

b) Because direct sunlight dries the food
c) Because direct solar dryer does not cover the food
d) Because of contaminants brought by wind

View Answer

Answer: a
Explanation: A major problem with a direct solar dryer is that it can harm the food. This is because the sunlight could chemically alter some food item and make them less appetizing. Contamination due to wind is also a problem but it is not as bad as chemical alteration.

10. Indirect solar dryers protect the food.
a) False
b) True

View Answer

Answer: b
Explanation: Indirect solar dryers protect the food from directly exposing it to sunlight. Since they heat the incoming air they do not directly expose the food to sunlight. This prevents chemical alteration of food items.

11. _____ are used as air exhausts in indirect solar dryers.
a) Turbines
b) Ceiling fans
c) Chimneys
d) Table fans

Answer: c
Explanation: Chimneys are used as air exhausts in indirect solar dryers. They let the moisture containing air pass out of the chamber thereby making room for freshly heated air.

12. A glass cover _____ solar dryers.
a) decreases the efficiency of
b) is not used in
c) does not affect the efficiency of
d) increases the efficiency of

View Answer

Answer: d
Explanation: A glass cover increases the efficiency of solar dryers. Sometimes, direct solar dryers are equipped with glass covers to trap more heat thereby increasing the efficiency of the system.

13. Which of the following best explains the increment in efficiency of a glass covered solar dryer?
a) Greenhouse effect
b) Greenhouse gas
c) Climate change
d) Thermohaline circulation

View Answer

Answer: a
Explanation: Greenhouse effect best explains the increment in efficiency of a glass covered solar dryer. Greenhouse effect is the process of increasing the temperature of a chamber covered with glass by trapping sun's heat within the chamber.

14. Which of the following is an example of indirect solar dryer?
a) Wet clothes laid on wired lines
b) Solar cabinet dryer
c) Solar tunnel dryer
d) Biomass cabinet dryer

View Answer

Answer: b
Explanation: Solar cabinet dryer is an example of indirect solar dryer. Wet clothes laid on wired lines is an example of direct solar dryer. Solar tunnel dryer and biomass cabinet dryer are not examples of indirect solar dryers.

b) False

View Answer

Answer: a
Explanation: Indirect solar dryers work on natural air convection. This is because the incoming air is heated by a black surface. As the air is heated, it rises thereby giving room for the heavier colder air to get heated.

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Solar Energy Questions and Answers – Solar Distillation or Desalination of Water

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Distillation or Desalination of Water”.

1. What is solar distillation?
a) Use solar energy to evaporate water and collect its condensate within the same closed system
b) Use solar energy to evaporate water and collect it within the same closed system
c) Use solar energy to collect the condensate of water within the same closed system
d) Use solar energy to evaporate water and collect its condensate within different closed systems

View Answer

Answer: a
Explanation: Solar distillation is the use solar energy to evaporate water and collect its condensate within the same closed system. It is important to note that the same system is used to both evaporate and condensate water.

c) Photovoltaics
d) Heat engines

View Answer

Answer: b
Explanation: Solar still houses the process of solar distillation. Solar thermo-mechanical system, photovoltaics and heat engines are not used to perform distillation.

3. Which of the following is a configuration of solar still?
a) Solar panel
b) Solar cell
c) Cone shaped
d) Frustum shaped

View Answer

Answer: c
Explanation: The three basic configurations of solar still are cone shaped, box-like and frustum shaped. Solar cells and panels are not solar stills and are not used for solar distillation.

4. Which of the following best describes the process of solar distillation?
a) Influent → solar distillation system → salty solute remains → evaporation of volatile solvents as effluents
b) Influent → evaporation of volatile solvents as effluents → solar distillation system → salty solute remains
c) Influent → solar distillation system → evaporation of volatile solvents as effluents → s

solute remains

View Answer

Answer: d
Explanation: The influent enters the solar distillation system. The volatile solvents evaporate as effluents leaving behind salty solute.

5. Which of the following is an example of solar distillation?
a) Natural water cycle
b) Fractional distillation
c) Reverse osmosis
d) Osmosis

View Answer

Answer: a
Explanation: Natural water cycle is a very common example of solar distillation that the earth experiences. Fractional distillation, osmosis and reverse osmosis are not solar distillation.

6. What are the two categories of solar still?
a) Active and deactivate
b) Active and passive
c) Box and cone
d) Passive and pit

View Answer

7. What do the two categories of solar still namely, active and passive depict?
a) The method of evaporation
b) The method of condensation
c) The method of acquiring energy to drive evaporation
d) The method of collecting evaporated water

View Answer

Answer: c
Explanation: The two categories of solar still depict the method of acquiring energy to drive evaporation. Evaporation, condensation and collection of condensate are performed only after energy is supplied to the system.

8. What is an active solar still?
a) A solar still that solely relies on sun to distill water
b) A solar still that relies only on sun and wind
c) A solar sill that automatically gets activated when sun shines on it
d) A solar still that uses additional heat sources apart from sun

View Answer

Answer: d
Explanation: An active solar still uses additional heat sources apart from sun. These additional heat sources are used to promote existing thermal processes like initial start-up.

9. Which of the following are examples of active solar stills?
a) Compound Parabolic Concentrators and flat plate collectors

d) Compound parabolic concentrators and sun

View Answer

Answer: a
Explanation: Compound parabolic concentrators, flat plate collectors and solar heaters are examples of active solar stills. Photovoltaics and heat engines are not solar stills. Sun is the energy source of solar still.

10. Active stills demote faster and larger quantities of freshwater generation.
a) True
b) False

View Answer

Answer: b
Explanation: Active stills demote faster and larger quantities of freshwater generation. This comes at the cost of increased design complexity and manufacturing.

11. What is a passive solar still?
a) A solar still that uses photovoltaics to start
b) A solar still that relies only on sun and wind
c) A solar still that solely relies on sun to distill water
d) A solar still that uses additional heat sources apart from sun

View Answer

12. Which of the following is a type of passive stills?
a) Solar still with compound parabolic concentrator
b) Single-effect stills with flat plate collectors
c) Multi-effect stills with compound parabolic concentrator
d) Single-effect solar still

View Answer

Answer: d
Explanation: Single-effect and multi-effect solar stills are types of passive stills. However, if any of these systems are attached with additional thermal sources like compound parabolic concentrators and flat plate collectors, they become active solar stills.

13. In a single-effect still, it is crucial to keep the distiller _____
a) airtight
b) aerated
c) connected with another distiller
d) connected with multiple distillers

View Answer

Answer: a
Explanation: Single-effect stills are the simples and popularly used solar stills. In a single-effect solar still, it is a crucial design challenge to keep the distiller airtight. It uses a single interface to convey the energy and collect the condensate.

14. Neutral stills use seawater greenhouses to create freshwater.
a) False
b) True

View Answer

Answer: b
Explanation: Neutral stills use seawater greenhouses to create freshwater. They are neutral because the energy that goes into creating freshwater is used to grow plants that promote evaporative cooling of air inside.

15. A good insulator is necessary to reduce thermal losses in solar stills.
a) True
b) False

View Answer

Answer: a

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Solar Energy Questions and Answers – Solar Thermo-Mechanical Systems -1

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This set of Solar Energy Multiple Choice Questions & Answers (MCQs) focuses on “Solar Thermo-Mechanical Systems -1”.

1. Which of the following best describes the flow of energy in a solar thermo-mechanical system?
a) Solar → thermal → mechanical → electricity
b) Electricity → thermal → mechanical → solar
c) Mechanical → solar → electricity → thermal
d) Solar → electricity → thermal → mechanical

View Answer

Answer: a
Explanation: In a solar thermo-mechanical system, the solar energy is first converted to thermal energy. Then this energy is used to drive mechanical systems thereby being converted to mechanical energy. This mechanical energy is further converted to usable forms like electricity.

b) System that converts thermal and chemical energy to mechanical energy
c) System that converts mechanical energy to thermal energy
d) System that converts mechanical energy to thermal and chemical energy

View Answer

Answer: b
Explanation: A heat engine is an energy converting system. It converts in the heat or thermal energy and chemical energy to mechanical. This mechanical energy can be used to do mechanical work.

3. How does heat engine convert thermal and chemical energy to mechanical energy?
a) With the help of steam
b) By converting the input energy into electrical energy which is then used to drive mechanical systems
c) By bringing a working substance from a higher state temperature to a lower state temperature
d) By converting the input electrical energy to mechanical energy

View Answer

Answer: c
Explanation: The heat engine convert thermal and chemical energy to mechanical energy. It does this by bringing a working substance from a higher state temperature to a lower state temperature. During this conversion, any form of energy being used is not converted to electrical energy.

4. Which of the following is/are examples of heat engines?

d) Rankine cycle and Brayton cycle

View Answer

Answer: d
Explanation: Rankine cycle and Brayton cycle are examples of heat engines. Photovoltaics and concentrating mirrors are not heat engines. Fuel cells are another type of source that convert chemical energy to electrical energy.

5. Which of the following is a popular solar thermal power system?
a) Central receiver thermal electric power system
b) Photovoltaics
c) Concentrating mirrors
d) Solar reflectors

View Answer

Answer: a
Explanation: Central receiver thermal electric power system is a popular solar thermal power system. Photovoltaics are not solar thermal power systems. They directly convert solar energy to electrical energy. Concentrating mirrors and solar reflectors are components of various solar thermal power systems.

6. Which of the following best describes the working of central receiver thermal power system?
a) Sunlight → heliostats absorb solar flux → central receiver → turbine system → electricity
b) Sunlight → heliostats reflect solar flux → central receiver → turbine system → electricity
c) Heliostats reflect solar flux → sunlight → turbine system → central receiver → electricity

Answer: b
Explanation: In a s central receiver thermal power system, the solar radiation from the incident sunlight is reflected by heliostats onto central receiver. The receiver consists of a boiler to boil the working fluid which is in turn used to drive the turbines to generate electricity.

7. What is the operating temperature of turbines in a central receiver thermal power system? Note that “C” stands for Celsius.
a) 10 – 100 degree C
b) 5000 degree C
c) 500 – 800 degree C
d) 200 – 500 degree C

View Answer

Answer: c
Explanation: The typical operating temperature of the turbines in a central receiver thermal power system is between 500 – 800 degree C. The temperatures are so high because large concentrations of solar flux are reflected onto the central receiver by several arrays of heliostats (hundreds and sometimes even thousands).

8. Which of the following is a line focus collector used in a distributed power system?
a) Parabolic mirrors
b) Convex mirrors
c) Concave lenses
d) Linear fresnel reflector

View Answer

mirrors may reflect sunlight but they may not be line focused collector. Lenses are not used to collect sunlight in a distributed power system.

9. How is energy collected in a distributed power system?
a) Sunlight → line focused collectors → interconnecting pipes → heat engines → turbines → electricity
b) Line focused collectors → sunlight → interconnecting pipes → heat engines → turbines → electricity
c) Sunlight → line focused collectors → turbines → interconnecting pipes → heat engines → electricity
d) Interconnecting pipes → sunlight → line focused collectors → heat engines → turbines → electricity

View Answer

Answer: a
Explanation: The solar radiation from the incident sunlight is collected by various line focused collectors. This energy is collected through pipes interconnecting the dispersed collector units and then supplied to the heat engines which in turn use the working substance to drive turbines and generate electricity.

10. The type of heat engine depends on _____
a) material of interconnecting pipes
b) type of collector
c) sunlight
d) photovoltaics

Answer: b
Explanation: The type of heat engine depends on the type collector, temperature of operation, cycle efficiency, working fluid, conversion efficiency, transport fluid, etc. Photovoltaics are not used in solar thermo-mechanical systems.

11. What is Carnot efficiency?
a) Rate of the temperature difference divided by rate of initial temperature change
b) Ratio of relative temperature between source and sink and the relative source temperature
c) Ratio of absolute temperature between source and sink and the absolute source temperature
d) Ratio of rate of the temperature difference and the absolute source temperature

View Answer

Answer: c
Explanation: Carnot efficiency is ratio of absolute temperature between source and sink and the absolute source temperature. It can also be defined in terms of heat added to the source at some temperature and heat rejected by the fluid at some temperature.

12. Heat engine efficiency increases as the source temperature _____
a) decreases
b) remains the same
c) decrement rate increases
d) increases

View Answer

Answer: d
Explanation: Heat engine efficiency increases as the source temperature increases. Also, the rate of increase of the source temperature should be greater at lower temperatures than at higher temperatures.

13. Distributed power system is a type of solar thermo-mechanical system.
a) True
b) False

View Answer

Answer: a
Explanation: Distributed power system is a type of solar thermo-mechanical system. It works on the principle of collecting the incident solar radiation using multiple arrays of line focused reflectors distributed across a large area. These collectors are interconnected by pipes which transfer the energy to the mechanical system.

d) increase in

View Answer

Answer: b
Explanation: Heat engine efficiency increases with decrease in sink temperature. It should also be noted that the rate of decrement of sink temperature should be faster than the rate which the source temperature is increased.

15. Isothermal process is a process conducted at constant temperature.
a) True
b) False

View Answer

Answer: a
Explanation: Isothermal process is a process conducted at constant temperature. Isobaric process is a process conducted at constant pressure.

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Solar Energy Questions and Answers – Solar Thermo-Mechanical Systems -2

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This set of Solar Energy MCQs focuses on “Solar Thermo-Mechanical Systems -2”.

1. How does an ideal Rankine cycle work?
a) Heat-addition process does not occur at constant temperature
b) Heat-addition process occurs at temperature
c) Heat-addition process does not occur at constant pressure
d) Heat-addition process occurs at constant pressure

View Answer

Answer: a
Explanation: Like Carnot cycle, Rankine cycle is a heat engine phase cycle. It determines how working fluid is used to convert energy from one form to another. The heat-addition process in Rankine cycle does not occur at constant temperature.

liquid residue is pumped back into boiler
c) Vapour runs the turbine → working fluid is heated in boiler → exhaust vapour is condensed → liquid residue is pumped back into boiler
d) Exhaust vapour is condensed → Working fluid is heated in boiler → vapour runs the turbine → liquid residue is pumped back into boiler

View Answer

Answer: b
Explanation: In an ideal Rankine cycle, the working fluid is heated in boiler and converted to vapours which is used to run the turbine. The exhaust vapours from the turbine is condensed to form a liquid residue which is pumped back into the boiler to complete the cycle.

3. Why is the efficiency of Rankine cycle less than that of Carnot cycle?
a) Because of the working fluid
b) Because of the turbines
c) Because all the heat is not supplied at upper temperatures
d) Because all the heat is supplied at upper temperatures

View Answer

Answer: c
Explanation: The efficiency of Rankine cycle is less than that of Carnot cycle because all the heat is not supplied at upper (higher) temperatures. However, is has a high work ratio and its steam consumption is less than Carnot cycle.

4. How can the efficiency of Rankine cycle be improved?

d) By using a part of rejected heat

View Answer

Answer: d
Explanation: Rankine cycle has lower efficiency that Carnot cycle because all the heat is not supplied at upper temperatures. The efficiency of Rankine cycle can be improved by using a part of rejected heat in heating the liquid.

5. How does Stirling cycle differ from Carnot cycle?
a) The two adiabatic steps in Carnot cycle are replaced by two constant volume steps
b) The two adiabatic steps in Carnot cycle are replaced by two constant temperature steps
c) The two isothermal steps in Carnot cycle are replaced by two constant volume steps
d) The two isobaric steps in Carnot cycle are replaced by two constant volume steps

View Answer

Answer: a
Explanation: The working of Stirling cycle is similar to that of Carnot cycle except for two steps. The two adiabatic steps in Carnot cycle are replaced by two constant volume steps.

6. In Stirling cycle, the heat addition and rejection take place at _____
a) constant pressure
b) constant temperature
c) two different temperatures
d) multiple pressures

temperatures. A suitable gas or air is used as working fluid and the turbine, compressor and heat exchanger are closely coupled.

7. Which of the following best describes Brayton Cycle?
a) Exhaust gas → hot compressed gas → expands through turbine by doing work → heat exchanger → rejection of heat → gas goes to compressor
b) Exhaust gas → hot compressed gas → expands through turbine by doing work → heat exchanger → gas goes to compressor → rejection of heat
c) Hot compressed gas →expands through turbine by doing work → exhaust gas → heat exchanger → rejection of heat → gas goes to compressor
d) Heat exchanger → exhaust gas → hot compressed gas → expands through turbine by doing work → gas goes to compressor → rejection of heat

View Answer

Answer: c
Explanation: In Brayton Cycle, the hot compressed gas expands through the turbine by doing work. The exhaust gas from the turbine is passed into heat exchanger to reject heat. Then this gas is fed into the compressor to be compressed and used again.

8. Which of the following governs the efficiency of any practical solar thermo-mechanical system?
a) Photovoltaics
b) Rankine Cycle
c) Brayton Cycle
d) Properties of working fluid

View Answer

mechanical system. Rankine and Brayton Cycles are techniques to implement heat engines to convert the input energy into a usable output energy.

9. The choice of working fluid depends on the operating temperatures in the boiler.
a) True
b) False

View Answer

Answer: a
Explanation: The choice of working fluid depends on the operating temperatures in the boiler. It also depends on the condenser being used and the type of heat engine.

10. What is the main problem in a solar thermo-mechanical system as the collection (operating) temperature increases?
a) Efficiency of collection system and engine decreases
b) Efficiency of collection system decreases but engine efficiency increases
c) Efficiency of collection system and engine increases
d) Efficiency of collection system increases and engine efficiency decreases

View Answer

Answer: b
Explanation: The main problem in a solar thermo-mechanical system is that as the collection (operation) temperature increases efficiency of the collection system decreases. However, the engine efficiency increases as the temperature of working fluid increases.

c) has lesser efficiency as compared to the
d) always has minimum efficiency equal to that of

View Answer

Answer: c
Explanation: The practical heat engine used in solar thermo-mechanical systems always has lesser efficiency as compared to the theoretical efficiency. It can never exceed the theoretical limit due to practical limitations.

12. What is the bare minimum requirement for the construction materials used in solar thermo-mechanical systems?
a) Contaminate the working fluid
b) Withstand heat from the working fluid
c) Withstand pressure from the working fluid
d) Withstand both, heat and pressure from working fluid

View Answer

Answer: d
Explanation: The bare minimum requirement from the construction materials used in a solar thermo-mechanical system is that they withstand both, heat and pressure from the working fluid. The materials should not contaminate the fluid.

13. Which of the following affects the installation of a solar thermo-mechanical system?
a) Availability of land
b) Availability of photovoltaics
c) Availability of sunlight and clouds
d) Availability of rain

View Answer

Answer: a
Explanation: Availability of land affects the installation of solar thermo-mechanical system. Sunlight is important but most places on earth receive sunlight. Clouds and rain are a hinderance to the system.

14. What is the minimum vapour pressure (in kPa) of the working fluid to drive a turbine?
a) 300
b) 700
c) 100
d) 50

View Answer

The preferred vapour pressure 2000kPa for useful work.

15. Organic vapours are used small plants and low powered solar thermo-mechanical systems.
a) True
b) False

View Answer

Answer: a
Explanation: Organic vapours are used small plants and low powered solar thermo-mechanical systems. This is simply driven by the demands and finances.

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Wind Energy Questions and Answers – Origin of Winds – 1

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This set of Wind Energy Multiple Choice Questions & Answers (MCQs) focuses on “Origin of Winds – 1”.

1. Which of the following provides energy for winds to blow naturally?
a) Sun
b) Water
c) Man
d) Food

View Answer

Answer: a
Explanation: The energy that drives winds originates from the sun’s heat received along with sunlight. The heat creates areas of low pressure and high pressure, thereby causing winds to blow. Wind is abiotic and does not need food. Any wind blowing due to man is artificial. Water aids in magnifying a low or high pressure area but does not cause winds.

b) high, low
c) low, high
d) low, low

View Answer

Answer: b
Explanation: Wind always flows from a high pressure area to a low pressure area. The difference in pressures causes wind to flow from in a direction. Winds originate from the heat received by sun which heat's the earth's surface unevenly resulting in a pressure difference.

3. What is a gust?
a) No change in wind speed
b) A brief decrease in wind speed for a very long period of time
c) A brief increase in wind speed for a very short period of time
d) A brief increase in wind speed for a very long period of time

View Answer

Answer: c
Explanation: A gust or a wind gust is a brief increase in wind speed for a very short period of time, typically less than 20 seconds and has a transient characteristic unlike a squall.

4. What is a squall?
a) A sudden, sharp increase in wind speed lasting for a few hours
b) A sudden, sharp decrease in wind speed lasting for a few minutes
c) A sudden, sharp decrease in wind speed lasting for a few hours

Answer: d
Explanation: A squall is a sudden, sharp increase in wind speed lasting for a few minutes. Squalls occur during rain showers, thunderstorms or heavy snow fall.

5. A windstorm _____
a) is strong enough to cause property damage
b) is not stronger than gust
c) does not exist
d) is not strong enough to cause property damage

View Answer

Answer: a
Explanation: A windstorm consists of winds strong enough to cause property damage like uprooting of trees and damaging erected buildings. Wind speed in a typical windstorm exceeds 55km/s and can be extremely detrimental.

6. What are planetary or prevailing winds?
a) Winds not blowing from one latitude to another
b) Winds blowing from one latitude to another
c) Gusts
d) Winds that do not cover large areas of earth

View Answer

Answer: b
Explanation: Planetary winds are winds that blow from one latitude to another throughout

7. Which of the following are the two most important planetary winds?
a) Hosting
b) Trades and economics
c) Trade winds and westerly winds
d) Deployment

View Answer

Answer: c
Explanation: Trade winds and westerly winds are the two most important planetary or prevailing winds. Other options – trade and economics, hosting and deployment are not related to winds.

8. What are trade winds?
a) Winds blowing from equatorial low pressure areas to sub-tropical high pressure areas
b) Winds that trade with each other
c) Winds blowing from equatorial high pressure areas to sub-tropical low pressure areas
d) Winds blowing from sub-tropical high pressure areas to equatorial low pressure areas

View Answer

Answer: d
Explanation: Trade winds are extremely steady winds blowing from sub-tropical high pressure areas to equatorial low pressure areas. They maintain a constant direction throughout their course.

9. How does Coriolis effect trade winds in Northern Hemisphere?

d) Coriolis effect only affects the trade winds in Southern Hemisphere

View Answer

Answer: a
Explanation: Coriolis effect and Ferrel's law disrupt the flow of trade winds from north to south and deflect them towards right in the Northern Hemisphere. Thus, they blow in a north east direction in the Northern Hemisphere.

10. How does Coriolis effect trade winds in Southern Hemisphere?
a) Coriolis effect deflects trade winds to the right
b) Coriolis effect deflects trade winds to the left
c) Coriolis effect does not affect the trade winds in Southern Hemisphere
d) Coriolis effect only affects the trade winds in Northern Hemisphere

View Answer

Answer: b
Explanation: Coriolis effect and Ferrel's law disrupt the flow of trade winds flowing from north to south and deflect them towards left in the Southern Hemisphere. Thus, they blow in a south east direction in the Southern Hemisphere.

11. Trade winds _____
a) do not maintain a constant direction but blow steadily
b) maintain a constant direction but do not blow steadily
c) maintain a constant direction and blow steadily
d) shrinking technique

Answer: c
Explanation: Trade winds are also called as tropical easterlies. They maintain the same direction and blow steadily in that direction. Shrinking technique is not related to winds.

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Wind Energy Questions and Answers – Origin of Winds – 2

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This set of Wind Energy Multiple Choice Questions & Answers focuses on “Origin of Winds – 2”.

1. What are westerly winds?
a) Winds blowing from sub-tropical high pressure areas to sub-polar low pressure areas
b) Winds that trade with each other
c) Winds blowing from equatorial high pressure areas to sub-tropical low pressure areas
d) Winds blowing from equatorial low pressure areas to sub-tropical high pressure areas

View Answer

Answer: a
Explanation: Westerly winds are winds blowing from sub-tropical high pressure areas to sub-polar low pressure areas. The direction of flow is from west to east between 30 and 60 degrees latitude.

c) are stronger but do not maintain a constant direction than its counterpart in Northern Hemisphere
d) blow from equatorial low pressure areas to sub-tropical high pressure areas

View Answer

Answer: b
Explanation: Westerly winds of Southern Hemisphere are fairly stronger and maintain a constant direction as compared to its counterpart in Northern Hemisphere. They blow from sub-tropical high pressure areas to sub-polar low pressure belts.

3. What are periodic winds?
a) Westerly winds
b) Winds that do not change their direction periodically with the change in season
c) Winds that change their direction periodically with the change in season
d) Trade winds

View Answer

Answer: c
Explanation: Periodic winds are winds that change their direction periodically as the season changes. Trade and westerly winds are planetary winds and are not periodic in nature.

4. Which of the following are examples of periodic winds?
a) Gusts
b) Windstorm
c) Westerly winds

Answer: d
Explanation: Monsoons, land and sea breeze, mountain and valley breeze are examples of periodic winds. Westerly winds are planetary winds and are not periodic in nature. Windstorm and gusts are not periodic in nature.

5. A downburst is created by an area of rain-cooled air that _____
a) after hitting the ground generates strong winds which spread in all directions
b) don't hit the ground
c) after hitting the ground generates extremely weak winds which spreads in all directions
d) are short gusts

View Answer

Answer: a
Explanation: Downbursts are caused by an area of rain-cooled air that after hitting the ground level generates strong winds which spread in all directions. They are not gusts.

6. What is sea breeze?
a) Winds that don't strike the ground level
b) Winds from sea that flow during day towards the land and replace the lighter and rising hot air
c) Winds that hit the land to generate extremely weak winds which spreads in all directions
d) Short gusts originating from sea

View Answer

Answer: b
Explanation: When the coastal lands heat up, the air above it also gets hot. Hot air is light a

7. What is land breeze?
a) Winds that hit the sea to generate extremely weak winds which spreads in all directions
b) Winds from land that flow during night towards the sea and replace the lighter and rising hot air
c) Winds from sea that flow towards the land and replace the lighter and rising hot air
d) Short gusts originating from land

View Answer

Answer: c
Explanation: During night, the inland temperatures drop to an extent such that the sea is warmer than the land thereby causing the air above it to become hot and rise. Cool air from land rush towards the sea to replace the hot air.

8. Which of the following equations best explains the phenomenon of winds flowing from high pressure to low pressure?
a) Pressure = Force/Area
b) Roult's law
c) Force = mass*acceleration
d) Ideal gas equation

View Answer

Answer: d
Explanation: From Kinetic theory of gases, it is evident that ideal gas equation – PV = nRT explains the phenomenon of gases flowing from high pressure to low pressure. Raoult's l deals with vapour pressure. Force = mass*acceleration and Pressure = Force/Area do

9. How do thunderstorms form?
a) Thunderstorms originate from a pleasant breeze
b) Thunderstorms are produced by mid-level clouds
c) Thunderstorms are produced by cumulonimbus cloud which generated gusty winds and heavy rains
d) Thunderstorms originate from low-level clouds and do not carry rain with them

View Answer

Answer: c
Explanation: Thunderstorms is a type of storm with thunder and lightning and is produced by cumulonimbus clouds. These clouds generate strong gusty winds and heavy rains which accompany the thunderstorm.

10. Which of the following are types of winds?
a) Planetary winds, periodic winds, local winds
b) Trade winds, westerly winds, plate tectonics
c) Apples, monsoon
d) Clouds, rains, storms

View Answer

Answer: a
Explanation: Planetary winds, periodic winds, local winds, trade winds, westerly winds, monsoons are types of winds. Plate tectonics is related to earth. Clouds, rains and storms are not the types of winds.

c) 1
d) 4

View Answer

Answer: b
Explanation: Beaufort wind scale is an empirical scale for measuring wind speeds. On this scale, 0 corresponds to a calm breeze, 6 corresponds to a strong breeze, 1 corresponds to a light air and 4 corresponds to a moderate breeze.

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Wind Energy Questions and Answers – Nature of Winds

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This set of Wind Energy Multiple Choice Questions & Answers (MCQs) focuses on “Nature of Winds”.

1. What is the definition of wind?
a) Air in net motion
b) Air in motion
c) Gas molecules in random motion
d) Stationary gas molecules

View Answer

Answer: a
Explanation: Wind is better defined as air in net motion. On a microscopic level, gas molecules are always in a random motion and are not visible to the naked eye. In fact, motion of individual gas molecules cannot be sensed by our senses. Thus, gas molecules are never stationary.

b) Fluid dynamics
c) Combustion
d) Polymer science

View Answer

Answer: b
Explanation: Fluid dynamics involves the studies of wind motion and its underlying physics. Fluids consists of both, liquids and gases. Hence, wind is also a fluid because it consists of gas molecules.

3. Which of the following best describes the motion of air on earth?
a) A two-dimensional vector
b) A one-dimensional vector
c) A three-dimensional vector
d) A four-dimensional vector

View Answer

Answer: c
Explanation: The motion of air on earth is best described as a three-dimensional vector. It is also important to note that air motion is typically described and studied relative to earth's rotation.

4. Which of the following are the three individual components/dimensions best used to describe air motion on earth?
a) A meridional component pointing south-to-north, a zonal component pointing north-to-eas

c) A meridional component pointing north-to-south, a zonal component pointing east-to-south, a vertical upward component pointing from ground to sky
d) A meridional component pointing south-to-north, a zonal component pointing west-to-east, a vertical upward component pointing from ground to sky

View Answer

Answer: d
Explanation: The three individual components that correspond to the three dimensions are – a meridional component pointing south-to-north, a zonal component pointing west-to-east and a vertical upward component pointing from ground to sky.

5. Which of the following devices indicate wind direction?
a) Weather vanes, windsocks
b) Multimeter, oscilloscope
c) Accelerometer
d) Wind's direction cannot be measured

View Answer

Answer: a
Explanation: The direction of wind is generally indicated by weather vanes, windsocks and balloons. Multimeters and oscilloscopes are electronic instruments used to measure voltage and current. Accelerometer is a device that measures a body's acceleration.

6. What is geostrophic wind?
a) Wind generated due to disbalance between wind forces and Coriolis force

d) Wind flowing in stratosphere

View Answer

Answer: b
Explanation: Geostrophic wind is the wind generated due to balance between pressure gradient force and Coriolis force. It occurs above the atmospheric boundary layer (ABL).

7. What are eddies in wind?
a) Areas where the global wind blows opposite to that of the net direction of wind-motion
b) Areas where the local wind blows in the same direction as the net direction of wind-motion
c) Areas where the local wind blows opposite to that of the net direction of wind-motion
d) Areas where the local wind blows randomly to that of the net direction of wind-motion

View Answer

Answer: c
Explanation: Eddies are small areas where the local wind blows opposite to that of the net direction of wind-motion for a short period of time. Eddies are always local in nature and do not occur globally.

8. The Coriolis force deflects the wind to the right in Northern Hemisphere until _____
a) equilibrium of forces is not achieved
b) gas molecules stop moving
c) water vapour evaporates
d) equilibrium of forces is achieved

equilibrium is achieved. The equilibrium is between the pressure gradient of the wind and the Coriolis force.

9. Wind speed is measure by _____
a) anemometers
b) odometers
c) ammeter
d) weather vanes

View Answer

Answer: a
Explanation: Anemometers are used to measure wind speeds. They are commonly used in weather stations. Odometers measure distance of a wheeled vehicle. Ammeters measure current and weather vanes are used to indicate the direction of wind.

10. What is wind speed?
a) Net molecular flux along the wind axis divided by the mean molecular number density
b) Molecular flux along the wind axis divided by the mean molecular number density
c) Net molecular flux along the wind axis divided by molecular number density
d) Molecular flux opposite the wind axis divided by the mean molecular number density

View Answer

Answer: a
Explanation: Wind speed is defined as the net molecular flux along the wind axis divided the mean molecular number density. Flux is the number of molecules crossing a unit a

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Wind Energy Questions and Answers – Wind Turbine Siting

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1. When looking for a wind site, assessors start by _____
a) determining the direction of prevailing wind at the site
b) looking for a good source of water
c) looking for a location with good sunlight
d) determining all the directions of the local wind

View Answer

Answer: a
Explanation: To install a wind turbine, wind assessors look for locations with strong and smooth winds. They start by assessing the direction of the prevailing wind at the site. Generally, winds blowing in a particular direction are strong and smooth.

c) Still air
d) A consistent wind flow with obstructions

View Answer

Answer: b
Explanation: For a wind turbine system to run effectively, it requires a good wind site. A good wind site is one with a consistent and strong wind flow in a direction.

3. Which of the following is preferred in a good wind site?
a) Still air
b) A higher altitude terrain with objects obstructing the wind flow
c) A higher altitude terrain with no or minimum objects obstructing the wind flow
d) A lower altitude terrain with no or minimum objects obstructing the wind flow

View Answer

Answer: c
Explanation: Terrain is known to affect wind speeds which in turn affect the efficiency of a wind turbine system. A higher altitude terrain with no or minimum objects obstructing the wind flow is always preferred.

4. What is the minimum height above which the rotor of the wind turbine system is installed in a good wind site?
a) 100 feet above the tallest obstacle within a 5-foot radius
b) 5 feet above the tallest obstacle within a 500-foot radius
c) 10 feet above the tallest obstacle within a 5000-foot radius

Answer: d
Explanation: A wind turbine can be located anywhere in a good wind site provided the rotor is installed slightly on a higher terrain. The rotor is typically mounted 30 feet above the tallest obstacle within a 500-foot radius.

5. Which of following are considered during wind siting?
a) Safety impact, community impact, environmental impact
b) Radiation
c) Sunlight
d) Water

View Answer

Answer: a
Explanation: Before selecting and deciding on a good site, various impacts of installing a wind turbine are considered. The engineers ensure that the wind site does not harm any living creature. They also ensure that the site is far away from the nearest village to prevent any noise pollution.

6. Which of the following impacts a community/village/society due to installation of wind turbine system?
a) Private and Public cloud
b) Noise from the turbine, flicker
c) Private, Public and Hybrid cloud
d) Public and Hybrid cloud

View Answer

community/society/village. The other options are not related to wind siting.

7. Does the wind turbine harm birds?
a) True
b) False

View Answer

Answer: a
Explanation: The wind turbine system harms the birds and may even kill them. Thus, it is imperative to select a site with minimum or no living creatures.

8. Which of the following factors affect wind speed near the turbine system?
a) Birds flying
b) Sunlight
c) Time of the day, temperature, season
d) A village far away from the wind site

View Answer

9. Do wind sites need an access to transmission lines?
a) False
b) True

View Answer

Answer: b

10. Which of the following can make a good wind site?
a) A national sanctuary with wildlife
b) A city
c) A village
d) A barren land with wind speed of 6 on beaufort scale

View Answer

Answer: d
Explanation: A barren land with a wind speed of 6 on beaufort scale is a potential wind site. A city, village or national sanctuary are poor choices for wind sites as they obstruct wind flow. Also, it is not safe to install a wind turbine in such places.

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Wind Energy Questions and Answers – Major Applications of Wind Power

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This set of Wind Energy Multiple Choice Questions & Answers (MCQs) focuses on “Major Applications of Wind Power”.

1. Which of the following is not an application of wind energy?
a) Electricity
b) Steam engine
c) Agriculture
d) Energy storage for emergencies

View Answer

Answer: b
Explanation: Steam engine is not an application of wind energy because coal was used to generate the steam powering the engine. Wind is used to generate electricity with the help of wind turbines. This energy can either be stored for emergencies or can be used in agriculture, viz. pumping water.

b) Chess
c) Carroms
d) Kho-Kho

View Answer

Answer: a
Explanation: Wind surfing is a surface water sport that combines elements of surfing and sailing. Chess and carroms are board games. Kho-Kho is a running sport. All three of them do not use wind energy.

3. Does the team sport cricket, use wind?
a) True
b) False

View Answer

Answer: a
Explanation: Cricket is a team sport that uses wind energy in a unique manner. Wind energy is used to swing the ball into (or away from) the batsman. This phenomenon is demonstrated by Magnus effect.

4. How is wind energy used in flourmills?
a) To beat corn grains into paste
b) To beat wheat grains into paste
c) To grind wheat and corn grains into flour
d) Wind energy is not used in flourmills

Answer: c
Explanation: Wind energy is used in flourmills to grind wheat and corn grains into their respective flour. Wind mill blades are connected to a drive shaft which is in turn connected to gears and millstones. When the grains are poured into the revolving millstone, the motion grinds it into flour.

5. Which of the following wind turbine is mostly used to extract wind energy?
a) DC generator
b) Vertical-axis wind turbines
c) Sailing boat
d) Horizontal-axis wind turbines

View Answer

Answer: d
Explanation: Horizontal-axis wind turbines are mostly used to extract wind energy. They are made up of several blades that are aerodynamically shaped like airplane wings and are based on ancestral winds. Sailing boats use wind energy and do not extract energy from wind. DC generator generates DC current.

6. Wind energy is not used to pump water to a higher level.
a) True
b) False

View Answer

Answer: b

7. _____ light is used to denote dangers of birds, bats or/and airplanes.
a) Red
b) Blue
c) Yellow
d) Green

View Answer

Answer: a
Explanation: The red light is used to indicate any danger like birds or bats. It is fitted on the wind mill to identify itself with the airplanes.

8. Which of the following is a mechanical application of wind energy?
a) Lighting
b) Electricity
c) Pumping water
d) Wind surfing

View Answer

Answer: c
Explanation: Pumping water is a mechanical application of wind energy. Generating and transporting electricity to the grid as well as lighting are electrical applications. Wind surfing is a sport that uses wind energy.

9. Which of the following is a potential application of wind energy?
a) Converting heat to wind energy

d) Converting the wind flow due to speeding cars into electricity on highways

View Answer

Answer: d
Explanation: Wind blowing due to speeding cars on highways or trains can be used to power street lamps and is a potential application of wind energy. Converting other forms of energy to wind energy is not an application of wind energy. Transportation of electrical energy is an existing practice.

10. Does flying a kite use wind energy?
a) True
b) False

View Answer

Answer: a
Explanation: Flying a kite and maintaining it in air requires two things – consistent wind flow and proper kite control by the user. For the kite to remain stable in the air, it requires a constant wind flowing across its sides.

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Biomass Energy Questions and Answers – Usable Forms of Biomass, their Composition and Fuel Properties – 2

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This set of Biomass Energy written test Questions & Answers focuses on “Usable Forms of Biomass, their Composition and Fuel Properties – 1".

1. What is cellulose made up of?
a) Polysaccharide
b) Steel
c) Carbon nano fibre
d) Silicon

View Answer

Answer: a
Explanation: Cellulose is a complex polymer, or polysaccharide. Polysaccharide is made up of glucose, a six carbon sugar. Steel is used in industries to manufacture various things like automobile bodies, etc. Silicon is used in manufacturing glass and in semiconductor industry.

2. Why is cellulose resistant to hydrolysis?
a) Because it consists of polysaccharides
b) Because it has a crystalline structure
c) Because it is hydrophobic
d) Because it is a polymer

View Answer

Answer: b
Explanation: Cellulose is resistant to hydrolysis because of its crystalline made up of polysaccharide. Hydrolysis the chemical reaction that releases simple, fermentable sugars from polysaccharide.

3. Hemicellulose is a source of biomass accounting from 20% to 40% by _____
a) volume
b) moles
c) weight
d) molarity

View Answer

Answer: c
Explanation: Hemicellulose is another major source of biomass. It accounts from 20 – 40% by weight and is the next best source after cellulose. It is a complex polysaccharide made from 5 to 6 carbon sugars.

4. Why does burning biomass not add to greenhouse gas emissions?

d) Because it releases greenhouse gas that was captured and converted into other forms during its growth

View Answer

Answer: d
Explanation: Burning biomass does not add to greenhouse gas emissions because it does not release any additional amount. Instead, it released the same amount of gas that was captured and converted to other forms during its growth.

5. What are the two types of moisture content in biomass?
a) Intrinsic and extrinsic
b) Higher heating value and lower heating value
c) Lower heating value and extrinsic
d) Higher heating value and intrinsic

View Answer

Answer: a
Explanation: Moisture content is one of the main properties of biomass. The two types of moisture content are intrinsic moisture content and extrinsic moisture content. Heating value talks about the total amount of energy available in the fuel.

6. What is intrinsic moisture content in biomass?
a) Moisture content of the material with the moisture content in atmosphere
b) Moisture content of the material without the influence of weather effects
c) Moisture content of the material with the influence of weather effects

Answer: b
Explanation: Intrinsic moisture content is the moisture content in biomass without the influence of weather effects. It does not depend on the amount of moisture content present in the atmosphere.

7. What is extrinsic moisture content?
a) Moisture content of the material with the moisture content in atmosphere
b) Moisture content of the material without the influence of weather effects
c) Moisture content of the material with the influence of weather effects
d) Moisture content evaporated to the atmosphere

View Answer

Answer: c
Explanation: Extrinsic moisture content of biomass is the moisture content due to influence of weather conditions. It is essentially the amount of moisture absorbed from the atmosphere due to changes in weather.

8. Which of the following is a problem for using biomass as a source of energy?
a) Less moisture content in the atmosphere during time of harvesting
b) Low calorific value
c) Low intrinsic silica content
d) High moisture content in the surroundings

View Answer

Answer: d

is significantly reduced due to absorption of moisture. The heat used to burn the fuel will first be used to evaporate the water vapour thereby leading to excess use of resources.

9. What is calorific value (CV) of a material?
a) Amount of energy content or heat value released by the material when burnt in air
b) Amount of energy content or heat value released by the material when burnt in water
c) Amount of energy content or heat value absorbed by the material when burnt in air
d) Amount of energy content or heat value absorbed by the material when burnt in water

View Answer

Answer: a
Explanation: Calorific value is another important property that indicates how good is the biomass. It is the amount of energy content or heat value released by the material when burnt in air. Burning or combustion is usually not done in water.

10. What is the volatile matter in biomass?
a) The content in biomass that remains after heating
b) The content in biomass that is driven off as gas by heating
c) The biomass that is being heated
d) The moisture content in biomass

View Answer

Answer: b
Explanation: Volatile matter is that content in biomass which is driven off as gad by heating also includes the water vapour. Moisture content present in biomass is not volatile matter

11. What is fixed carbon content in biomass?
a) The carbon content in biomass
b) The carbon content that is fixed in biomass and cannot be changed
c) The content in biomass that is driven off as gas by heating
d) The mass that remains after the releases of volatile matter on heating the biomass

View Answer

Answer: d
Explanation: Fixed carbon content is the mass that remains after the releases of volatile matter on heating the biomass. Since it is fixed and not released as gas, it is called fixed carbon content.

12. A biomass feedstock with a high cellulose/hemi-cellulose is needed to produce ethanol.
a) True
b) False

View Answer

Answer: a
Explanation: For the production of ethanol, a biomass feedstock with a high cellulose/hemi-cellulose content is chosen. This is because it provides a high l/t yield.

13. Ash is the residue content is the solid residue after chemical breakdown of biomass.
a) True
b) False

View Answer

Answer: b
Explanation: The chemical breakdown either by thermo-chemical or bio-chemical processes of biomass produces a solid residue. When the residue is produced by combustion in air, it is called ash.

14. In a bio-chemical process, the solid residue represents _____ present in biomass.
a) the quantity of biodegradable carbon
b) the quantity of biodegradable potassium
c) the quantity of non-biodegradable carbon
d) the quantity of biodegradable sodium

View Answer

Answer: c
Explanation: In a bio-chemical process, the solid residue represents the quantity of n

15. Which of the following is most impacted by the bulk-density of the biomass as-produced?
a) Calorific value
b) Storage of the fuel after processing
c) Heating value
d) Transportation and fuel storage costs

View Answer

Answer: d
Explanation: Transportation and fuel storage costs are most impacted by the bulk density or volume of the biomass as-produced. These costs are before processing the fuel to produce energy. Calorific and heating value are not affected by bulk density.

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Wind Energy Questions and Answers – Wind Turbine Aerodynamics – 1

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This set of Wind Energy Multiple Choice Questions & Answers (MCQs) focuses on “Wind Turbine Aerodynamics – 1”.

1. What are the two primary aerodynamic forces acting on wind turbine rotors?
a) Lift, drag
b) Drag, gravitational force
c) Gravitational force, lift
d) Gravitational force, electrical force

View Answer

Answer: a
Explanation: Lift and drag are the two primary aerodynamic forces acting on modern wind turbine rotors. Gravitational force is due to earth’s gravity and is not an aerodynamic force. Similarly, electrical force is due to an electrical potential difference or an electric field and is not an aerodynamic force.

c) diagonal to the direction of wind flow
d) perpendicular to the direction of wind flow

View Answer

Answer: d
Explanation: Lift is an aerodynamic force that acts perpendicular to the direction of wind flow. A simplified explanation of lift is that it should travel faster to reach the end of the blade to meet the wind travelling over upwind face of the blade.

3. Drag is an aerodynamic force acting _____
a) perpendicular to the direction of wind flow
b) parallel to the direction of wind flow
c) diagonal to the direction of wind flow
d) opposite to the direction of wind flow

View Answer

Answer: b
Explanation: Drag is an aerodynamic force acting in the direction parallel to the wind flow. Though it is conceptually simple, it has poor power extraction vs area efficiency.

4. What is an aerodynamic force?
a) Force exerted on the body due to mass of another body nearby
b) Force exerted on the body by liquid
c) Force exerted on the body by air (or any gas) in which the body is immersed

Explanation: Aerodynamic force is the force exerted on a body by air (or any gas) in which the body is immersed. It is due to the relative motion between the body and air. Buoyancy is the force exerted by the liquid in which the body is immersed. Gravitational force on a body is due to mass of another body.

5. What happens on the upwind side of the wind mill blade?
a) No pressure is exerted
b) Low pressure area
c) High pressure area
d) Wind is trapped

View Answer

Answer: c
Explanation: On the upwind side of the wind mill blade, a region of high pressure is formed. This is due to slow movement of air on the upwind side as compared to the downwind side.

6. The upwind side experiences a force that slows the blade.
a) True
b) False

View Answer

Answer: a
Explanation: The upwind side experiences a force due to the slow movement of air relative the downside. This results in a region of high pressure on the upwind side which exerts a fo

a) Amount of lift generated by a blade divided by its aerodynamic drag
b) Amount of drag generated by a blade divided by its lift
c) Amount of drag generated by a blade divided by its aerodynamic lift
d) Amount of lift generated by a blade divided by its aerodynamic drag

View Answer

Answer: a
Explanation: Lift-to-drag ratio is the amount of lift generated by a blade (or a wing/ flying vehicle) divided by its aerodynamic drag. It's essential to determine the blade's efficiency and is considered during the design of the wing.

8. A higher lift-to-drag ratio indicates a higher efficiency.
a) False
b) True

View Answer

Answer: b
Explanation: As the name suggests, lift-to-drag ratio is the ratio of the aerodynamic lift generated by the blade to the aerodynamic drag generated by the blade. It is used to determine the efficiency of the blade. Higher the lift-to-drag ratio, higher the efficiency.

9. Turbine blades use a/an _____ design.
a) bulky
b) airfoil

Explanation: Airfoil design is the cross-sectional shape of an airplane wing. Turbine blades us an airfoil design. Unlike trains and trucks, they are not bulky. Though teardrop is the most aerodynamic shape, turbine blades don't use this design.

10. Which of the following is the governing equation for power extraction and calculation? Note that the text in bold denotes a vector quantity.
a) Power = **force . velocity**
b) Power = **force . area**
c) Power = **velocity . force**
d) Power = **energy / time**

View Answer

Answer: a
Explanation: In aerodynamics, power = **force . velocity** is used to extract and calculate power. Though power = energy / time is correct but both energy and time are written in bold which is not true. Energy and time are scalar quantities. The other options are mathematically incorrect.

11. Why is it necessary to have an optimal tip speed ratio (TSR)?
a) To ensure maximum efficiency
b) To ensure good aerodynamics
c) To increase drag
d) To ensure minimum efficiency but good aerodynamics

View Answer

wind to pass through undisturbed and does not extract sufficient energy. However, if the blades rotate too quickly, it creates a large amount of drag.

12. What is tip speed ratio (TSR)?
a) Ratio of wind speed to the speed of rotor
b) Ratio of the speed of rotor tip to wind speed
c) Ratio of wind speed to the speed of rotor tip
d) Ratio of wind speed to the speed of the blade's center

View Answer

Answer: b
Explanation: Tip speed ratio is the ratio of the speed of the rotor tip to the wind speed. It is used to determine the optimal speed at which the rotor (and blades) are required to rotate to ensure maximum efficiency.

13. What does tip speed ratio (TSR) depend on?
a) Motor material
b) Wind tower material
c) Rotor blade shape profile
d) Different types of gases

View Answer

Answer: c
Explanation: Tip speed ratio depends on rotor blade shape and its wind profile. It also depends on the number of turbine blades and the design of the wind turbine propeller.

14. Which of the following blade designs is becoming less popular?
a) HAWT
b) Airfoil design
c) Curve design
d) Flat blade design

View Answer

Answer: d
Explanation: Flat blade design is one of the oldest designs and is becoming less popular due its low efficiency. Airfoil and curve designs deliver much higher efficiencies. Horizontal axis wind turbine (HAWT) is a propeller type and not a blade design.

15. The airfoil/curve blade designs are affected by drag along its length.

Explanation: Drag is one of the two important aerodynamic forces. It reduces the blade's rotating speed. Thus, blades need to be designed in such a way that they experience minimum drag force.

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Wind Energy Questions and Answers – Wind Turbine Aerodynamics – 2

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This set of Wind Energy Question Bank focuses on “Wind Turbine Aerodynamics – 2”.

1. How is drag force experienced by the blade reduced in various modern blade designs?
a) Bending and tapering the blade
b) Using heavy metals
c) Twirling the blade
d) Increasing the length of the blade

View Answer

Answer: a
Explanation: Turbine blades experience drag force. They are bent and tapered along their length to reduce the effect of drag force.

2. What is angle of attack?

d) Angle between the blade and the wind tower

View Answer

Answer: c
Explanation: Angle of attack is the angle between the direction of the oncoming wind and the pitch of the blade. It is important to note that position of the pitch of the blade is with respect to the oncoming wind.

3. When plotting lift vs angle of attack, which of following best describes the shape of the curve?
a) Exponential
b) Cubic
c) Linear
d) Parabolic

View Answer

Answer: d
Explanation: The shape of lift vs angle of attack curve is parabolic in nature. The value of lift attains a maxima when the angle is between 15-18 degrees.

4. There is no ideal angle of attack for best rotation.
a) True
b) False

View Answer

5. The speed at the tip of the blade is faster than its center.
a) True
b) False

View Answer

Answer: a
Explanation: The speed of the tip of a rotating blade is faster than its center or root. This ensures a good tip-speed-ratio and provides high efficiency.

6. What is the angle by which the rotor blades are twisted?
a) 5-10 degrees
b) 15-45 degrees
c) 100-120 degrees
d) 10-20 degrees

View Answer

Answer: d
Explanation: The rotor blades are twisted by an angle between 10-20 degrees from root to tip. This ensures that the angle of attack decreases from the region where the air is moving slowly near the root to the region where the air is moving much faster at the tip.

7. Which of the following blade designs further increases the efficiency of airfoil blades?
a) Twisting and tapering the blades
b) Reducing wind tower height
c) Increasing wind tower height

Answer: a
Explanation: Twisting and tapering any airfoiled blade further increases its efficiency. The other options may increase efficiency but they are not related to blade designs.

8. Why is a blade twisted along its length rather than its width?
a) Drag reduction
b) Weight reduction
c) Drag reduction and improvement in angle of attack
d) Aesthetic reasons

View Answer

Answer: c
Explanation: A rotor blade is twisted along its length to improve the angle of attack and reduce drag. It is not done to reduce weight or for aesthetic reasons. Every engineering design has a logical reason.

9. Which of the following blade designs further increases the efficiency of airfoil blades?
a) Reducing wind tower height
b) Twisting and tapering the blades
c) Increasing wind tower height
d) Increasing rotor speed

View Answer

Answer: b
Explanation: Twisting and tapering any airfoiled blade further increases its efficiency. T

10. Why does wind speed increase with height above ground?
a) More slip boundary conditions
b) Less obstructions and no slip boundary conditions
c) More obstructions and slip boundary conditions
d) Gas molecules have less mass

View Answer

Answer: b
Explanation: Increase in wind speed with increasing height is due to both, less number of obstructions and no slip boundary conditions. While the fluid analysis at ground level assume these conditions, the mathematics for analyzing at a considerable height above ground level is suitable changed.

11. Increased wind tower height and longer blades do not result in an increase in power.
a) True
b) False

View Answer

Answer: b
Explanation: Increasing the wind tower height and blade length results in increased output power. However, the benefits of increasing the form factor comes at the expense of economics and safety.

12. Why should longer turbine blades be made of stronger materials?
a) Longer turbine blades experience greater forces
b) Longer turbine blades experience lesser forces

Answer: a
Explanation: Longer turbine blades experience greater aerodynamic forces – lift and drag forces. Hence, they need to be made of stronger materials which are not particularly cheap.

13. Which of the following is best reason for not using longer blades even though they produce greater output power?
a) Longer turbine blades experience greater forces
b) Longer turbine blades experience lesser forces
c) Safety concerns due to greater momentum of longer blades
d) Stronger materials are available in abundance

View Answer

Answer: c
Explanation: Though longer turbine blades produce greater output power; they are not used commercially because they have more mass. If any of the blades falls off the tower, its net momentum could cause extensively damage the environment.

14. Which theory is used to model the wind turbine?
a) Blade element momentum theory
b) Kinetic gas theory
c) Archimedes principle
d) Einstein's theory of photoelectric effect

View Answer

Answer: a
Explanation: Blade momentum theory is used to for aerodynamic modelling due to its simplicity. Kinetic gas theory is related to gas molecules and energy of a gas molecule. Archimedes principle is related to floatation and immersion of a body in a liquid. Einstein's theory is related to the photoelectric effect which is a quantum mechanical phenomenon.

15. What is blade element momentum theory?
a) It is same as blade element theory
b) It is same as momentum theory
c) It talks about the motion of a body in a given frame of reference
d) It is used to calculate the local forces on the propeller or blade

View Answer

Answer: d
Explanation: Concepts of both, element theory and blade momentum theory are combined and used in Blade element momentum theory. It is used to aerodynamically model turb

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Wind Energy Questions and Answers – Wind Turbine Types and their Construction – 1

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This set of Wind Energy Multiple Choice Questions & Answers (MCQs) focuses on “Wind Turbine Types and their Construction – 1”.

1. Wind turbines convert wind energy to _____
a) mechanical energy
b) electrical energy
c) heat energy
d) solar energy

View Answer

Answer: a
Explanation: Wind turbines convert wind energy to mechanical energy. This mechanical energy is then converted to electrical energy using an electric generator. They neither convert wind energy to heat energy nor to solar energy.

b) Blades – rotor – shaft – electric generator
c) Shaft – blades – rotor – electric generator
d) Electric generator – blades – rotor — shaft

View Answer

Answer: b
Explanation: A wind turbine system first converts wind energy to mechanical energy and then to electrical energy using an electric generator. The correct order is blades – rotor – shaft – electric generator.

3. Which of the following are commonly used commercial wind turbines?
a) Vertical and DFIG
b) Horizontal and SCIG
c) Horizontal and vertical
d) DFIG and SCIG

View Answer

Answer: c
Explanation: Horizontal axis wind turbines (HAWT) or horizontal and vertical axis wind turbines (VAWT) or vertical are commonly used commercial wind turbines. DFIG, SCIG and PMSG are commercially used power generators for wind energy.

4. What are horizontal wind turbines?
a) Wind turbines are rotate about an axis perpendicular to the plane of ground
b) Wind turbines are rotate about an axis diagonal to the plane of ground

Answer: d
Explanation: Horizontal wind turbines are made up of blades that rotate about an axis parallel to the plane of wind streamlines. Hence, they are also called as Horizontal Axis Wind Turbines (HAWT). They are the most popularly used wind turbines for commercial wind energy harvesting applications.

5. Which of the following is an advantage of a horizontal axis wind turbine?
a) Blades are to the side of turbine's center of gravity
b) Blades are parallel to the vertical axis passing through the turbine's center of gravity
c) Blades are parallel to the horizontal axis passing through the turbine's center of gravity
d) Blades are positioned perpendicular to the plane of the ground

View Answer

Answer: a
Explanation: In a horizontal axis wind turbine (HAWT), the blades are positioned to the side of the turbine's center of gravity. This provides stability to the entire setup. Blades rotate to an axis parallel to the plane of ground.

6. What is an upwind turbine?
a) Rotor of the turbine is behind the unit
b) Rotor of the turbine is in front of the unit
c) Rotor is positioned at the bottom of the tower
d) Rotor is positioned at the center of the tower

View Answer

of the unit. The position is similar to that of propellers used in airplanes. Most of the wind turbines used commercially are upwind turbines.

7. What is the main advantage of an upwind turbine?
a) Increased tower shadow effect
b) Reduced tower shadow effect
c) No tower shadow effect
d) Manufacturing

View Answer

Answer: b
Explanation: Tower shadow effect occurs when the tower acts as an obstruction between the blades and the wind. In an upwind turbine, both rotor and blades are attached in front of tower. Thus, the tower shadow effect reduces considerably.

8. What is the main disadvantage of an upwind turbine?
a) Increased tower shadow effect
b) Reduced tower shadow effect
c) A rotor that needs to be placed at some distance from the tower
d) An inflexible rotor that needs to be placed close to the tower

View Answer

Answer: c
Explanation: The main disadvantage of any upwind turbine is the requirement of placing rotor at some distance from the tower. This setup prevents problems with a blade strike. Tl

9. What is a downwind turbine?
a) Rotor is positioned at the three-quarters of the height of the tower
b) Rotor of the turbine is in front of the unit
c) Rotor is positioned at the bottom of the tower
d) Rotor of the turbine is behind the unit

View Answer

Answer: d
Explanation: A downwind turbine is a type of wind turbine where the rotor is positioned behind the tower. The nacelle used is typically designed to seek the wind.

10. What is the main advantage of any downwind turbine?
a) Inflexible rotor blades
b) Flexible rotor blades
c) Position of the rotor
d) Reduced tower shadow effect

View Answer

Answer: b
Explanation: The main advantage of a downward turbine is that the rotor blades can be made flexible. This reduces the cost of manufacturing and relieves stress on the tower at high wind speeds.

11. What is the main disadvantage of a downward wind turbine?
a) Increased tower shadow effect

d) Bending of blades at high wind speeds

View Answer

Answer: b
Explanation: Since the rotor of a downward wind turbine is placed behind the tower, it experiences an increased tower shadow effect. Flexible rotor blades enable bending at high wind speeds. This is its main advantage.

12. What is a vertical wind turbine?
a) Wind turbines are rotate about an axis perpendicular to the plane of wind streamlines
b) Wind turbines are rotate about an axis diagonal to the plane of ground
c) Wind turbines are rotate about an axis 30 degrees to the plane of ground
d) Wind turbines are rotate about an axis parallel to the plane of ground

View Answer

Answer: a
Explanation: Vertical wind turbines are made up of blades that rotate about an axis perpendicular to the plane of wind streamlines. Hence, they are also called as Vertical Axis Wind Turbines (HAWT). Most of its main components is near the ground unlike a HAWT.

13. What are the types of VAWT?
a) Lift, horizontal
b) Horizontal, vertical
c) Drag, lift
d) Urban wind turbines

View Answer

Answer: c
Explanation: There are two types of VAWT – drag and lift. Horizontal and vertical wind turbines are classified based on their axis of rotation. Urban wind turbines are specially designed turbines to harvest wind energy in cities and other urban areas.

14. What is the main advantage of a vertical axis wind turbine?
a) Directional and sensitive to wind turbulence
b) Not directional and sensitive to wind turbulence
c) Directional and insensitive to wind turbulence
d) Not directional and insensitive to wind turbulence

View Answer

Answer: d

15. What is the main disadvantage of a vertical axis wind turbine?
a) Not directional and insensitive to wind turbulence
b) More drag than HAWTs
c) Less drag than HAWTs
d) High starting torque

View Answer

Answer: b
Explanation: Vertical wind axis turbines cause more drag than HAWTs as their blades are constantly spinning back into the wind. Their main advantage is that they are not directional and insensitive to wind turbulence. Also, they have a low starting torque and may require an external source to start turning.

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Wind Energy Questions and Answers – Wind Turbine Types and their Construction – 2

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This set of Wind Energy Questions and Answers for Entrance exams focuses on “Wind Turbine Types and their Construction – 2”.

1. What is the main disadvantage of a horizontal axis wind turbine?
a) Easy operation at near ground winds
b) Does not self-start
c) Difficult operation at near ground winds
d) High starting torque

View Answer

Answer: c
Explanation: The main disadvantage of any horizontal wind axis turbine is that it cannot be operated at near ground winds. This is due to the height of the tower and size of the blades. However, most of them are self-starting and do not have a high starting torque.

c) Sugar
d) Plastic

View Answer

Answer: a
Explanation: Rotor blades are made using glass fibre reinforced polyester (GRP). It is a material made impregnating a matrix of fibre glass mats with a polyester. This polyester is hardened after impregnation.

3. Which of the following materials can be used to make a rotor blade of a wind turbine apart from glass fibre reinforced polyester (GRP)?
a) Silicon, germanium
b) Epoxy, carbon fibre
c) Plastic
d) Salt

View Answer

Answer: b
Explanation: Apart from GRP, epoxy and carbon fibre can be used to make rotor blades. Though carbon fibre is lighter and has higher material strength, it is expensive. Silicon and germanium are generally used in semiconductor industry.

4. Fatigue testing of rotor blades subject the blades to an oscillation in _____ direction.
a) horizontal
b) vertical

Answer: c
Explanation: During fatigue testing of rotor blades, they are oscillated in the flapwise direction for millions of cycles. A typical flapwise test takes about three hours. Depending on the results of a fatigue test, we comment on whether a rotor blade can withstand high wind speeds or not.

5. Which of the following are the major parts of a wind turbine system?
a) Tower, rotor, water storage tank, air compressor
b) Tower, rotor and blades, air compressor, vacuum pump, electricity generator
c) Electricity generator, nacelle, rotor and blades, power converter, building
d) Tower, nacelle, rotor and blades, power converter, electricity generator

View Answer

Answer: d
Explanation: Tower, nacelle, rotor and blades, power converter, electricity generator and wind shaft are the major parts of a wind turbine system. Water storage tank, air compressor and vacuum pump are not used in a wind turbine system.

6. What is the main function of tower in a wind turbine system?
a) Acts a support to all other components used in wind turbine system
b) Acts as an antenna for wireless radio communications
c) Acts as an electric pole for power transportation
d) Destabilizes the wind turbine system

View Answer

components. It also stabilizes both, the rotor and blades which eventually convert wind energy to electrical energy via mechanical energy.

7. Which of the following towers is used for small wind turbines?
a) Hybrid tower
b) Guyed pole tower
c) Electric pole
d) Wooden pole

View Answer

Answer: b
Explanation: The guyed pole tower is used for small wind turbines. It is a single vertical pole supported by guy cables from different sides. An electric pole is specifically used for electricity transportation. Wooden pole is a general purpose pole and can be used for a variety of applications.

8. What is a hybrid type tower?
a) Guyed tower
b) Guyed tower and wooden tower
c) Thin and tall lattice type guyed tower
d) Guyed tower and electric pole

View Answer

Answer: c
Explanation: Unlike the guyed tower which uses a single pole, the hybrid tower uses a thin and

9. Nacelle is a kiosk that houses _____
a) a MOSFET
b) a diode
c) a wifi router
d) a yaw drive

View Answer

Answer: d
Explanation: Nacelle is a big box that houses various components like power converter, yaw drive, gearbox, etc. MOSFETs and diodes are discrete electrical components used to realize various electrical and electronic circuits. Nacelle does not house a Wi-Fi router.

10. What is the main function of gearbox in a wind turbine system?
a) Multiples rotation speed to generate electricity
b) Divides rotation speed to generate electricity
c) Multiples rotation speed to consume wind energy
d) Divides rotation speed to consume wind energy

View Answer

Answer: a
Explanation: The blades rotate slowly and this speed is not sufficient to generate electricity. So, the main function of a gearbox in a wind turbine system is to multiply the rotation speed to a sufficiently high level so as to generate electricity.

11. What is a pitch drive motor?

d) A motor to rotate the blades

View Answer

Answer: b
Explanation: A pitch drive motor is a motor used to control the angle of blades. Pitching is the process of rotating the angle of blades to cut maximum wind for harvesting energy.

12. What is a yaw drive?
a) A device used to support and stabilize other components
b) A device used to house various energy conversion components
c) A motor to ensure that nacelle faces the wind
d) A device used to track wind direction

View Answer

Answer: c
Explanation: A yaw drive is a motor to ensure that the nacelle faces in the direction of the wind. This advocates maximum energy extraction from the incoming wind. It is controlled by a PLC that uses wind vane to track the net direction of wind.

13. What is the cost of a wind turbine per megawatt?
a) $10000
b) $1000
c) $100
d) $1 million

View Answer

Answer: d
Explanation: As of 2019, a wind turbine costs about $1 million per megawatt. Manufacturing the rotor blades consume most of the budget. Depending on the size and material used, the cost may vary. For example, carbon fibre is expensive when compared to glass fibre.

14. Wind turbines require regular maintenance.
a) False
b) True

View Answer

Answer: b
Explanation: Wind turbines require regular maintenance to ensure reliability and maintain initial efficiency. They are generally serviced after 3-4 months of usage. In best case, they are available to generate energy 98% of the time.

b) True

View Answer

Answer: a
Explanation: Offshore wind turbines are erected in water bodies like oceans or continental shelves. They are used to harvest energy from winds flowing above the water bodies. They generate about 40% more electricity as compared to other wind turbines on land.

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Wind Energy Questions and Answers – Wind Energy Conversion Systems (WECS) – 1

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This set of Wind Energy Multiple Choice Questions & Answers (MCQs) focuses on “Wind Energy Conversion Systems (WECS) – 1”.

1. What are wind energy conversion systems designed for?
a) To convert wind energy to mechanical energy
b) To convert wind energy to potential energy
c) To convert wind energy to electrical energy
d) To convert mechanical energy to wind energy

View Answer

2. Which of the following is a part of a general wind energy conversion system?
a) Server
b) Wind turbine
c) Cloud User

3. What are the two types of gear boxes used in wind turbine?
a) VAWT and HAWT
b) Differential
c) Parallel shaft and planetary shaft
d) Manual transmission

View Answer

4. What are parallel shaft gears?
a) Motor shaft and the speed controller shaft are on perpendicular planes
b) Motor shaft and the speed controller shaft are on skewed planes
c) Motor shaft and the speed controller shaft are on diagonal planes
d) Motor shaft and the speed controller shaft are on parallel planes

View Answer

5. What is a planetary shaft gearbox?
a) Input shaft and output shaft are aligned
b) Motor shaft and the speed controller shaft are on perpendicular planes
c) Motor shaft and the speed controller shaft are on parallel planes
d) Input shaft and output shaft are parallel

View Answer

6. Parallel shaft gearbox is used in small turbines.
a) False
b) True

View Answer

7. Planetary shaft gearbox is not used in large turbines.
a) False
b) True

View Answer

8. Power generation contains _____
a) mechanical systems
b) kinetic systems
c) electromagnetic and electrical subsystems
d) nuclear systems

b) WECS operating at non-differential speeds
c) WECS operating at variable speeds
d) WECS operating at constant speed

View Answer

10. Fixed speed WECS are equipped _____ generators.
a) squirrel-cage induction
b) squirrel induction
c) induction squirrel
d) doubly-fed induction

View Answer

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1. How is the speed varied in limited variable speed WECS?
a) Variable rotor resistance
b) Fixed rotor resistance
c) Fixed capacitance
d) Variable rotor

View Answer

Answer: a
Explanation: Limited variable speed WECS is an evolution of fixed-speed WECS. The variable speed is achieved with the help of a variable rotor resistance which is controlled by power electronics. Thus, the total resistance is adjustable.

c) Induction squirrel
d) Induction generator

View Answer

Answer: b
Explanation: Double-fed induction generator is used in a variable speed WECS. The name doubly-fed comes from the fact that the stator voltage is applied from the grid and the rotor voltage is impressed by the power converter.

3. Which of the following components are used as converters in power electronics converter?
a) BJT
b) Earphone
c) IGBT
d) Wi-Fi driver

View Answer

Answer: c
Explanation: Two IGBTs are used as converters, namely the rotor side and the grid side converter. BJT is not used as converter. Both, earphone and Wi-Fi driver are not electrical components. Earphones are used to listen to music and Wi-Fi driver is used to connect to the Wi-Fi.

4. What is the function of rotor side converter?
a) To control the DC-link voltage
b) To ensure operation at large power factor

Answer: c

Explanation: The function of rotor side converter is to control the generator. It controls the generator in terms of active and reactive power by ensuring minimum power loss during power conversion. The rotor side converter is made up of IGBT.

5. What is the function of grid side converter?

a) To ensure operation at low power factor

b) To control generator in terms of reactive power

c) To control generator in terms of active power

d) To control the DC-link voltage

View Answer

Answer: d

Explanation: The function of grid side converter is to control the DC-link voltage. It also ensures operations at a large power factor. An IGBT is used to make the converter.

6. What is sub-synchronous mode in doubly-fed induction generator (DFIG)?

a) Rotor runs below synchronous speed

b) Rotor runs above synchronous speed

c) Rotor runs at synchronous speed

d) Slip power is fed into AC power supply

View Answer

Answer: a

Explanation: In a doubly-fed induction generator (DFIG), sub-synchronous mode is a mo

7. What is super-synchronous mode in doubly-fed induction generator (DFIG)?
a) Rotor runs below synchronous speed
b) Rotor runs above synchronous speed
c) Rotor runs at synchronous speed
d) Rotor takes power from AC mains

View Answer

Answer: b
Explanation: In a doubly-fed induction generator (DFIG), super-synchronous mode is a mode where the rotor runs above the synchronous speed. This is conducive towards feeding the slip power into AC mains supply with the help of an inverter-converter combination.

8. Which of the following generators are mostly used in WECS?
a) PMSG and SCIG
b) DFIG and SCIG
c) DFIG and PMSG
d) VAWT and HAWT

View Answer

Answer: c
Explanation: Doubly-fed induction generator (DFIG) and permanent magnet synchronous generator (PMSG) are the two most commonly used generators in WECS. SCIG is typically used in a fixed speed WECS which has a low efficiency. VAWT and HAWT are types of wind turbines.

9. Which of the following is a flowchart depicting WECS modelling?

d) Wind turbine aerodynamic model → gear train model → generator (PMSG/DFIG) → power grid

View Answer

Answer: d
Explanation: Wind turbine is connected to the electrical generator through a coupling device gear train. The output of the generator is connected to the power grid via a power controller to minimize power loss and ensure system protection.

10. _____ speed WECS is the most flexible in terms of the generator used.
a) Full variable
b) Limited variable
c) Half variable
d) Fixed

View Answer

Answer: a
Explanation: Full variable speed WECS is the most flexible in terms of the generator used. Various generators like squirrel-cage induction generator (SCIG), wound-rotor synchronous generator (WRSG) or permanent-magnet synchronous generator (PMSG) can be used.

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Wind Energy Questions and Answers – Effects of Wind Speed and Grid Condition (System Integration) – 1

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This set of Wind Energy Multiple Choice Questions & Answers (MCQs) focuses on “Effects of Wind Speed and Grid Condition (System Integration) – 1”.

1. What happens to wind speed when many turbines operate collectively?
a) Wind speed reduces
b) Wind speed increases
c) Wind speed does not change
d) Wind speed increases exponentially and then decreases linearly

View Answer

Answer: a
Explanation: Wind turbines are used to extract kinetic energy from the incoming wind. When multiple turbines operate collectively, the wind speed of the atmospheric flow reduces after crossing each turbine. This affects the efficiency of the turbines.

2. Which of the following is true?
a) More than 50% of the land area on earth can generate 1W per square meter
b) Less than 5% of the land area on earth can generate 1W per square meter
c) 60 – 80% of the land area on earth can generate 1W per square meter
d) More than 80% of the land area on earth can generate 1W per square meter

View Answer

Answer: b
Explanation: After multiple simulations, research has shown that less than 5% of land area can actually generate 1W per square meter. A global climate model was used to simulate scenarios of different wind energy across all continents.

3. Lower wind speeds result in _____
a) higher wind energy obtained
b) no wind energy obtained
c) lower wind energy obtained
d) 100% energy conversion for half the operation time and less than 10% energy conversion for the remaining half of the operation time

View Answer

Answer: c
Explanation: Wind speeds disproportionally affect the electricity generation from wind turbines. Lower wind speeds result in much lower wind energy. This further decreases the conversion efficiency resulting in extremely low powers.

b) The output power first decreases then monotonically increases
c) The output power decreases
d) The output power increases

View Answer

Answer: d
Explanation: When the wind turbine blades rotate faster for the entire operation time, the output power increases. The output power increases until the speed of rotation is decreased.

5. Higher wind speeds _____ the speed of rotation of the wind blades.
a) increase
b) decrease
c) monotonically decrease
d) first increase and then decrease

View Answer

Answer: a
Explanation: Higher wind speeds increase the speed of rotation of the wind blades. This in turn generates more output power as the net mechanical energy increased due to increase in rotational speed of the wind blade.

6. What is cut-in wind speed?
a) Wind turbine stops generating output power
b) Wind turbine starts generating output power
c) Wind turbine stops functioning

Answer: b
Explanation: Wind turbines are designed to operate within a specific range of wind speeds. The cut-in wind speed is that wind speed at which the wind turbine starts generating output power. It is not the speed at which the turbine starts functioning.

7. What is rated speed?
a) Wind turbines generate least output power
b) Wind turbines do not generate any output power
c) Wind turbines generate maximum output power
d) Wind turbines have no rated speed as the output power always increases

View Answer

Answer: c
Explanation: The rated wind speed is that wind speed at which the wind turbines generate maximum output power. Maximum power point tracking (MPPT) is used to ensure that the wind turbines always operate in the neighbourhood of the rated wind speed.

8. Which of the following are the limits of the range of wind speeds for which the turbines are designed?
a) Elasticity
b) Threshold voltage
c) Networking
d) Cut-in speed and cut-out speed

View Answer

the cut-out speed. Elasticity is the ability of a material to come back to its original shape after stretching. Threshold voltage is related to electrical devices like diodes, BJTs, etc.

9. How does the output power vary between cut-in speed and the rated speed?
a) cubically
b) linearly
c) square
d) exponential

View Answer

Answer: a
Explanation: Between the cut-in speed and the rated speed, the output power of the wind turbines varies cubically. The output power cubically increases until the rated speed is reached – if the wind speed doubles, the output power increases by 8 times.

10. What is the cut-out speed?
a) Wind turbine starts generating output power
b) Wind turbine must be shut down
c) Wind turbine stops functioning
d) Wind turbine starts functioning but does not generate output power

View Answer

Answer: b
Explanation: Cut-out speed is the wind speed at which the wind turbine must be shut do
This prevents damage to the equipment used in the wind turbines. The cut-out speed

11. Power output is not related to the local air density.
a) False
b) True

View Answer

Answer: a
Explanation: Power output is related to the local air density. Air density is defined as the mass per unit volume of the earth's atmosphere. It depends on various physical factors.

12. Which of the following does the local air density depend upon?
a) Soil
b) Lightning
c) Altitude and pressure
d) Nitrogen and oxygen

View Answer

Answer: c
Explanation: Air density depends on altitude, pressure and temperature. It does not depend on soil and its topography as well as on lightning. Nitrogen and oxygen are types of gases and are components of air.

13. Higher air density leads to higher power output.
a) True
b) False

View Answer

Answer: a
Explanation: Higher air density results in higher output power. This is because denser air exerts more pressure on the wind blades which increases the speed of rotation. Thus, an increase in the speed of rotation increases output power.

14. What is feather of wind turbine blades?
a) Adding feathers to the blades
b) Reducing the weight of wind turbine blades
c) Reducing the angle of pitch
d) Increasing the angle of pitch

View Answer

Answer: d
Explanation: Increasing the angle of pitch is called feathering of wind turbine blades. I

15. Why is feathering of wind turbine blades required?
a) To increase drag
b) To reduce drag
c) To prevent the blades from being destroyed by strong winds
d) To extract power from strong winds originating from storms

View Answer

Answer: c
Explanation: Feathering of wind turbine blades is used to prevent the blades from destruction by storm winds. By orienting the wind blades in a direction parallel to the incoming air flow, the net drag from a stopped propeller is minimized and the system is shut down.

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Wind Energy Questions and Answers – Effects of Wind Speed and Grid Condition (System Integration) – 2

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This set of Wind Energy Assessment Questions and Answers focuses on “Effects of Wind Speed and Grid Condition (System Integration) – 1”.

1. Why is the energy output of wind power plant variable?
a) Wind speed is variable
b) Wind speed is an unknown constant
c) Wind speed is known constant
d) Poor equipment is used

View Answer

Answer: a
Explanation: The energy output of any wind power plant (WPP) is variable because the wind speed is variable. The equipment used in power plant is designed to deal with such variability and uncertainty.

2. Which of the following is a reason for variable wind speed?
a) Water
b) Earth’s rotation
c) Electrons
d) Fans

View Answer

Answer: b
Explanation: Day and night cycle caused by earth’s rotation and seasonal changes due to tilt axis of earth cause changes in wind speed. Water, electrons and fans do not affect wind speed.

3. What is grid integration of wind energy?
a) Planning the connection of wind power plant to the grid
b) Physical connection of wind power plant to the grid
c) Energy sent from grid to run the wind turbines
d) Collection of all activities related to connecting wind power plants to the grid

View Answer

Answer: d
Explanation: Grid integration of wind energy is simply the collection of all activities related to connecting wind power plants to the grid. The wind power plant sends energy to the grid. It does not consume energy from the grid.

4. Which of the following depicts the correct order of the stages involved in grid integratior wind energy?

d) Physical connection → planning → system operations

View Answer

Answer: c
Explanation: Grid integration of wind energy consists of three stages starting with planning the connection. After laying out the plan, the power plant is physically connected to the substation (grid). Lastly, the functioning of each system is handled under systems operation.

5. What are the two types of planning activities related to grid integration?
a) Network-wide and project-specific
b) BJT and MOSFET
c) Rotor and shaft
d) Low power and high power designs

View Answer

Answer: a
Explanation: The two types of planning activities related to grid integration are network-wide and project-specific activities. BJT and MOSFET are electronic/electrical devices (components). Rotor and shaft are used in a rotating mechanism. Low power and high power designs are circuit design specifications.

6. Which of the following best describes network-wide planning activity in grid integration?
a) Planning activities related to a unique wind project
b) Planning activities for all the future wind power plants
c) Planning activities for a telecommunication system

Answer: b

Explanation: Network-wide plans are laid out for all the future wind power plants. Planning activities for a telecommunication system are not related to grid integration of wind energy. Maintenance of existing wind power plants is covered in the previous network-wide plan.

7. Network-wide plans in wind energy grid integration include _____

a) system impact studies done for a specific wind project

b) materials used to manufacture wind turbine blades

c) developing grid code

d) solar panel manufacturing plant

View Answer

Answer: c

Explanation: Network-wide plans include development of grid code, network-wide system integration studies with scenarios for different levels of wind penetration and system operation studies. They are not done for a specific wind project.

8. What is project specific planning in wind energy grid integration?

a) Planning activities for a solar panel system

b) Planning activities for all the future wind power plants

c) Planning activities related to a unique wind project

d) Planning activities for the maintenance of the existing thermal power plants

View Answer

Answer: c

specific wind project. The input for this type of study is the wind power plant which is being studied.

9. In a substation, the wind power plant line is connected to a _____ voltage bus bar.
a) high
b) low
c) mini
d) medium

View Answer

Answer: d
Explanation: In a substation, the wind power plant line is connected a medium voltage bus bar. A medium voltage bus bar is used for medium voltages – 10kV to 50kV. At the wind turbine generator, this bar is connected to a step up transformer which steps up the output of the generator from 0.69kV to 11kV or 33kV.

10. Which of the following are a few primary tests performed after commissioning phase in the physical connection stage?
a) Switch-gear functioning and quality parameters
b) Feathering
c) Wind turbine blade tests
d) Rotor and shaft tests

View Answer

Answer: a

is done to prevent the blades from being damaged by storm winds. Wind turbine blade, rotor and shaft tests do not come under grid integration tests.

11. Which of the following are impacts of grid integration of wind power plant?
a) Day-ahead unit commitment process
b) Day-ahead unit commitment process, economic dispatch process
c) Generator types
d) Rotor and shaft tests

View Answer

Answer: b
Explanation: The unit commitment process is cost-effective combination of generating units to meet forecasted load and reserve requirements, while adhering to generator and transmission constraints. Economic dispatch is the optimization of production from generators to minimize cost of generation while meeting all the constraints. In most grids, wind energy has the highest priority due to its low marginal costs.

12. Which of the following is/are good practices for grid integration of wind power plant?
a) Day-ahead unit commitment process
b) Day-ahead unit commitment process, economic dispatch process
c) Optimized transmission from resources-rich areas to load, flexible generation
d) Rotor and shaft tests

View Answer

Answer: c
Explanation: Optimizing transmission from resource-rich areas to load saves both, power and costs. Using the under-utilized line to transmit power instead of setting a new transmission line is an example of optimization. Flexible power generation helps meeting in varying power demands.

13. What is a grid code for wind energy integration?
a) A binary code
b) A hexadecimal code
c) A code of conduct
d) A rulebook specifying generator properties

View Answer

Answer: d
Explanation: A grid code for integration is a rulebook that specifies properties of generators and other equipment used to connect to the grid. The equipment must satisfy th

b) Marginal cost
c) Fixed cost
d) Fundamental Analysis

View Answer

Answer: a
Explanation: Grid integration costs are divided into three categories – transmission extension, balancing of increased volatility in grid and covering the peak load. The other options are various terms used in economics and finance to define different types of costs. They are not particularly related to grid integration.

15. What is a power flow study in wind energy integration?
a) A binary code
b) Determines flow of electrical energy from generators to consumers
c) Determines flow of electrical energy from generators to consumers meeting line loading requirements
d) A study specifying generator properties

View Answer

Answer: c
Explanation: A power flow study in wind energy integration determines flow of electrical energy from generators to consumers meeting line loading requirements and all grid code requirements. It is performed using various power systems modelling software like PSS/E and ETAP.

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Wind Energy Questions and Answers – Wind Energy Storage – 1

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This set of Wind Energy Multiple Choice Questions & Answers (MCQs) focuses on “Wind Energy Storage – 1”.

1. Which of the following is a reason for storing wind energy?
a) Wind power generation is not correlated to the demand cycle
b) Wind power generation is correlated to the demand cycle
c) Wind is a renewable resource
d) Wind power is guaranteed to be available during peak demands

View Answer

Answer: a
Explanation: Most of the electricity produced from the plants is consumed immediately. Moreover, wind power generation is not correlated to the demand cycle. It is also not guaranteed to be available during peak demands. Thus, wind power storage is necessary.

c) Running a consumer electrical appliance
d) Turning off consumer electrical appliances when not in use

View Answer

Answer: b
Explanation: Wind energy can be stored as electro-chemical energy in the form of batteries. Glowing a bulb and running a consumer electrical appliance consumes energy. While turning off an appliance when not in use saves energy, it doesn't store energy.

3. What is an example of storing wind power electro-chemically?
a) Electro-hydrogen generation
b) Pumped storage
c) Batteries
d) Electric grid

View Answer

Answer: c
Explanation: Storing energy in batteries is the most common and simplest method to store wind energy. An electric grid is an interconnected network for delivering power from suppliers to consumers.

4. _____ is an example of storing wind energy chemically.
a) Flywheels
b) Pumped storage
c) Batteries

Answer: d
Explanation: Electro-hydrogen is an example of storing wind energy chemically. Batteries typically come under the category of electro-chemical storage. Flywheels come under the category of mechanical storage.

5. Wind energy can be switched on ‘on demand’.
a) True
b) False

View Answer

Answer: b
Explanation: Wind energy cannot be switched on ‘on demand’. It is inherently intermitted, variable and non-dispatchable. To match the supply with demand, it requires a backup to store the generated power.

6. Energy storage devices can manage power fluctuations.
a) True
b) False

View Answer

Answer: a
Explanation: Energy storage devices can manage power fluctuations, particularly from renewable sources of energy – wind and solar. Thus, they enable such fluctuating and irregular technologies to cope with consumer’s demand.

c) Power capacity, energy storage capacity, efficiency, response time, round-trip efficiency
d) Stress, strain, Young's Modulus, elasticity, rigidity

View Answer

Answer: c
Explanation: Power capacity, energy storage capacity, efficiency, response time and round-trip efficiency are generally used to describe an energy storage device. Stress, strain, Young's modulus, elasticity and rigidity are used to describe a material. The other options are not used to describe 'storage potential/capacity'.

8. What is energy storage capacity?
a) Power stored
b) Amount of energy that can be drawn from a storage device
c) Amount of energy stored in a storage device
d) Amount of energy a storage device can store for a period of time

View Answer

Answer: d
Explanation: Energy storage capacity is the amount of energy a storage device can store for a period of time. It is usually measured in kilowatt-hours (KWh) or megawatt-hours (MWh). It is not the same as amount of energy stored.

9. Pumped hydroelectric is an example of _____
a) Gravitational potential storage
b) Latent heat storage

Answer: a
Explanation: Pumped hydroelectric storage is an example of gravitational potential storage. It is the most mature storage technique and has the largest storage capacity. For optimization, the pump and the turbine are combined into a single device.

10. What type of materials are used for latent heat storage?
a) Materials with high stress
b) Phase-change materials
c) Materials with high stress/strain ratio
d) Elastic materials

View Answer

Answer: b
Explanation: Phase change materials are used for latent heat storage. Stress and strain are used to describe a material's deformation ability. Elastic materials are those which when deformed regain their original shape.

11. Flywheels are an example of _____ energy storage.
a) potential
b) electric potential
c) thermal kinetic
d) kinetic

View Answer

Answer: d

12. When does a power conversion system act as a rectifier for an energy storing device?
a) When the device is being charged
b) When the device is being discharged
c) When the device stops working
d) When the power conversion system is being charged

View Answer

Answer: a
Explanation: A power conversion system acts as a rectifier when the energy storing device is being charged. This is because any existing energy storage cannot store AC. Except for mechanical storage devices, it is necessary to convert alternating current (AC) to direct current (DC) and vice-versa.

13. When does a power conversion system act as an inverter for an energy storing device?
a) When the device is being charged
b) When the device is being discharged
c) When the device starts working
d) When the power conversion system is being discharged

View Answer

Answer: b
Explanation: A power conversion system acts as an inverter when the energy storing device is being discharged. The converted AC current is then transported to the consumer. Transporting alternating currents reduces the amount of resistive losses.

14. Which of the following parameters are used to describe rechargeable batteries?
a) Power
b) Frequency
c) Charge-to-discharge ratio
d) Angular speed

View Answer

Answer: c
Explanation: Charge-to-discharge ratio, depth of discharge (DoD) and memory effect are commonly used to describe rechargeable batteries. Power, frequency and angular speed are not used to describe any storage device's characteristics.

15. Capacitors store energy in the form of _____
a) potential
b) AC voltage

Answer: d
Explanation: Capacitors store energy in the form of electric potential. The energy is stored between two metallic plates. Neither AC voltage nor alternating current can be stored.

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Wind Energy Questions and Answers – Wind Energy Storage – 2

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This set of Wind Energy Question Paper focuses on “Wind Energy Storage – 2".

1. What is depth of discharge?
a) Percentage of the battery that is discharged during a cycle
b) Percentage of the battery that is discharged
c) Amount of charge discharged from a battery during a cycle
d) Amount of charge discharged from a battery

View Answer

Answer: a
Explanation: Depth of discharge (DoD) is the percentage of the battery that is discharged during a cycle. It has a wider use because it indicates a percentage instead of an absolute value. Indicating the absolute value of the charge discharged is not practical as it is unique for every battery and cannot be generalized.

c) Ratio of the amount of charge during charging cycle to the amount of charge during discharge cycle
d) Time taken to discharge the device

View Answer

Answer: b
Explanation: Charge-to-discharge ratio is the ratio of time taken to charge the device relative to the time taken to discharge the device. For instance, if a device takes 2 times longer to charge than to discharge, it has a charge-to-discharge ratio of 2:1.

3. What is memory effect?
a) Electro-hydrogen generation
b) Pumped storage
c) Remembering a charging level
d) Electric grid

View Answer

Answer: c
Explanation: Memory effect is mainly used to describe rechargeable batteries. If they are not fully charged for long periods of time then they 'remember' that charging level. Thus, they lose some of their capacity. The other options are storage techniques of wind energy.

4. Which of the following have large power (>50MW) and storage capacities (>100MWh)?
a) Memory effect
b) Battery energy storage (BES) and flow battery energy storage

Answer: d

Explanation: Pumped hydro-electric storage (PHES) and underground pumped hydro-electric storage (UPHES) are grouped under the category of large power (>50MW) and storage capacity (>100MWh). Compressed air energy storage (CAES) is another example of this category. Memory effect is a parameter used to describe a rechargeable battery.

5. Efficiency of pumped hydro-electric storage is in the range of _____

a) 50% — 80%

b) 80% — 120%

c) 10% — 20%

d) 45% — 50%

View Answer

Answer: a

Explanation: Efficiency of pumped hydro-electric storage is in the range of 50% — 80%. It has large power (>50MW) and storage capacity (>100MWh). The efficiency is further being improved using variable speed machines.

6. How does pumped hydro-electric storage work?

a) Pumps water from higher level to a lower level

b) Pumps water from lower level to higher level

c) Uses electrical energy present in the water

d) Uses nuclear energy present in the water molecules

View Answer

higher level and stored. When required, the water falls from the higher level and rotates turbines connected to an electrical generator.

7. Which of the following is an application of pumped hydro-electric storage?
a) Energy source
b) Frequency regulation only in pumping mode
c) Frequency regulation in both pumping and generation modes
d) Absorbs power to increase the net expenses

View Answer

Answer: c
Explanation: Pumped hydro-electric storage is used for frequency regulation in both pumping and generation modes. In fact, it absorbs power in a more cost-effective manner and boosts efficiency upto 3%.

8. What is a major disadvantage with pumped hydro-electric system?
a) No dependence on geographical locations
b) Small scale construction for effective functioning
c) Low initial costs of construction
d) Depends on specific geographical locations for the construction of the two reservoirs

View Answer

Answer: d
Explanation: A major disadvantage with PHES is its dependence on specific geograph locations for the construction of the two reservoirs. It also demands that the two reservoirs

9. Which of the following best indicates the flow diagram of storage mode in compressed air energy storage?
a) Power from grid → motor → compressor → storage
b) Power from grid → motor → storage → compressor
c) Power from grid → compressor → motor → storage
d) Motor → power from grid → compressor → storage

View Answer

Answer: a
Explanation: In CAES, power is drawn from the grid during off-peak hours to run a motor which in turn drives a compressor. Air passed into the compressor is then compressed and stored.

10. Which of the following best indicates the flow diagram of power generation mode in compressed air energy storage?
a) Storage → LPT → HPT → generator
b) Storage → HPT → LPT → generator
c) Storage → LPT → generator → HPT
d) HPT → Storage →LPT → generator

View Answer

Answer: b
Explanation: In CAES, the compressed air is first sent from the storage tank to a high pressure turbine (HPT) which is in turn connected to a lower pressure turbine (LPT). Finally, the LP˙ connected to an electric generator.

b) Capacitors
c) Lead acid
d) Reservoirs

View Answer

Answer: c
Explanation: Lead acid (LA) is used for large scale BES. Nickel-cadmium (NiCd) and sodium-sulphur (NaS) are also commonly used BES. Capacitors are not batteries. Li-ion is an upcoming technology and hasn't been established as the industry standard yet. However, it is likely to take over the industry in the next decade.

12. How does a flow battery energy storage work?
a) Electrolyte tanks → pumps → electrodes → current
b) Electrolyte tanks → pumps → current → electrodes
c) Electrolyte tanks → current → electrodes → pumps
d) Electrolyte tanks → electrodes → current → pumps

View Answer

Answer: a
Explanation: FBES operate in a similar way. Two charged electrolytes are pumped to the cell stack where a chemical reaction occurs, allowing current to be obtained from the device when required. This current is then harnessed by sending it to a load.

13. The central shaft in a flywheel energy storage device rotates on two magnetic bearings.
a) False
b) True

View Answer

Answer: b
Explanation: A flywheel energy storage (FES) consists of a central shaft. The shaft holds a rotor and a flywheel. The central shaft rotates on two magnetic bearings which considerably reduces friction losses. The entire setup is placed in vacuum to prevent drag losses.

14. Flywheels are used in uninterrupted power supply (UPS).
a) True
b) False

View Answer

Answer: a
Explanation: The entire setup is mechanical, it can be repeatedly charged and discharg

15. Capacitors do not suffer from _____
a) dielectric breakdown
b) material dependence
c) excess electric potential
d) memory effect

View Answer

Answer: d
Explanation: Capacitors store energy in the form of electric potential. They do not suffer memory effect as the energy is stored between two conducting plates. However, they do suffer from dielectric breakdown when excess electric potential is applied.

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Biomass Energy Questions and Answers – Solar Radiation on Inclined Plane Surface

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This set of Biomass Energy Problems focuses on “Solar Radiation on Inclined Plane Surface”.

1. When is the power density of the absorbing surface equal to the incident sunlight?
a) Absorbing surface and incident sunlight are perpendicular to each other
b) Absorbing surface and incident sunlight are parallel to each other
c) Absorbing surface and incident sunlight are inclined at an acute angle to each other
d) Absorbing surface and incident sunlight are inclined at an obtuse angle to each other

View Answer

Answer: d
Explanation: Net power received from incident sunlight depends on two things – the power contained in the sunlight and the angle of the receiver with respect to the incident sunlight. Incident power equals the received power when the receiver is perpendicular to the incident sunlight.

b) False

View Answer

Answer: b
Explanation: For a fixed receiver, incident power density and received power density are not equal always. In fact, the net received power is often less than the incident power as the angle between the sun and the receiver changes continuously.

3. What is direct solar radiation?
a) Radiation scattered by molecules
b) Radiation reflected from an obstacle
c) Radiation traveling on a straight line from sun to earth
d) Sum of diffused and reflected radiation energies

View Answer

Answer: c
Explanation: Direct solar radiation is that radiation which travels in a straight line from the sun. It travels to the earth without deviating from its path due to obstacles.

4. What is diffused solar radiation?
a) Sum of direct and reflected radiation energies
b) Radiation reflected from an obstacle
c) Radiation traveling on a straight line from sun to earth
d) Radiation scattered by molecules

and particles in atmosphere. Though it deviates from its initial path, it does travel down to the earth.

5. Which of the following is tried to maximized in tilted receivers (panels)?
a) Direct radiation
b) Diffused radiation
c) Reflected radiation
d) Diffracted radiation

View Answer

Answer: a
Explanation: Receivers are tilted to maximize the collection of direct solar radiation from the sun. The tilt tries to ensure that the receivers are perpendicular to the direct radiation. It accounts for the continuous change in angle between the sun and the receiver.

6. When receivers (panels) are laid horizontally, they usually collect _____
a) Direct radiation
b) Diffused radiation
c) Deflected radiation
d) Heat

View Answer

Answer: b
Explanation: When solar receivers (panels) are laid horizontally, they usually collect diffus radiation. This is because diffused radiation is equally distributed throughout the sky a

7. More the tilt in receivers (panels), larger amounts of diffused radiation is collected.
a) False
b) True

View Answer

Answer: a
Explanation: More the tilt in receivers, larger amounts of direct radiation is collected. As the tilt increases, the amount of diffused radiation received considerably reduces.

8. What is reflected solar radiation?
a) Sum of direct and reflected radiation energies
b) Radiation reflected from an atmospheric obstacle
c) Radiation traveling on a straight line from sun to earth
d) Radiation reflected from a non-atmospheric obstacle

View Answer

Answer: d
Explanation: Reflected solar radiation is that sunlight/radiation that is reflected from a non-atmospheric obstacle. The obstacles could be trees, ground, light poles, cars, etc. They do not contribute significantly towards electricity generation from solar panels.

9. Reflected solar radiation is used in _____
a) Snowy regions
b) Temperate region
c) Equatorial region

Answer: a

Explanation: Generally, reflected solar radiation does contribute significantly towards electricity generation. However, energy from reflected radiation is harvested in snowy regions as fresh snow reflects about 80-90% of the incident radiation.

10. What is global insolation?

a) Direct radiation + diffused radiation

b) Diffused radiation – direct radiation

c) Direct radiation + diffused radiation + reflected radiation

d) Reflected radiation * direct radiation

View Answer

Answer: c

Explanation: Global insolation or total insolation is the sum of the radiation received by earth from sun. It is nothing but the sum of direct radiation, diffused radiation and reflected radiation. This is used as a reference for the insolation at some tilt.

11. What is normal radiation?

a) Direct radiation

b) Sun's radiation and striking surface are perpendicular to each other

c) Incident solar radiation and striking surface are perpendicular to each other

d) Global insolation – direct radiation

View Answer

Answer: b

about the incident radiation. It may so happen that normal radiation and direct radiation may be the same at some tilt.

12. What is hour angle of the sun?
a) Angle of radiation with earth's surface
b) Angle between the hands of sun dial
c) Angle made by the sun's rays with moon's surface
d) Orientation of earth with respect to sun

View Answer

Answer: d
Explanation: Hour angle of sun is defined as the actual orientation of earth with respect to the sun. Mathematically, it is calculated by converting earth's one rotation in degrees and dividing it by the time taken – 360/24 = 15 degrees/h.

13. What is solar intensity?
a) Amount of outgoing solar energy
b) Amount of incoming solar energy on a plane surface
c) Amount of outgoing solar energy on a plane surface per unit time
d) Amount of incoming solar energy on a plane surface per unit time per unit area

View Answer

Answer: d
Explanation: Solar intensity is defined as the amount of incoming solar energy on a plane surface per unit time per unit area. It is a weighted average of the full radiation and is equal to 1367 Watt/square meter.

14. What is solar azimuth angle?
a) Orientation of earth with respect to sun
b) Orientation of moon with respect to sun
c) Angle of radiation with earth's surface
d) Angular distance between zero azimuth and sun's projection on ground

View Answer

Answer: d
Explanation: Solar azimuth angle is defined as the angular distance between zero azimuth and the projection of the line of sight to sun on the ground. Zero azimuth is a line due north or due south. Azimuth angle is measured clockwise from zero azimuth.

15. Diffuse radiation models can be classified into _____ and _____

d) anisotropic and adiabatic

View Answer

Answer: c
Explanation: Diffuse radiation models can be classified into isotropic and anisotropic. Isotropic models of diffuse radiation model diffuse radiation intensity by assuming uniform distribution throughout the sky (medium). Anisotropic models include suitable modules that are used to represent regions of increased (varied) diffuse radiation.

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Biomass Energy Questions and Answers – Photosynthesis Process

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This set of Biomass Energy Multiple Choice Questions & Answers (MCQs) focuses on “Photosynthesis Process”.

1. What is photosynthesis?
a) Plants generating carbohydrates and oxygen from carbon dioxide, water and sunlight using chlorophyll
b) Algae generating carbohydrates and oxygen from carbon dioxide, water and sunlight using chlorophyll
c) Cyanobacteria generating carbohydrates and oxygen from carbon dioxide, water and sunlight using chlorophyll
d) Photoautotroph generating carbohydrates and oxygen from carbon dioxide, water and sunlight

View Answer

Answer: d
Explanation: Photosynthesis is the process by which photoautotrophs generate food for themselves. They use carbon dioxide, water and sunlight to generate carbohydrates and oxygen. Photo means light.

2. What is the primary product of photosynthesis?
a) Glucose
b) Oxygen
c) Water
d) Carbon dioxide

View Answer

Answer: a
Explanation: The primary product of photosynthesis is glucose. Oxygen is the by product. Water and carbon dioxide are the reactants.

3. Which of the following best indicates photosynthesis?
a) Carbon dioxide + water → oxygen + glucose
b) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ (in the presence of sunlight)
c) Carbon dioxide + water → glucose + oxygen (in the presence of sunlight)
d) Oxygen + glucose → carbon dioxide + water

View Answer

Answer: b
Explanation: Photosynthesis occurs in the presence of sunlight. The balanced reaction of photosynthesis best describes the process of photosynthesis. The option with oxygen and glucose as reactants is not photosynthesis.

4. Which of the following organisms can perform photosynthesis?
a) Autotrophs

d) Plants

View Answer

Answer: c
Explanation: Photoautotrophs are organisms that perform photosynthesis to produce food for themselves. Algae and plants come under the category of photoautotrophs. All autotrophs are not necessarily photoautotrophs.

5. Which of the following are photoautotrophs?
a) Cyanobacteria, algae, plants
b) Archaebacteria
c) Deer
d) Tiger

View Answer

Answer: a
Explanation: Cyanobacteria, algae and plants are photoautotrophs. Archaebacteria are chemoautotrophs. Deer and tiger are not autotrophs as they do not create their own food.

6. Conversion of usable sunlight energy into chemical energy is associated with _____
a) Red pigmentation
b) Green pigmentation
c) Orange pigmentation
d) Fruits

green pigmentation. This green pigmentation is called chlorophyll. Plants and algae consist of chlorophyll which is a key ingredient for photosynthesis.

7. Cyanobacteria have chloroplasts.
a) True
b) False

View Answer

Answer: b
Explanation: Though cyanobacteria are photoautotrophs, they do not have chloroplasts. Instead, the chlorophyll is stored in thylakoids in their cytoplasm.

8. _____ and _____ is present in all chlorophylls.
a) A hydrophilic tail, a lipid soluble head
b) A hydrophobic tail, a lipid soluble head
c) A hydrophilic tail, a lipid insoluble head
d) A lipid soluble tail, a hydrophilic head

View Answer

Answer: d
Explanation: A lipid soluble tail and a hydrophilic head is present in all chlorophylls. The tail is a lipid soluble hydrocarbon and the hydrophilic head consists of magnesium ion at its centre.

9. What type of chemical reactions are involved in photosynthesis?

d) Single displacement

View Answer

Answer: a
Explanation: The chemical reactions involved in photosynthesis are condensation reactions and redox reactions respectively. Combustion, single and double displacement reactions do not occur in photosynthesis.

10. What is the condensation reaction responsible for in the process of photosynthesis?
a) Electron transfer
b) Splitting out water molecules
c) Splitting out water molecules and phosphorylation
d) Electron transfer and phosphorylation

View Answer

Answer: c
Explanation: Condensation reaction is responsible for splitting out water molecules and phosphorylation. Phosphorylation is the addition of a phosphate group to an organic compound. Electron transfer occurs in a redox reaction.

11. Where does the light-dependent reactions in the process of photosynthesis occur?
a) Stroma of chloroplasts
b) Thylakoid of chloroplasts
c) Inner membranes
d) Grana of chloroplasts

Answer: d
Explanation: The light-dependent reactions in the process of photosynthesis occur in the grana of chloroplasts. These reactions require the light energy to make energy-carrier molecules that are used further.

12. Where does the light-independent reactions in the process of photosynthesis occur?
a) Stroma of chloroplasts
b) Thylakoid of chloroplasts
c) Outer membranes
d) Grana of chloroplasts

View Answer

Answer: a
Explanation: The light-independent reactions in the process of photosynthesis occur in the stroma of chloroplasts. The products of light reaction are used to make carbohydrates from carbon dioxide.

13. What is photoionisation? Assume presence of sunlight.
a) Freeing of electron from the molecule to form a negatively charged chlorophyll ion
b) Freeing of photoexcited electron from the molecule to form a positively charged chlorophyll ion
c) Absorbing of electron from the molecule to form a negatively charged chlorophyll ion
d) Absorbing of electron from the molecule to form a positively charged chlorophyll ion

View Answer

Answer: b
Explanation: Electrons of chlorophyll molecule gain energy and move to higher energy level when light is absorbed. On gaining sufficiently high energy, the electron leaves the molecule thereby forming a positively charged chlorophyll ion. This process is called photoionisation.

14. Where does the energy to drive the electron transfer system come from?
a) Photosystem 1
b) Photosystem 3 and photosystem 2
c) Photosystem 1 and photosystem 2
d) Photosystem 1 and photosystem 3

View Answer

Answer: c
Explanation: An electron transfer system (basically, a series of chemical reactions) carries two electrons to and fro across the thylakoid membrane. The energy for the system comes from

b) Glyceraldehyde 3-phosphate and NADPH
c) Carbohydrates
d) ATP and NADPH

View Answer

Answer: c
Explanation: The light-dependent reactions require direct energy of sunlight. They are a series of chemical reactions forming ATP and NADPH. These products are further used by light-independent reactions to produce carbohydrates.

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Biomass Energy Questions and Answers – Usable Forms of Biomass, their Composition and Fuel Properties – 1

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This set of Biomass Energy Multiple Choice Questions & Answers (MCQs) focuses on “Usable Forms of Biomass, their Composition and Fuel Properties – 1”.

1. What is biomass?
a) Organic materials from living organisms
b) Inorganic materials from living organisms
c) Inorganic materials from non-living organisms
d) Organic materials from non-living organisms

View Answer

Answer: a
Explanation: Biomass is a term for all organic materials stemming from living organisms like plants, animals and microorganisms. Examples of biomass are – animal waste, dead plants and animals, sugar, fats, etc.

2. Which of the following can be classified under biomass?
a) Steel
b) Organic molecules containing hydrogen
c) NaOH
d) Iron

View Answer

Answer: b
Explanation: Organic molecules containing hydrogen is a biomass. Steel is made up of inorganic materials. NaOH is a strong base which is made up of an inorganic material called sodium (Na). Iron (Fe) is another inorganic material which is used for its magnetic properties.

3. Which of the following is not used as food for humans?
a) Sugars
b) Glucose
c) Cellulosic matter
d) Fats

View Answer

Answer: c
Explanation: Cellulosic biomass is not used as a food source for humans. It is made up of very complex sugar polymers. Sugars, glucose and fats are used in various food items.

4. _____ is an example of cellulosic biomass.
a) Glucose

d) Agricultural residue

View Answer

Answer: d
Explanation: Agricultural residue is an example of cellulosic biomass. They generally include leftover material from crops like stalks and leaves. Fats, lipids and glucose are not cellulosic biomass.

5. Value of any biomass depends on _____ properties.
a) chemical and physical
b) chemical and photo sensitive
c) physical and photo sensitive
d) the number of carbon molecules and on the number of tin molecules

View Answer

Answer: a
Explanation: The value of any biomass depends on the chemical and physical properties. These are basically the properties of the large molecules from which it is made. It does not depend on the light and the number of molecules.

6. Which of the following are characterizes an ideal energy crop?
a) High yield, high energy input to produce, high cost and high nutrient requirements
b) High yield, low energy input to produce, low cost and low nutrient requirements
c) High yield, high energy input to produce, low cost and high nutrient requirements
d) Low yield, high energy input to produce, high cost and high nutrient requirements

Answer: b
Explanation: In general, the characteristics of any ideal energy crop are – high yield, low energy input to produce, low cost, consists of least contaminants and low nutrient requirements. These depend on the local climate and soil conditions.

7. Which energy forms can biomass be converted to?
a) Electrical and light
b) Light and chemical
c) Electrical and heat
d) Heat and light

View Answer

Answer: c
Explanation: Biomass can be converted to electrical and heat energy. It can also be used as transport fuel and chemical feedstock. It cannot be converted to light energy.

8. The heating value is expressed in BTU/kg.
a) True
b) False

View Answer

Answer: a
Explanation: The heating value is expressed in BTU/kg. BTU stands for British Thermal Unit and is used to measure thermal (heat) energy. It is the amount of energy needed to rais pound of water 1 degree farad at sea level. Other commonly used units are MJ/kg and cal/g.

b) Amount of energy required to process biomass to produce energy
c) Amount of energy required as heat by the organisms
d) Amount of energy that is available in the fuel

View Answer

Answer: d
Explanation: Heating value indicates the total amount of energy that is available in the fuel. It is one of the most important characteristics of a fuel. It is mostly a function of fuel's chemical composition.

10. What is higher heating value?
a) Amount of energy available in the fuel + energy contained in water vapour in the exhaust gases
b) Total amount of energy available in the fuel – energy contained in water vapour in the exhaust gases
c) Total amount of energy available in the fuel * energy contained in water vapour in the exhaust gases
d) Total amount of energy available in the fuel

View Answer

Answer: a
Explanation: Higher heating value is the total amount of energy available in the fuel, including energy contained in water vapour in the exhaust gases. Heating value indicates the total amount of energy available in the fuel.

b) Total amount of energy available in the fuel – energy contained in water vapour in the exhaust gases
c) Total amount of energy available in the fuel / energy contained in water vapour in the exhaust gases
d) Total amount of energy available in the fuel which cannot be used

View Answer

Answer: b
Explanation: Lower heating value (LHV) is total amount of energy available in the fuel – energy contained in water vapour in the exhaust gases. Generally, LHV is not an appropriate value to use for biomass combustion.

12. High moisture fuels burn readily and provide more useful heat per unit mass.
a) True
b) False

View Answer

Answer: b
Explanation: High moisture content in fuels do not allow them to burn readily and provide less useful heat per unit mass. This is because water itself does not provide any energy value. In fact, much of the supplied energy is used to heat and vaporize water which leads wastage of supplied energy.

13. Moisture content can be calculated on two bases, namely _____
a) light and heavy
b) weighted and even
c) wet and dry
d) light and dry

View Answer

Answer: c
Explanation: Moisture content can be calculated on two bases, namely, wet and dry. Weighted is generally used to calculate weighted average. Light and heavy are not related to moisture content.

14. What are the main components of cellulosic biomass?
a) Hemicellulose and lignin
b) Hemicellulose and sugars
c) Cellulose, sugars and fats
d) Cellulose, hemicellulose and lignin

Answer: d
Explanation: The main components of cellulosic biomass are cellulose, hemicellulose and lignin. Sugars and fats are not cellulosic biomass.

15. Biomass is seasonal.
a) True
b) False

View Answer

Answer: a
Explanation: Biomass is seasonal, especially plant biomass. This is a problem because most biomass comes from agricultural feedstock. However, the energy and feedstock demands are continuous irrespective of season.

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Biomass Energy Questions and Answers – Biomass Resources

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This set of Biomass Energy Multiple Choice Questions & Answers (MCQs) focuses on “Biomass Resources”.

1. Which of the following can be classified under solid biomass?
a) Agricultural residues
b) Waste water
c) Industrial effluents into rivers
d) Plastic

View Answer

Answer: a
Explanation: Agricultural residues can be classified under solid biomass resource. Waste water and polluted rivers are not solids. Plastic is not a biomass.

d) Crops that produce energy

View Answer

Answer: b
Explanation: Energy crops are crops that are grown with the specific intention to generate energy. They don't produce energy by themselves but they are used to generate energy or serve as fuel. Eg. – bioethanol.

3. Which of the following are examples of energy crops?
a) Banyan
b) Mango
c) Herbaceous and woody
d) Apple and herbaceous

View Answer

Answer: c
Explanation: Herbaceous and woody crops are examples of energy crops. Like agricultural crops are grown to feed, energy crops are grown specifically to be used as an energy resource.

4. What are herbaceous crops?
a) Insecticides
b) Rice
c) Agricultural fertilizers
d) Agricultural byproducts

stems. Generally, they are agricultural byproducts like columbine. Sometimes, crops like potatoes are solely grown to produce energy.

5. Which of the following are examples of woody biomass?
a) Fallen trees due to natural disasters
b) Mint
c) Columbine
d) Agricultural byproducts

View Answer

Answer: a
Explanation: Woody biomass are basically forestry byproducts, by product of management and restoration of forests, etc. Fallen trees due to a natural disaster is an example of woody biomass. Other examples are leaves, trunks, etc.

6. Which of the following are examples of lipids?
a) Sugar
b) Palm oil
c) Glucose
d) Cellulose

View Answer

Answer: b
Explanation: Palm oil is an example of lipids. Other examples are soybean oil, rapeseed wax, animal fat, etc. Glucose is an example of sugar.

b) Soda
c) Biomass ash
d) Coal ash

View Answer

Answer: c
Explanation: Biomass ash can be used as a soil amendment to help replenish nutrients. Coal ash cannot be used for the same because it contains toxic metals. Steel and soda are not used to replenish soil's nutrients.

8. Which of the following is an example of short rotation coppice?
a) Maize
b) Wheat
c) Corn
d) Willow

View Answer

Answer: d
Explanation: Willow is an example of short rotation coppice (SRC). It is a forestry residue. Corn, maize and wheat are examples of herbaceous crops.

9. Algae are used as feedstocks for bioenergy.
a) True
b) False

containing key components like lipids, proteins and carbohydrates. They include microalgae, macroalgae like seaweed and cyanobacteria or blue-green algae.

10. Which of the following found in municipal waste can be used as biomass?
a) Agricultural residue
b) Kitchen waste
c) Residential garbage
d) Plastic covers

View Answer

Answer: b
Explanation: Kitchen waste can be used as a resource for biomass. Residential garbage and plastic covers cannot be used directly. Agricultural residue is not found in municipal waste.

11. Land fill is an example of wet waste.
a) False
b) True

View Answer

Answer: b
Explanation: Land fill is an example of wet waste. It consists of residential wastes, industrial wastes and other wastes from sewage. It also consists of manure in the form of animal wastes.

12. _____ wastes are used as methane boosters.
a) Agricultural

d) Municipal

View Answer

Answer: c
Explanation: Many industrial wastes are used as methane boosters due to their extremely high methane potential. Agricultural, municipal and forestry wastes are not suitable for methane boosters.

13. _____ biomass is used for waste water treatment.
a) Agricultural
b) Industrial
c) Municipal
d) Aquatic

View Answer

Answer: d
Explanation: Aquatic biomass in the form of micro-organisms are used for waste water treatment. They operate in anaerobic environment during the treatment.

14. Which of the following parameters is used to define sustainability of biogas feedstock?
a) Heating value
b) Calorific value
c) C:N ratio
d) Thermal voltage

View Answer

Answer: c
Explanation: Carbon to nitrogen (C:N) ratio is one of the most important parameters used to talk about the sustainability of the biogas feedback. Heating and calorific value are parameters to describe the available fuel in a given biomass.

15. Which of the following is not a biomass resource?
a) Animal wastes
b) Forestry residue
c) Agricultural residue
d) Sunlight

View Answer

Answer: d
Explanation: Sunlight is not a biomass resource. Animal wastes, forestry residue &

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Biomass Energy Questions and Answers – Biomass Resources

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1. Which of the following can be classified under solid biomass?
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b) Waste water
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View Answer

Answer: a
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d) Crops that produce energy

View Answer

Answer: b
Explanation: Energy crops are crops that are grown with the specific intention to generate energy. They don't produce energy by themselves but they are used to generate energy or serve as fuel. Eg. – bioethanol.

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View Answer

Answer: c
Explanation: Herbaceous and woody crops are examples of energy crops. Like agricultural crops are grown to feed, energy crops are grown specifically to be used as an energy resource.

4. What are herbaceous crops?
a) Insecticides
b) Rice
c) Agricultural fertilizers
d) Agricultural byproducts

stems. Generally, they are agricultural byproducts like columbine. Sometimes, crops like potatoes are solely grown to produce energy.

5. Which of the following are examples of woody biomass?
a) Fallen trees due to natural disasters
b) Mint
c) Columbine
d) Agricultural byproducts

View Answer

Answer: a
Explanation: Woody biomass are basically forestry byproducts, by product of management and restoration of forests, etc. Fallen trees due to a natural disaster is an example of woody biomass. Other examples are leaves, trunks, etc.

6. Which of the following are examples of lipids?
a) Sugar
b) Palm oil
c) Glucose
d) Cellulose

View Answer

Answer: b
Explanation: Palm oil is an example of lipids. Other examples are soybean oil, rapeseed wax, animal fat, etc. Glucose is an example of sugar.

b) Soda
c) Biomass ash
d) Coal ash

View Answer

Answer: c
Explanation: Biomass ash can be used as a soil amendment to help replenish nutrients. Coal ash cannot be used for the same because it contains toxic metals. Steel and soda are not used to replenish soil's nutrients.

8. Which of the following is an example of short rotation coppice?
a) Maize
b) Wheat
c) Corn
d) Willow

View Answer

Answer: d
Explanation: Willow is an example of short rotation coppice (SRC). It is a forestry residue. Corn, maize and wheat are examples of herbaceous crops.

9. Algae are used as feedstocks for bioenergy.
a) True
b) False

containing key components like lipids, proteins and carbohydrates. They include microalgae, macroalgae like seaweed and cyanobacteria or blue-green algae.

10. Which of the following found in municipal waste can be used as biomass?
a) Agricultural residue
b) Kitchen waste
c) Residential garbage
d) Plastic covers

View Answer

Answer: b
Explanation: Kitchen waste can be used as a resource for biomass. Residential garbage and plastic covers cannot be used directly. Agricultural residue is not found in municipal waste.

11. Land fill is an example of wet waste.
a) False
b) True

View Answer

Answer: b
Explanation: Land fill is an example of wet waste. It consists of residential wastes, industrial wastes and other wastes from sewage. It also consists of manure in the form of animal wastes.

12. _____ wastes are used as methane boosters.
a) Agricultural

d) Municipal

View Answer

Answer: c
Explanation: Many industrial wastes are used as methane boosters due to their extremely high methane potential. Agricultural, municipal and forestry wastes are not suitable for methane boosters.

13. _____ biomass is used for waste water treatment.
a) Agricultural
b) Industrial
c) Municipal
d) Aquatic

View Answer

Answer: d
Explanation: Aquatic biomass in the form of micro-organisms are used for waste water treatment. They operate in anaerobic environment during the treatment.

14. Which of the following parameters is used to define sustainability of biogas feedstock?
a) Heating value
b) Calorific value
c) C:N ratio
d) Thermal voltage

View Answer

Answer: c
Explanation: Carbon to nitrogen (C:N) ratio is one of the most important parameters used to talk about the sustainability of the biogas feedback. Heating and calorific value are parameters to describe the available fuel in a given biomass.

15. Which of the following is not a biomass resource?
a) Animal wastes
b) Forestry residue
c) Agricultural residue
d) Sunlight

View Answer

Answer: d
Explanation: Sunlight is not a biomass resource. Animal wastes, forestry residue &

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Biomass Energy Questions and Answers – Biomass Conversion Technologies – 1

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This set of Biomass Energy Multiple Choice Questions & Answers (MCQs) focuses on “Biomass Conversion Technologies – 1”.

1. Which of the following technologies are used to convert biomass into useful energy forms?
a) Bio-chemical process
b) Galvanization
c) Doping
d) Photoelectric effect

View Answer

Answer: a
Explanation: The three main technologies used to convert biomass into useful forms of energy are bio-chemical, thermo-chemical and physio-chemical processes. Galvanization is a process used to prevent corrosion of metals. Doping and photoelectric effect are not related to biomass conversion technologies.

b) Pyrolysis, gasification, combustion, hydrothermal processing
c) Pyrolysis, gasification, combustion, doping
d) Photovoltaic effect, gasification, combustion, hydrothermal processing

View Answer

Answer: b
Explanation: The four main types of thermo-chemical processes are pyrolysis, gasification, combustion and hydrothermal processing. Photovoltaic effect, doping, chemo-mechanical effect and galvanization are not related to biomass conversion technologies.

3. What are the two primary processes under bio-chemical conversion?
a) Photosynthesis and respiration
b) Photosynthesis and photovoltaic
c) Anaerobic digestion and fermentation
d) Anaerobic digestion and photosynthesis

View Answer

Answer: c
Explanation: Anaerobic digestion and fermentation are two primary processes under bio-chemical conversion. Photosynthesis, photovoltaic and respiration are not related to biomass conversion technologies.

4. Which of the following is an example of physio-chemical conversion technique to convert biomass into usable forms of energy?
a) Pyrolysis

d) Extraction with esterification

View Answer

Answer: d
Explanation: Physio-chemical process mainly consists of extraction with esterification. Pyrolysis and gasification are thermo-chemical conversion. Anaerobic digestion is a bio-chemical conversion process.

5. Which of the following is a product of pyrolysis of biomass?
a) Producer gas
b) Steel
c) Agricultural residue
d) Sodium

View Answer

Answer: a
Explanation: The output is producer gas. Steel and sodium are not the outputs of any pyrolysis process. Agricultural residue is a type of biomass.

6. Pyrolysis occurs in the presence of _____ oxygen.
a) large amounts of
b) absence of
c) extremely large amount of
d) low amounts of

oxygen. The output of pyrolysis is producer gas which is a mixture of flammable gases (primarily CO and H2) and non-flammable gases (primarily nitrogen and carbon dioxide).

7. Which of the following best indicates the process of gasification?
a) Biomass → carbon dioxide and water → producer gas and charcoal → carbon monoxide and hydrogen
b) Biomass → carbon monoxide and hydrogen → carbon dioxide and water → producer gas and charcoal
c) Biomass → producer gas and charcoal → carbon dioxide and water → carbon monoxide and hydrogen
d) Producer gas and charcoal → carbon dioxide and water → carbon monoxide and hydrogen → biomass

View Answer

Answer: c
Explanation: Gasification basically converts all the available biomass to “gas”. In the first stage, the biomass is partially combusted to form producer gas and charcoal which is then sent to the second stage. In the second stage, the carbon dioxide and water produced in the first stage is chemically reduced by charcoal to form carbon monoxide and hydrogen.

8. Which of the following is best suited for hydrothermal processing?
a) Forestry byproducts
b) Wheat
c) Corn
d) Sewage sludge

Answer: d

Explanation: Feedstocks with high moisture content like sewage sludge are suitable for hydrothermal processing. Agricultural residue like wheat and corn and forestry byproducts are not best suited for hydrothermal processing.

9. What is hydrothermal processing?

a) Heating aqueous slurries of biomass at high pressures to produce products of greater energy density

b) Heating aqueous slurries of biomass at high temperatures to produce products of lower energy density

c) Heating aqueous slurries of biomass at low pressures to produce products of greater energy density

d) Heating aqueous slurries of biomass at low temperatures to produce products of lower energy density

View Answer

Answer: a

Explanation: Hydrothermal processing is a biomass conversion technique that involves heating of aqueous slurries of biomass at high pressures to produce products of greater energy density. Feedstocks with high moisture content like manures are best suited for this process.

10. What is anaerobic digestion?

a) Produces biogas by heating the biomass

b) Produces biogas using micro-organisms operating in anaerobic conditions

c) Produces biogas by subjecting the biomass to high pressures

Answer: b
Explanation: Anaerobic digestion is a biological process of breaking down the biomass to produce products with high energy density – biogas. It occurs in anaerobic conditions. Waste water treatment plants commonly use anaerobic conditions to treat the influent.

11. Catalytic liquefaction occurs at _____
a) low temperature, low pressure
b) high temperature, high pressure
c) low temperature, high pressure
d) high temperature, low pressure

View Answer

Answer: c
Explanation: Catalytic liquefaction is a thermo-chemical biomass conversion process. It requires low temperature and high pressure and the process is carried out in liquid phase under the presence of a catalyst.

12. Sugarcane is used to produce ethanol.
a) True
b) False

View Answer

Answer: a
Explanation: One of the most commonly used feedstocks to produce ethanol is sugarcane. This is very popular in developing due to the high productivity of sugarcane when supplied with sufficient water.

13. Which of the following are used to produce ethanol when water is not available in plenty?
a) Sugarcane
b) Wheat
c) Corn
d) Sorghum

View Answer

Answer: d
Explanation: Cassava or sorghum is commonly used to produce ethanol when water is not available in plenty. Sugarcane is used when there is no limitation on water content. Wheat and corn do not produce ethanol.

14. Which of the following are commonly used in fermentation process?

d) Virus

View Answer

Answer: a
Explanation: Yeast is commonly used in fermentation process. Fermentation is the process converting biomass to alcohol and carbon dioxide.

15. Fermentation is aerobic process.
a) True
b) False

View Answer

Answer: b
Explanation: Fermentation is an anaerobic process. It is another commonly used bio-chemical process of converting feedstock (biomass) to energy in the presence of micro-organisms.

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Biomass Energy Questions and Answers – Biomass Conversion Technologies – 2

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This set of Biomass Energy Objective Questions & Answers focuses on “Biomass Conversion Technologies – 2".

1. What are the two main products of anaerobic digestion?
a) Biogas and bio-fertilizer
b) Waste water
c) Producer gas
d) Syngas

View Answer

Answer: a
Explanation: The two main products of anaerobic digestion are biogas and bio-fertilizer. Wastewater is the input to the anaerobic digester. Producer gas is produced during pyrolysis.

d) Sodium

View Answer

Answer: b
Explanation: Methane gas and carbon dioxide are present in biogas. Butane is not present in biogas. Nitrogen and sodium are not organic compounds.

3. Which of the following are considered as contaminant gases in biogas?
a) Chlorine
b) Fluorine
c) Nitrogen, hydrogen and carbon monoxide
d) Methane gas and carbon dioxide

View Answer

Answer: c
Explanation: Nitrogen, hydrogen and carbon monoxide are the contaminant gases present in biogas. Methane gas and carbon dioxide constitute the fuel present in biogas. Chlorine and fluorine are not present in biogas.

4. Which of the following products of anaerobic digestion consists of organic humus and nutrients?
a) Biogas
b) Chlorine
c) Top soil
d) Bio-fertilizer

Answer: d
Explanation: Bio-fertilizer is a product of anaerobic digestion consisting of organic humus and nutrients for plantation. Top soil and chlorine are not products of anaerobic digestion. Biogas does not consist of organic humus.

5. Which of the following are used to store manure?
a) Silos and cellars
b) Plastic bottles
c) Glass bottles
d) Tin cans

View Answer

Answer: a
Explanation: Silos and cellars are used to store manure. Manure bags are specifically designed to store manure. Plastic bottles, glass bottles and tin cans are not used to store manure.

6. What are the three methods of pre-treatment of influent for anaerobic digestion?
a) Galvanization, pyrolysis and pre-heating
b) Mechanical treatment, pre-heating and thermal treatment
c) Galvanization, pyrolysis and thermal treatment
d) Pyrolysis, thermal treatment and pre-heating

View Answer

Answer: b
Explanation: Mechanical treatment, pre-heating and thermal treatment are the three differ.

7. Thermo-chemical processes have higher efficiencies than bio-chemical processes.
a) True
b) False

View Answer

Answer: a
Explanation: Thermo-chemical processes do have higher efficiencies than bio-chemical processes. In fact, they also have quicker reaction times and superior ability to decompose most organic compounds.

8. Which of the following is best suited to decompose lignin?
a) Anerobic digestion
b) Fermentation
c) Thermo-chemical conversion techniques
d) Bio-chemical conversion techniques

View Answer

Answer: c
Explanation: Thermo-chemical conversion techniques can decompose lignin. When compared with bio-chemical conversion techniques, they have superior ability to decompose most organic compounds. Anaerobic digestion and fermentation are bio-chemical processes.

9. Which of the following are types of pyrolysis?
a) Flash and ablative
b) Intermediate and anaerobic digestion

Answer: a
Explanation: Flash and ablative are types of pyrolysis. Anaerobic digestion and fermentation are bio-chemical processes and are not types of pyrolysis.

10. Bio-oil has double the heating value of conventional fuel oil.
a) True
b) False

View Answer

Answer: b
Explanation: Bio-oil has half the heating value of conventional fuel oil. It is produced after condensing the hot vapors in fast pyrolysis.

11. What are the three types of hydrothermal processing of biomass?
a) Hydrothermal liquefaction, hydrothermal gasification and ablate pyrolysis
b) Hydrothermal liquefaction, hydrothermal gasification and fast pyrolysis
c) Hydrothermal liquefaction, hydrothermal gasification and hydrothermal carbonisation
d) Intermediate pyrolysis, hydrothermal gasification and ablate pyrolysis

View Answer

Answer: c
Explanation: Hydrothermal liquefaction, hydrothermal gasification and hydrothermal carbonisation are the three types of hydrothermal processes. Intermediate, fast and ablate are the types of pyrolysis.

c) Ablate
d) Hydrothermal carbonisation

View Answer

Answer: d
Explanation: Hydrothermal carbonisation is the mildest of the three hydrothermal processes. Ablate is not a hydrothermal process. It is a type of pyrolysis.

13. Which of the following hydrothermal processes produces syngas?
a) Hydrothermal gasification
b) Hydrothermal liquefaction
c) Fermentation
d) Hydrothermal carbonisation

View Answer

Answer: a
Explanation: Hydrothermal gasification or supercritical water gasification (SCWG) occurs temperatures greater than 375 degree Celsius and pressure above 200 bar. It produces syngas. Fermentation is not a type of hydrothermal process. It is a bio-chemical process.

14. Hydrothermal liquefaction produces _____
a) syngas
b) bio-crude
c) bio-oil
d) producer gas

View Answer

Answer: c
Explanation: Hydrothermal liquefaction produces bio-crude which can be distillated to obtain petroleum products. Bio-oil is produced in fast pyrolysis. Producer gas is produced in pyrolysis and syngas is produced in hydrothermal gasification.

15. Which of the following produces a solid hydro-char?
a) Catalytic liquefaction
b) Carbonisation
c) Hydrothermal gasification
d) Hydrothermal carbonisation

View Answer

Answer: d

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Biomass Energy Questions and Answers – Biomass Gasification – 1

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This set of Biomass Energy Multiple Choice Questions & Answers (MCQs) focuses on “Biomass Gasification – 1”.

1. What is unique about the gasification agent entering in a fluidized gasifier?
a) Enters from bottom at a relatively fast rate as compared to a fixed bed gasifier
b) Enters from bottom at a relatively slow rate as compared to a fixed bed gasifier
c) Enters from top at a relatively fast rate as compared to a fixed bed gasifier
d) Enters from top at a relatively slow rate as compared to a fixed bed gasifier

View Answer

Answer: a
Explanation: In a fluidized gasifier, the gasification agent enters the bed from the bottom at a relatively faster rate and exits from the top. This type of gasification features a uniform temperature distribution in the bed zone.

c) Biomass
d) Air non-permeable bed material

View Answer

Answer: b
Explanation: Fluidized gasifier features a uniform temperature distribution in the bed zone. This is achieved using an air-fluidized bed material. Biomass and gasification agent do not contribute towards the temperature consistency.

3. What are the three types of fluidized gasifiers used?
a) Single fluidized bed, dual fluidized bed and bubbling fluidized bed
b) Straight fluidized bed, dual fluidized bed and bubbling fluidized bed
c) Circulating fluidized bed, dual fluidized bed and bubbling fluidized bed
d) Single fluidized bed, dual fluidized bed and straight fluidized bed

View Answer

Answer: c
Explanation: Circulating fluidized bed, dual fluidized bed and bubbling fluidized bed are the three main types of fluidized gasifiers used. They are mainly used to achieve a uniform temperature distribution.

4. How is the temperature maintained in a bubbling fluidized bed?
a) Biomass
b) Gasification agent
c) A constant ratio of biomass and gasification agent

Answer: d
Explanation: A bubbling fluidized bed gasifier applies inlet from the bottom and moves the bed of fine-grained materials. The temperature is maintained by manipulating the ratio of biomass and gasification agent.

5. What is the temperature range in a bubbling fluidized bed?
a) Between 700 and 900 degree Celsius
b) Less than 500 degree Celsius
c) Above 1000 degree Celsius
d) Between 100 and 200 degree Celsius

View Answer

Answer: a
Explanation: The temperature range in a bubbling fluidized bed gasifier is between 700 and 900 degree Celsius. This distribution is achieved by manipulating the ratio of biomass and gasification agent.

6. What is the biomass decomposed to in a bubbly fluidized bed?
a) Producer gas
b) Char and gas products with a low tar percentage
c) Char and gas products with a high tar percentage
d) Char with a low tar percentage

View Answer

Answer: b

7. What are the two main units in a circulating fluidized bed?
a) Bubbling fluidized bed and dual fluidized bed
b) Bubbling fluidized bed and gasifier unit
c) Circulating unit and gasifier unit
d) Circulating unit and dual fluidized bed

View Answer

Answer: c
Explanation: The two main units in a circulating fluidized bed are circulating unit and gasifier unit. Bubbling fluidized bed and dual fluidized bed are types of fluidized gasifier. They are not a part of circulating fluidized bed gasifier.

8. Where can the ash and hot gas be separated in a circulating fluidized bed gasifier?
a) Gasifier unit
b) Circulation unit
c) Tornado separator
d) Cyclone separator

View Answer

Answer: d
Explanation: Ash and hot gas can be separated in the cyclone separator. The bed material and the char is circulated between the reaction chamber and the cyclone separator where the separation takes place.

9. The two separate fluidized beds in a dual fluidized bed gasifier are used for pyrolysis a

b) False

View Answer

Answer: a
Explanation: A dual fluidized bed gasifier consists of two separated fluidized beds. One of the beds is used for pyrolysis and the other is used for combustion. Generally, the first bed is used for pyrolysis.

10. Which of the following best indicates the process in a dual fluidized bed gasifier?
a) Combustion reactor → pyrolysis reactor
b) Pyrolysis reactor → combustion reactor
c) Evaporation reactor → condensation reactor
d) Combustion reactor → condensation reactor

View Answer

Answer: b
Explanation: The first bed in a dual fluidized bed gasifier is used for pyrolysis. The second bed is used for combustion. The second reactor provides heat by burning char provided from the first reactor.

11. What are the two types of entrained flow gasifiers?
a) Bubbling fluidized gasifier and dual fluidized gasifier
b) Bubbling fluidized gasifier and top-fed gasifier
c) Top-fed gasifier and side-fed gasifier
d) Side-fed gasifier and dual fluidized gasifier

Answer: c
Explanation: The two main types of entrained flow gasifiers are top-fed gasifier and side-fed gasifier. Bubbling fluidized bed and dual fluidized bed gasifiers are fluidized bed gasifiers and not entrained flow gasifiers.

12. Which of the following gasifiers is suitable for integrated gasification combined cycle (IGCC)?
a) Fluidized gasifier
b) Fixed bed gasifier
c) Downdraft gasifier
d) Entrain flow gasifier

View Answer

Answer: d
Explanation: Entrail flow gasifiers are suitable for IGCC. They are applied in large-scale gasification and are widely used for coal, biomass and refinery residues. Downdraft is a type of fixed bed gasifier which is not suitable for IGCC.

13. Which of the following is a problem due to tar formation in gasifiers?
a) Equipment blockages
b) High system efficiency
c) Improved quality of gas
d) Reduction in maintenance

View Answer

Answer: a
Explanation: Tar formation in a gasifier leads to equipment blockage, lower system efficiency and increased maintenance. The most important problem is that it contaminates the gas and reduces its quality.

14. Which of the following is a component of tar?
a) Sodium
b) Benzene
c) Chlorine
d) Nickel

View Answer

Answer: b
Explanation: Tar is generally composed of carbon compounds like benzene, naphthalene, single-ring aromatic hydrocarbons, toluene, etc. It does not contain of non-carbon materials like sodium, chlorine and nickel.

b) False

View Answer

Answer: a
Explanation: Tar is removed by choosing the appropriate catalyst. Other methods include setting the appropriate operation parameter and downstream removal after gasification – mechanical method and thermal cracking.

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Biomass Energy Questions and Answers – Biomass Gasification – 2

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1. Which of the following is a product of biomass gasification?
a) Hydrogen
b) Steel
c) Carbon (solid)
d) Iron

View Answer

Answer: a
Explanation: Biomass gasification is process that converts biomass into gases in a controlled amount of oxygen or partial combustion. Hydrogen is a product of biomass gasification. Steel, carbon (solid) and iron are not gases.

c) Carbon dioxide + water + heat → Carbon monoxide + Hydrogen
d) Carbon monoxide + water + heat → Carbon dioxide + Hydrogen

View Answer

Answer: b
Explanation: carbon monoxide + water → carbon dioxide + hydrogen + small heat is the water-gas shift reaction. It is an exothermic reaction as heat is released and not used.

3. Which of the following temperature ranges are suitable for biomass gasification?
a) Above 1000 degree Celsius
b) Between 500 and 600 degree Celsius
c) Between 700 and 1000 degree Celsius
d) Less than 500 degree Celsius

View Answer

Answer: c
Explanation: The most suitable temperature range for biomass gasification is between 700 and 1000 degree Celsius. The reactant is partially oxidized to produce a mixture of gaseous products including hydrocarbons. Sometimes, steam is also used as gasification agents.

4. What are the three main types of gasifiers?
a) Fixed bed, hydrothermal liquefaction and carbonisation
b) Fixed bed, fluidized gasifiers and carbonisation
c) Carbonisation, liquefaction and entrained flow gasifiers
d) Fixed bed, fluidized gasifiers and entrained flow gasifiers

Answer: d
Explanation: Fixed bed, fluidized and entrained flow gasifiers are the three main types of gasifiers used in biomass gasification. Liquefaction and carbonisation are not gasifying techniques.

5. Biomass is moved at a very slow rate in fixed bed gasifier.
a) True
b) False

View Answer

Answer: a
Explanation: Biomass is moved at a very slow rate in the fixed bed gasifier. Hence, it is also called as moving bed reactor and is operated around 1000 degree Celsius.

6. How is the biomass material and gasification agent fed into an updraft gasifier?
a) Biomass from top, gasifying agent from top
b) Biomass from top, gasifying agent from bottom
c) Biomass from bottom, gasifying agent from top
d) Biomass from bottom, gasifying agent from bottom

View Answer

Answer: b
Explanation: In an updraft gasifier, the biomass material is fed from the top of the reactor and the gasification agent is fed from the bottom of the reactor. As the gasifying agent flc through the biomass, gas is generated and exhausted from the top.

a) Gold
b) Platinum
c) Tar
d) Nickel

View Answer

Answer: c
Explanation: The hot gas coming from the bottom dries the biomass near the top of the vessel and provides heat for pyrolysis of the descending biomass. Along with providing heat, it also embeds tar into it. When the product gas is removed from a low temperature zone, it consists of tar which is a contaminant.

8. The product gas removed from the low temperature zone undergoes _____ before being used as fuel in combustion for electricity generator.
a) liquefaction
b) condensation
c) evaporation
d) cleaning

View Answer

Answer: d
Explanation: The product gas removed from the low temperature zone undergoes cleaning. This is to remove contaminants like tar from the gas so that it can be used as fuel in combustion engine for electricity generator.

c) Biomass from bottom, gasifying agent from left side
d) Biomass from top, gasifying agent from right side

View Answer

Answer: a
Explanation: In a downdraft generator, the biomass and the gasifying agent is fed into the vessel from the top. Air or oxygen is then fed into the system homogeneously at the so called throated area.

10. The tar content of the product gas in downdraft gasifier is _____ updraft gasifier.
a) equal to
b) less than
c) greater than
d) cleaner than

View Answer

Answer: b
Explanation: The tar content of the product gas in a downdraft gasifier is lower than updraft gasifier. However, the particulate content of the gas is higher.

11. Which of the following applications is the product gas from downdraft gasifier suitable for?
a) Fuel for combustion engine
b) Fuel for burning wood
c) Fuel for internal combustion engine
d) Fuel for household purposes

Answer: c
Explanation: The product gas from downdraft gasifier is suitable for applications like fuel for internal combustion engine to generate electricity. This is because it consists of less amount of tar and more amount of particulate matter as compared to the product gas from an updraft gasifier.

12. Which of the following applications can the producer gas be used for?
a) Producing nickel
b) Producing copper
c) Producing glucose
d) Producing methanol

View Answer

Answer: d
Explanation: Producer gas can be used to produce methanol in an economically viable manner. Methanol is used as fuel for heat engines as well as feedstock for industries.

13. Which of the following are keys to design a gasifier?
a) Reducing biomass to charcoal and converting charcoal at suitable temperature to produce carbon monoxide and hydrogen
b) Oxidizing biomass to charcoal and converting charcoal at suitable temperature to produce carbon monoxide and hydrogen
c) Reducing biomass to charcoal and converting charcoal at suitable temperature to produce carbon dioxide and hydrogen
d) Oxidizing biomass to charcoal and converting charcoal at suitable temperature to produce carbon dioxide and hydrogen

View Answer

Answer: a
Explanation: The key to gasifier design is to create conditions such that biomass is reduced to charcoal and the charcoal converted to carbon monoxide and hydrogen at suitable temperatures. It is important to note that biomass is reduced and not oxidized.

14. How does air enter and exit in a cross-draft gasifier?
a) Air enters from one of the sides and exits from the top
b) Air enters from one side and exits from the other
c) Air enters from one of the sides and exits from the bottom
d) Air enters from the bottom and exits from the top

View Answer

15. Ash sticks to the side in a cross-draft gasifier.
a) True
b) False

View Answer

Answer: b
Explanation: Ash falls to the bottom in a cross-draft gasifier. The ask does not interrupt the normal operation and hence the gasifier does not need a grate.

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Geothermal Energy Questions and Answers – Environmental Consideration

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This set of Geothermal Energy Multiple Choice Questions & Answers (MCQs) focuses on "Environmental Consideration".

1. Which of the following is a problem with a geothermal resource?
a) Noise pollution
b) Low greenhouse gas emission
c) Polluting water
d) Reversing damage to wildlife habitat

View Answer

Answer: a
Explanation: Noise pollution is one of the major problems caused due to establishment of a power plant near a geothermal resource. Also, the plant continuously uses and reuses water for cooling thereby affecting the local fresh water resources. It does not pollute water.

c) Sulphate
d) Argon

View Answer

Answer: b
Explanation: Sulphur, hydrogen sulphide and oxides of nitrogen and sulphur are released by a geothermal power plant. All these gases are harmful as they cause acid rain. Carbon is not a gas. Sulphates exist in liquid or solid form.

3. Why do binary power plants emit less amounts of pollutants?
a) Because they release steam into the atmosphere
b) Because they release steam into a local water body
c) Because they inject water back into the ground without any atmospheric exposition
d) Because they inject water back into the ground after atmospheric exposition

View Answer

Answer: c
Explanation: Binary power plants emit less amounts of pollutants because they inject water back into the ground without any atmospheric exposition. They also treat the steam before releasing into the atmosphere.

4. Which of the following best describes the cause for noise pollution due to a geothermal power plant?
a) Emission of gases
b) Ecological destruction

Answer: d
Explanation: Drilling wells is the major cause of noise pollution due to geothermal power plants. The other options do not cause noise pollution. Drilling may also affect wildlife habitat and ecology.

5. Geothermal plants use about 20L of fresh water per MWh.
a) True
b) False

View Answer

Answer: a
Explanation: Geothermal plants use about 20L of fresh water per MWh. This is negligible when compared to coal plants which use about 1370L of fresh water per MWh.

6. _____ water is used by The Geysers facility in California.
a) Fresh
b) Waste
c) Hot
d) Cold

View Answer

Answer: b
Explanation: Waste water is used by The Geysers facility in California for cooling purposes. In fact, the geothermal plant also treats the water and injects it back into the reservoir there reducing surface pollution.

b) Minor earthquakes and greenhouse gas emissions
c) Minor earthquakes and subsidence
d) Removal of magma and subsidence

View Answer

Answer: c
Explanation: The two main land use problems due to geothermal power plants are induced seismicity (minor earthquakes) and subsidence. Subsidence is gradual caving in of land. Geothermal power plants do not add to greenhouse gas emissions. As a matter of fact, this is not related to land use problems.

8. How are subsidence and induced seismicity mitigated?
a) By removing the fluid
b) By removing the gas
c) By drilling deeper wells
d) By injecting spent fluid back into the reservoir

View Answer

Answer: d
Explanation: Subsidence and induced seismicity are caused by removal of the fluid present in the reservoir. They can be mitigated by injecting spent fluid back into the reservoir. Drilling deeper wells will only add to the problem.

9. Geothermal plants are located near the reservoir.
a) False

Answer: a
Explanation: Geothermal plants are located far away from the reservoir. This is done to prevent impacts on the reservoir due to extraction of fluid.

10. Which of the following geothermal power plants have no significant impact on natural features.
a) Binary cycle
b) Direct use
c) High temperature
d) Coal

View Answer

Answer: b
Explanation: Direct use geothermal power plants have no significant impact on its surroundings. This is because it is small and directly use the fluid present in the reservoir without any (or much) auxiliary processing. Coal power plant is not a geothermal power plant.

11. Utilizing geothermal resources eliminates _____
a) sulphur emissions
b) usage of power grid
c) mining
d) earthquakes

View Answer

Answer: c

12. If a geothermal power plant is located near a reservoir, fluid from _____ reservoir is used.
a) the same
b) another neighbouring
c) coal
d) another far away

View Answer

Answer: d
Explanation: If a geothermal power plant is located near a reservoir, fluid from another far away reservoir is used. This is to prevent unwanted impacts on the reservoir near the plant's location.

13. Which of the following is most responsible for increasing usage of geothermal power plants?
a) Efficient heat pumps
b) More sites
c) Less sites
d) Poor heat pumps

View Answer

Answer: a
Explanation: Efficient heat pumps are responsible for increasing usage of geothermal power plants across the globe. Heat pumps transfer heat energy from a source of heat to a thermal reservoir (not same as geothermal reservoir).

14. Which of the following countries mainly use "direct-use" geothermal.
a) United States
b) Iceland
c) Iran
d) Greenland

View Answer

Answer: b
Explanation: Iceland is a nation built on about 130 volcanoes. It rests above a divergent plate boundary which brings continuous supply magma. Along with Turkey, it mainly uses "direct-use" geothermal energy.

15. Impacts on land, impacts on surrounding environment and gaseous emissions are the three main problems due to geothermal power plants.
a) True
b) False

Answer: a
Explanation: Impacts on land, impacts on surrounding environment and gaseous emissions are the three main problems due to geothermal power plants. While impacts on surrounding environment is regulated by a detailed survey of the area, the gaseous emissions are being mitigated by pre-treatment of effluents.

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Geothermal Energy Questions and Answers – Origin and Distribution of Geothermal Energy

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This set of Advanced Geothermal Energy Questions and Answers focuses on “Origin and Distribution of Geothermal Energy”.

1. How is the heat inside earth restored?
a) Radioactive decay of elements
b) Sun restores the heat
c) Hot steam is pumped into earth
d) Cosmic rays

View Answer

Answer: a
Explanation: Earth’s heat is generated and restored by the radioactive decay of radioactive elements. These elements are found in the mantle and core. Pumping hot steam, sun’s heat and cosmic rays do not contribute to restoration of earth’s heat.

c) 100 degree Celsius
d) 50 – 87 degree Celsius

View Answer

Answer: b
Explanation: The normal temperature gradient with respect to depth – increase in the temperature per kilometer is 17 – 30 degree Celsius. It is 50 – 87 in degree F.

3. What is the earth's core made up of?
a) Gamma rays
b) Nitrogen
c) Iron
d) Gold

View Answer

Answer: c
Explanation: Earth's core lies 4000 miles below the surface and consists of two layers. The core is made up of solid iron and is surrounded by molted iron.

4. Which of the following surrounds the earth's core?
a) Mt. Everest
b) Crust
c) Hydrogen
d) Mantle

about 1800 miles thick starting from the core.

5. What is continental drift?
a) Tectonic plates pushing against each other
b) Continents being pulled due to gravitational force
c) Continents being pulled due to nuclear force
d) Tectonic plates expanding

View Answer

Answer: a
Explanation: The earth's crust is not a uniform layer like the shell of an egg. It is made up of tectonic plates. These plates push against each other at the rate of 1 inch per year in a process called continental drift.

6. Who initiated electricity generation from geothermal energy?
a) Indians
b) Italians
c) Americans
d) Africans

View Answer

Answer: b
Explanation: Hot springs were used for recreational and healing purposes in the ancient times. However, the converting geothermal energy to electricity is a relatively new concept. It v initiated by Italians in 1904.

b) Insufficient steam
c) Corrosion of equipment
d) Availability of pure steam

View Answer

Answer: c
Explanation: The first Geysers project in California failed because of impurities in the steam at the geothermal site. These impurities corroded and abraded the pipes and turbines of the day.

8. Which of the following countries hosts the largest geothermal field?
a) Iran
b) Italy
c) Australia
d) United States

View Answer

Answer: d
Explanation: Geothermal energy is now used in more than 20 countries across the globe. The largest geothermal field is hosted by United States. It is known as “The Geysers” and is located in California. It is spread over 117 km^2 and consists of 22 power plants with a capacity of 1.5GW.

9. Which of the following is used to locate a geothermal site?
a) Drilling wells
b) Reflection

Answer: a

Explanation: Drilling wells to measure underground temperature is a well known method to locate geothermal sites. Reflection, seismograph and SONAR are not used to locate geothermal site. In fact, seismograph detects earthquakes.

10. Which of the following is the most probably location of geothermal site?

a) Grasslands

b) Volcanoes

c) Coasts

d) River beds

View Answer

Answer: b

Explanation: Most active geothermal sites are located along major plate boundaries where earthquakes and volcanoes are concentrated. Coasts, grasslands and river beds hardly experience any volcanoes so they are not the most probable location.

11. Most of the geothermal activity occurs at _____

a) Ring of water

b) Mt. Everest

c) Ring of fire

d) Amsterdam

View Answer

Answer: c

12. Which of the following is the major drawback of geothermal energy?
a) Low initial cost
b) Low carbon dioxide production
c) High carbon dioxide production
d) Extremely location specific

View Answer

Answer: d
Explanation: The major drawback of geothermal energy is its dependence on the geothermal site. In fact, it is probably the most location specific energy source. Also, the power plants are accused of causing mini tremors in the surrounding areas.

13. Geothermal energy has high initial cost.
a) True
b) False

View Answer

Answer: a
Explanation: Geothermal has a high initial cost because of the costs required to locate the geothermal site. The cost of admission also includes construction of the power plant at the site.

14. Which of the following gases is released by a geothermal site and power plant?
a) Carbon dioxide
b) Sulphur
c) Iron
d) Steel

View Answer

Answer: b
Explanation: Geothermal sites and power plants are accused of releasing sulphur and hydrogen sulfide. It has low carbon dioxide emissions. Iron and steel are not gases.

15. Lord Kelvin invented the heat pump.
a) True
b) False

View Answer

Answer: a
Explanation: Lord Kelvin invented the heat pump in 1853. Heinrich Zoelly had patented

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Geothermal Energy Questions and Answers – Types of Geothermal Resources – 1

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This set of Geothermal Energy Multiple Choice Questions & Answers (MCQs) focuses on “Types of Geothermal Resources – 1”.

1. What are the types of geothermal energy resources?
a) Hydrothermal, geo-pressurised brines, hot dry rocks, magma
b) Hydrothermal, geo-pressurised brines, hot dry rocks, sun
c) Biomass, geo-pressurised brines, hot dry rocks
d) Wind, magma, geopressurised brines, hydrothermal

View Answer

Answer: a
Explanation: The four types of geothermal energy resources are hydrothermal, geopressurised brines, hot dry rocks and magma, Biomass, sun and wind are not types of geothermal energy resources.

c) Solid and Bose-Einstein condensate
d) Plasma and liquid

View Answer

Answer: b
Explanation: Geothermal energy either comes in liquid form or in vapour form. They are not solids. Bose-Einstein condensate and plasma are not forms of geothermal energy. They are states of matter.

3. What is/are the ingredient in hydrothermal plants?
a) Water
b) Hot water
c) Hot water and steam
d) Steam and water

View Answer

Answer: c
Explanation: Generally, the ingredients for hydrothermal plants are hot water and steam. Both hot water and steam come together in a package. Steam cannot exists without the water being hot.

4. Which of the following naturally occurring heater is best responsible for the hot water in a geothermal site?
a) Solar heater
b) Induction stove

Answer: d
Explanation: Magma is mainly responsible for heating the surrounding water and generating steam in a geothermal site. Solar heater and induction stove are not natural heaters. Sunlight does not the water in a geothermal site.

5. Which of the following affect the usage of hydrothermal resources?
a) Temperature and depth of the source
b) Temperature and location of the site
c) Location of the site and depth of the source
d) Type of water and steam

View Answer

Answer: a
Explanation: Temperature and depth of the source affect the application of hydrothermal resource. It does not depend on the location of the site. Water and steam do not have types.

6. Which temperature range is most suitable for directly using the hydrothermal resource? Note that “F” stands for Fahrenheit.
a) 100 – 150 degree F
b) 50 – 60 degree F
c) -100 – -90 degree F
d) -100 – 0 degree F

View Answer

Answer: b

7. _____ directly use low temperature hydrothermal source.
a) Electricity generation
b) Waste treatment
c) Spas
d) Gas stove

View Answer

Answer: c
Explanation: Spas directly use low temperature hydrothermal source. Other examples are heating buildings and warming fish ponds. Gas stoves use LPG. Waste treatment is not done using geothermal sources.

8. Which of the following temperature ranges is most suitable to generate electricity from hydrothermal resources? Note that “F” stands for Fahrenheit.
a) 100 – 150 degree F
b) 55 – 60 degree F
c) -200 – -90 degree F
d) 300 – 700 degree F

View Answer

Answer: d
Explanation: Electricity generation requires higher temperatures to run turbines. The typical temperature range is between 300 to 700 degree F and can reach 1000 degree F as well.

9. Which of the following best indicates the electricity generation from dry steam?

d) Generator → steam → pipes → drilling well

View Answer

Answer: a
Explanation: The steam is extracted from the drilling wells via pipes. So, the steam flows through the pipes to run the turbines of generator thereby generating electricity.

10. Which of the following best indicates the electricity generation from hot water geothermal source?
a) Drilling well → hot water → generator → steam
b) Drilling well → hot water → steam → generator
c) Generator → hot water → steam → drilling well
d) Hot water → steam → drilling well → generator

View Answer

Answer: b
Explanation: Hot water geothermal reservoirs are the most common type. The hot water flows from the drilling wells through the pipe. This hot water is then vaporized to generate steam which in turn runs the turbines.

11. What is a binary cycle power plant?
a) Lower temperature hot water is used to cool a fluid which compresses
b) Higher temperature hot water is used to cool a fluid which compresses
c) Lower temperature hot water is used to heat a fluid which expands
d) Higher temperature hot water is used to heat a fluid which compresses

Answer: c
Explanation: A binary cycle power plant is used when the water is not sufficiently hot enough. So, the lower temperature hot water is used to heat a fluid which in turn expands when warmed.

12. Which of the following is used to run the turbine in a binary cycle power plant?
a) Fluid compressed due to hot water from the geothermal site
b) Hot water
c) Steam
d) Fluid expanded due to hot water from the geothermal site

View Answer

Answer: d
Explanation: A binary cycle power plant uses the hot water from the geothermal site to heat a fluid which in turn expands. The turbine is powered from the expanded and pressurized fluid.

13. What are geopressurised resources?
a) Increased pressure in the geothermal reservoir
b) Increased temperature in the geothermal reservoir
c) Decreased temperature in the geothermal reservoir
d) Decreased pressure in the geothermal reservoir

View Answer

Answer: a
Explanation: Geopressurized resources are formed when the geothermal reservoir is trapped by an impermeable sedimentary cap rock. This is the reason for the increase in pressure inside the reservoir.

14. The pressure inside a geothermal reservoir increases due to the weight of the sediment layer.
a) True
b) False

View Answer

Answer: b
Explanation: The pressure inside a geothermal reservoir increases because of the weight and the lack of permeability of the sediment layer. This is the same sediment layer that traps the geothermal reservoir.

15. Why are geopressurized sites desirably?

d) Because they decrease the temperature of the resource

View Answer

Answer: c
Explanation: The increased pressure inside geopressurized sites reduce the load on the pump. Thus, it also reduces the amount of energy required to pump the resource. The pressure increases because of the weight and impermeability of the sediment layer.

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Geothermal Energy Questions and Answers – Types of Geothermal Resources – 2

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This set of Geothermal Energy online test focuses on “Types of Geothermal Resources – 2”.

1. Which of the following is a type of high temperature geothermal resource?
a) Dry steam
b) Dry water
c) Wet steam
d) Water

View Answer

Answer: a
Explanation: High temperature hydrothermal resource is used to produce electricity. The two main types of high temperature hydrothermal resources are dry steam and hot water.

2. Dry steam is _____ dominated.

d) plasma

View Answer

Answer: b
Explanation: Dry steam is a type of high temperature hydrothermal resource. It is vapour dominated. It is mainly used to generate electricity.

3. Hot water is _____ dominated.
a) vapour
b) nitrogen
c) liquid
d) Bose-Einstein condensate

View Answer

Answer: c
Explanation: Hot water is liquid dominated high temperature hydrothermal resource. Like dry steam, it is used to generate electricity. Unlike low temperature resources, it cannot be used directly.

4. Which of the following is also called as a flash steam plant?
a) Low temperature hydrothermal resource
b) Dry steam
c) Hydrogen
d) Hot water

steam plant because the hot water is first converted to steam. This steam is used to drive the turbines to generate electricity.

5. What is hot dry rock geothermal resource made of?
a) Granite
b) Soil
c) Solid carbon dioxide
d) Liquid nitrogen

View Answer

Answer: a
Explanation: Hot dry rock is made up of granite. It is a unique geothermal resource that lacks stored fluid and has extremely low permeability. Fracture creation is required for commercial applications.

6. Which of the following fracture creation techniques is/are used in hot dry rock geothermal resource?
a) Condensation and hydrofracking
b) Hydrofracking and hydroshearing
c) Hydroshearing and distillation
d) Hydrofracking and combustion

View Answer

Answer: b
Explanation: Hydrofracking and hydroshearing are the two commonly used fracture creat

7. What is the difference between enhanced geothermal system and hot dry rock?
a) Lack of fluid permeability
b) Fluid permeability
c) Presence of fluid
d) Presence of rocks

View Answer

Answer: c
Explanation: The main difference between enhanced geothermal system and hot dry rock is the presence of fluid. Enhanced geothermal system contains hot fluid but hot dry rock does not or contains negligible amounts.

8. What is the similarity between enhanced geothermal system and hot dry rock?
a) Magma
b) Presence of steam
c) Presence of fluid
d) Lack of fluid permeability

View Answer

Answer: d
Explanation: The main similarity between the two is that both lack fluid permeability. Magma is not the right option because it is present irrespective of the resource. In fact, it heats the resource. Both the resources lack steam.

9. Enhanced geothermal resource is man-made.

Answer: a
Explanation: Enhanced geothermal resource is a man-made reservoir. It is created where there is hot rock but insufficient or little permeability of the fluid.

10. Deep hydrothermal systems are found at a depth of _____
a) 1km
b) 2.5 – 5km
c) 10km
d) 1 – 2km

View Answer

Answer: b
Explanation: Deep hydrothermal systems are found at a depth of 2.5 – 5km. The surrounding regions do not have elevated geothermal temperature gradients and the temperature range is between 120 – 140 degree Celsius.

11. What are deep hydrothermal systems?
a) Hot dry rock
b) Magma
c) Permeable and fluid saturated region
d) Impermeable and fluid saturated region

View Answer

Answer: c
Explanation: Deep hydrothermal systems consists of permeable and saturated fluid in

12. Which of the following is responsible for the volcanic geothermal heat?
a) Water
b) Hot dry rock
c) Carbon dioxide
d) Supercritical water

View Answer

Answer: d
Explanation: Supercritical water is responsible for the volcanic geothermal heat. The energy obtained from this supercritical water is much higher than conventional geothermal steam. Carbon dioxide does not contribute to any geothermal resource. Hot dry rock is a geothermal resource found beneath earth's surface and not near volcanoes.

13. Supercritical water is a liquid.
a) False
b) True

View Answer

Answer: a
Explanation: Supercritical water is a unique state of water where it neither behaves as a true liquid nor as a true gas. It is capable of generating upto 10 times more power than conventional geothermal sources.

14. Where is geothermal energy from volcanoes being harvested?
a) United States
b) Iceland
c) Iran
d) Greenland

View Answer

Answer: b
Explanation: Iceland is a nation built on about 130 volcanoes. It rests above a divergent plate boundary which brings continuous supply of hot and fresh magma from the mantle. Iceland Deep Drilling Project (IDDP) is the most famous amongst all the other projects.

15. Geothermal power plants are very good sources for baseload power.
Note – Baseload power is power that electric utility companies must deliver all day long.
a) True
b) False

View Answer

the high initial costs, they produce electricity very cheaply – 4.5 to 7 cents per KWh. In fact, baseload geothermal plants sell electricity all the time even when during high demand.

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Ocean Energy Questions and Answers – Tidal Energy – 1

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This set of Ocean Energy Multiple Choice Questions & Answers (MCQs) focuses on “Tidal Energy – 1”.

1. What is tidal power?
a) Energy from tides
b) Energy from water
c) Energy from moon
d) Energy from sun

View Answer

Answer: a
Explanation: Tidal power converts the energy from tides to usable forms. Though tides are water, it is not the same as the energy harnessed from a flowing river. Tides are caused due to moon.

c) Solar
d) Wind

View Answer

Answer: b
Explanation: Tidal power comes under the category of hydropower. Hydrothermal is basically energy harnessed from hot water/steam found in geothermal sites. Solar and wind are not related to water.

3. What is/are the cause(s) of tides?
a) Gravitational pull of moon
b) Gravitational pull of moon and sun
c) Gravitational pull of sun and moon and rotation of earth
d) Gravitational pull of sun

View Answer

Answer: c
Explanation: Tides are caused by the gravitational pull of moon, sun and the rotation of earth. It is the cumulative effect of all the three factors. No single factor individually dominates the other.

4. What is the minimum height of tides required for harnessing tidal energy economically?
a) 1 foot
b) 5 feet
c) 8 feet

Answer: d
Explanation: To harness tidal energy economically, the minimum height of the tides should be 10 feet. Most of the plants harness the tidal energy to generate electricity which is either used in remote locations or sent to the grid.

5. In terms of predictability, tidal energy _____ solar and wind.
a) is more predictable than
b) is less predictable than
c) has similar predictability like
d) cannot be predicted unlike

View Answer

Answer: a
Explanation: In terms of predictability, tidal energy is more predictable than solar and wind. This because of its origins – gravitational forces and earth's rotation. Intensity of sunlight and wind speeds vary greatly within a day unlike the tides.

6. Tidal barrage is similar to _____
a) wind plant
b) dam
c) wind turbines
d) coal plant

View Answer

Answer: b

7. Which of the following best describes the working of a tidal barrage for an incoming tide?
a) Incoming tides → generator → barrage → basin
b) Incoming tides → basin → generator → barrage
c) Incoming tides → barrage → basin → generator
d) Generator → barrage → basin → incoming tides

View Answer

Answer: c
Explanation: The incoming tides flow through the barrage into the basin. Once the basin is filled, the water is emptied by allowing it to pass through an electric generator thereby generating electricity.

8. Which of the following best describes the working of tidal barrage for outgoing tides?
a) Generator → basin → ocean → outgoing tide
b) Generator → ocean → basin → outgoing tide
c) Ocean → generator → basin → outgoing tide
d) Outgoing tide → generator → basin → ocean

View Answer

Answer: d
Explanation: The outgoing tides flow through the generator which converts the kinetic energy into electrical energy. The water is then emptied into the ocean via a separate basin.

9. Tidal barrages are a two-way tidal power system.
a) True

Answer: a
Explanation: Tidal barrages are a two-way power system. This is because they use both, the incoming and the outgoing tides to generate electricity. The water flow is controlled by sluice gates.

10. Which of the following is a potential problem of a tidal barrage?
a) Impacts on deep sea/ocean marine life
b) Impacts on estuaries of the tidal basin
c) A two-way tidal power system
d) Decrease in turbidity

View Answer

Answer: b
Explanation: One of the main problems that a tidal barrage can cause is the destruction of estuaries of the tidal basin. Tidal barrages also increase the turbidity of the water near the basin. They don't affect the deep sea marine life.

11. Which of the following tidal barrages has the largest capacity to generate electricity?
a) La Rance
b) Annapolis Royal
c) The Sihwa Lake Tidal Power Station
d) Russian tidal plants

View Answer

Answer: c

12. What are the three ways to harness tidal energy?
a) Tidal streams, tidal barrages and wind
b) Tidal barrages, wind and sun
c) Tidal lagoons, river streams and geothermal reservoirs
d) Tidal lagoons, tidal streams and tidal barrages

View Answer

Answer: d
Explanation: The three different ways to harness tidal energy are tidal streams, tidal barrages and tidal lagoons. Geothermal reservoirs, wind and sun are not tidal resources.

13. The United States has an economical tidal power plant.
a) True
b) False

View Answer

Answer: a
Explanation: At the very best, the United States does not have an economical tidal power. China, France, England, Canada and Russia are some of the popular countries known to harness tidal energy.

14. What is a tidal stream?
a) A river streams
b) A fast-flowing body of water due to tides
c) A fast-flowing body of water deposited into ocean
d) A fast-flowing body of water due to winds

View Answer

Answer: b
Explanation: A tidal stream is a fast-flowing body of water created by tides. It is not the same as a river stream. When compared to a river stream it has a much higher kinetic energy.

15. Tidal generators produce steady and reliable stream of electricity.
a) True
b) False

View Answer

Answer: a
Explanation: Tidal generators produce steady and reliable stream of electricity. This is becau unlike sun's intensity and wind speeds which vary over short duration of time, tides ,

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Ocean Energy Questions and Answers – Tidal Energy – 2

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This set of Ocean Energy online quiz focuses on “Tidal Energy – 2”.

1. What is a tidal lagoon?
a) A man-made structure that spans the area of coastline with a high tidal range
b) A man-made structure that spans the entire coastline
c) A barrage
d) A fast-flowing water body caused due to tides

View Answer

Answer: a
Explanation: A tidal lagoon spans that area of coastline which has a high tidal range. The large volume of water is collected in a man-made structure for electricity generation. Tidal stream is a fast-flowing water body caused due to tides.

d) By creating barrages

View Answer

Answer: b
Explanation: Tidal lagoon works by creating a difference in water levels. The water on the higher level is passed through a turbine to generate electricity. Tidal barrages work by creating barrages.

3. Which of the following steps best describes the working of tidal lagoons?
a) Floods → generator turbines → turbine wicket gates → lagoon → difference in water level between lagoon and sea
b) Floods → turbine wicket gates → generator turbines → lagoon → difference in water level between lagoon and sea
c) Floods → turbine wicket gates → lagoon → difference in water level between lagoon and sea → generator turbines
d) Turbine wicket gates → floods → lagoon → difference in water level between lagoon and sea → generator turbines

View Answer

Answer: c
Explanation: Sea water flows into lagoons which are controlled by turbine wicket gates. These gates control the flow and can be completely closed to stop the water from entering the lagoon. Once the difference in the water level between lagoon and sea is optimized, the gates are opened thereby allowing water to flow through generator turbines.

c) the same as tidal stream
d) bi-directional

View Answer

Answer: d
Explanation: Tidal lagoon is bi-directional. This is because the difference in water level between the lagoon and sea can be created by both, the incoming tides and the outgoing (ebbing) tides.

5. Tidal power is renewable because _____
a) tide falls and rises without fuel
b) tide falls and rises with fuel
c) tide neither falls nor rises without fuel
d) tide neither falls nor rises with fuel

View Answer

Answer: a
Explanation: The tidal power is renewable because the tides fall and rise without any external fuel. This is caused by the gravitational forces of moon and earth's rotation.

6. How many high tides occur every day?
a) One
b) Two
c) Four
d) Three

Answer: b
Explanation: Two high tides occur each day. This is because the earth rotates through two tidal bulges every lunar day. When the earth is in one of the bulges, coastal areas experience a high tide.

7. How many low tides occur every day?
a) One
b) Five
c) Two
d) Four

View Answer

Answer: c
Explanation: Two low tides occur each day. This is because the earth rotates through two tidal bulges every lunar day. When the earth is not in one of the bulges, a low tide occurs.

8. On which two sides of the earth do the tidal forces cause water to bulge out?
a) Both sides closest to moon
b) Both sides farthest from moon
c) Both sides facing the sun
d) Side closest to the moon and farthest from the moon

View Answer

Answer: d
Explanation: Tides are caused by the gravitational forces of moon acting on earth. Side clo

9. Bulges of water are called high tides.
a) True
b) False

View Answer

Answer: a
Explanation: Bulges of water are called high tides. The two earth's sides namely, the one closest to the moon and the one farthest from the moon experience these bulges – high tides.

10. What is a tide mill?
a) A dam to store the tide
b) A water mill driven by tidal rise and fall
c) A barrage
d) A lagoon

View Answer

Answer: b
Explanation: A tide mill is a water mill driven by tidal rise and fall. A dam is created across a tidal inlet to store the water thereby acting as a reservoir. A tidal mill is not same as a dam.

11. How does a tide mill work?
a) By storing the water and creating a difference in water level
b) By storing the water when the tide is low and releasing it through a turbine when the tide is high
c) By storing the water when the tide is high and releasing it through a turbine when the tid

Answer: c
Explanation: The tide mill works by storing the water when the tide is high and releasing it through a turbine when the tide is low. The water is stored in a dam constructed across a suitable tidal inlet.

12. Which of the following is **similar** to the working of tidal stream generator?
a) Geothermal turbine
b) Heat pump
c) Anaerobic digestion
d) Wind turbine

View Answer

Answer: d
Explanation: The working of tidal stream generator is similar to that of a wind turbine. Both use the kinetic energy of the respective fluids to rotate the turbine and generate electricity. Anaerobic digestion is a technique to treat and harness energy from biomass. It does not used turbines. Geothermal turbine and heat pumps use the thermal energy of the fluids.

13. Both horizontal and vertical turbines are used to harness energy from tides.
a) True
b) False

View Answer

Answer: a
Explanation: Depending on the tidal stream various turbines are used to harness the kinetic energy of the incoming tide. Some of the commonly used turbines are horizontal, vertical, open and ducted.

14. What is dynamic tidal power?
a) A theoretical technology exploiting potential energy of tides
b) A theoretical technology exploiting potential and kinetic energy of tides
c) A practical technology exploiting kinetic and potential energy of tides
d) A practical technology exploiting thermal energy of tides

View Answer

Answer: b
Explanation: Dynamic tidal power is a theoretical technology that exploits an interaction between the potential and kinetic energy of tides. It proposes the construction of long dams from coast into the sea so as to introduce tidal phase differences. These phase differences result in a differential water-level.

c) China
d) Australia

View Answer

Answer: c
Explanation: Strong coast-parallel oscillating tidal currents are generally found in China, UK and Korea. Dynamic tidal power (DTP) is a theoretical technology that features such currents and proposes harvesting energy from such currents.

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Ocean Energy Questions and Answers – Ocean Thermal Energy – 1

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This set of Ocean Energy Multiple Choice Questions & Answers (MCQs) focuses on “Ocean Thermal Energy – 1”.

1. What is ocean thermal energy conversion?
a) Harnessing the temperature differences between surface waters and deep ocean waters
b) Harnessing the temperature differences between the coastal waters and deep ocean waters
c) Harnessing the heat energy from the underwater volcanoes
d) Harnessing the heat energy between surface water vapour and atmospheric gases

View Answer

Answer: a
Explanation: The process of generating energy by using temperature difference (or gradient) varying with depth of seawater is called Ocean thermal energy conversion (OTEC). A temperature gradient exists between the surface waters and deep sea waters due to various physical phenomenon.

a) 10 degree F
b) A minimum of 77 degree F
c) Between 50 and 60 degree F
d) A minimum of 100 degree F

View Answer

Answer: b
Explanation: The temperature difference is at least 77 degree F (or 25 degree C). Ocean thermal energy conversion systems use this temperature difference between the surface and the bed (or deep sea waters) to generate electricity.

3. What is thermohaline circulation?
a) Circulation of halogens throughout the ocean
b) Circulation of halogens due to temperature differences throughout the ocean
c) Large scale ocean circulation driven by global density gradients
d) Large scale halogens circulation due to global density gradients

View Answer

4. What is the maximum estimated potential of ocean thermal energy conversion per year?
a) 80 GWh
b) 900 MWh
c) 10000 TWh
d) 88000 TWh

View Answer

energy resource. The maximum estimated potential is 880000 TWh per year. In fact, it is strongly believed that this resource could contribute to base-load power supply.

5. How does the cold and denser water masses sink to the depths of ocean?
a) Thermohaline circulation
b) Temperature gradient
c) Density gradient
d) Freshwater fluxes

View Answer

Answer: a
Explanation: The cold and denser water masses formed by surface water sink to the depths of the ocean by thermohaline circulation. It is circulation of ocean water due to density gradient.

6. Why is ocean thermal energy conversion a renewable resource?
a) Because the temperature gradient lasts for a short period of time
b) Because the upwelling of cold water from the deep ocean is replaced by downwelling of surface waters
c) Because ocean water is available in plenty
d) Because of sun's heat

View Answer

Answer: b
Explanation: Ocean thermal energy conversion is a renewable resource because temperature gradient is continuously restored. This occurs because the upwelling of c

7. Which of the following are types of systems used in ocean thermal energy conversion?
a) Horizontal and vertical
b) Vertical and open cycle
c) Open cycle and closed cycle
d) Horizontal and closed cycle

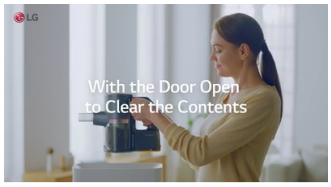
View Answer

Answer: c
Explanation: The types of systems used in ocean thermal energy conversion are closed cycle and open cycle systems. Horizontal and vertical are related to turbines used in harnessing tidal and wind energy.

8. Which of the following is used as working fluid in closed cycle oceanic thermal energy conversion systems?
a) Thermohaline circulation
b) Temperature gradient
c) Greenhouse gases
d) Refrigerants

View Answer

Answer: d
Explanation: Closed cycle oceanic thermal energy conversion systems use refrigerants like ammonia as working fluids. These fluids have low boiling points and are suitable to power the generator thereby producing electricity.



b) False

View Answer

Answer: a
Explanation: Rankine Cycle is the most commonly used heat cycle for ocean thermal energy conversion. It is a model used to predict the performance of a steam turbine and was also used to study reciprocating steam engines.

10. _____ turbine is used in closed cycle ocean thermal energy conversion.
a) Horizontal
b) Low-pressure
c) High-pressure
d) Vertical

View Answer

Answer: b
Explanation: Low-pressure turbines are used in closed cycle ocean thermal energy conversion. These systems use the Rankine heat cycle to generate electricity.

11. Open cycle ocean thermal energy conversion systems use _____ as the working fluid.
a) vapour from rivers
b) water from rivers
c) vapour from seawater
d) seawater

as the working fluid. Unlike the closed cycle ocean thermal conversion systems, the working fluids are not thought as refrigerants.

12. What is the byproduct of an ocean thermal energy conversion system?
a) Electricity
b) Clean water
c) Water vapour
d) Cold water

View Answer

Answer: d
Explanation: Ocean thermal energy conversion systems supply cold water as their by-product. These can be used for air conditioning and refrigeration. Electricity is the primary product.

13. Where is the world's only operating ocean thermal energy conversion plant located?
a) Japan
b) United States
c) China
d) Korea

View Answer

Answer: a
Explanation: Ocean thermal energy conversion was first developed in the 1880s. The world's only operating ocean thermal energy conversion plant is located in Japan. The plant is overseen by Saga University.

14. Which of the following best describes the working of an ocean thermal energy conversion plant?
a) Oceanic water → evaporator → turbine/generator → electricity
b) Warm surface oceanic water → evaporator containing working fluid → turbine/generator → electricity
c) Cold surface oceanic water → electricity → evaporator containing working fluid → turbine/generator
d) Cold deep oceanic water → electricity → evaporator containing working fluid → turbine/generator

View Answer

Answer: b
Explanation: Warm surface oceanic water is passed through an evaporator containing the working fluid. The vapourized fluid drives the turbine/generator thereby generating electric

a) True
b) False

View Answer

Answer: a
Explanation: The vapourized fluid in an ocean thermal energy conversion system is converted back into working liquid by passing it through a condenser. By using the deep oceanic cold water, the temperature of the condenser is maintained so as to cool the vapourized fluid.

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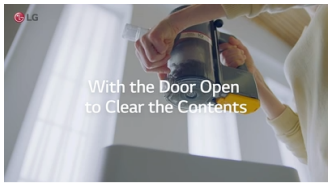

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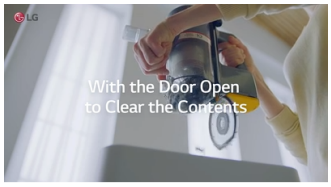

Ocean Energy Questions and Answers – Ocean Thermal Energy – 2

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This set of Ocean Energy Questions & Answers for Exams focuses on “Ocean Thermal Energy – 2”.

1. What type of working fluids do closed-cycle ocean thermal energy conversion (OTEC) systems use?
a) Low boiling point fluids at atmospheric pressure
b) High boiling point fluids at atmospheric pressure
c) Low boiling point fluids at 100 bar
d) High boiling point fluids at 100 bar

View Answer

Answer: a
Explanation: Closed-cycle ocean thermal energy conversion systems use low boiling point fluids at atmospheric pressure. An example of a low boiling point at atmospheric pressure is ammonia with a boiling point around -33 degree Celsius.

a) Heat compressor
b) Heat exchanger
c) Fluid compressor
d) Turbine

View Answer

Answer: b
Explanation: The warm surface seawater is pumped through a heat exchanger in a closed-cycle ocean thermal energy conversion system. This is to vapourise the working fluid to run the turbine.

3. How is the vapourised working fluid condensed in a closed-cycle ocean thermal energy conversion system?
a) Warm surface seawater
b) Fresh warm water
c) Cold water from deep ocean
d) Fresh cold water

View Answer

Answer: c
Explanation: The vapourised working fluid is condensed using the cold water from deep ocean in a closed-cycle ocean thermal energy conversion system. The cold water is pumped through a second heat exchanger to perform condensation.

4. Which of the following organisations developed the “mini OTEC”?

d) Natural Energy Laboratory

View Answer

Answer: d
Explanation: In 1979, the Natural Energy Laboratory and several private-sector partners developed the “mini OTEC” experiment. They successfully produced electrical power from a closed-cycle OTEC on the Hawaiian coast.

5. The open-cycle OTEC uses working fluid.
a) False
b) True

View Answer

Answer: a
Explanation: The open-cycle OTEC does not use a working fluid. It directly uses the warm surface seawater to produce electricity.

6. Which of the following best describes the open-cycle OTEC?
a) Warm surface seawater → heat exchanger → working fluid → turbine
b) Warm surface seawater → low-pressure container → turbine/generator
c) Deep seawater → heat exchanger → working fluid → turbine
d) Deep seawater → low-pressure container → turbine/generator

View Answer

7. Why does an open-cycle OTEC use low-pressure container?
a) To solidify the warm surface seawater
b) To evaporate the deep seawater
c) To boil and evaporate the warm surface seawater
d) To solidify the warm surface seawater

View Answer

Answer: c
Explanation: Open-cycle OTEC uses a low-pressure container to boil the warm surface seawater. Due to decrease in pressure, the seawater boils and expands to form vapour. This vapour is then used to drive the turbines to generate electricity.

8. Which of the following produces desalinized fresh water?
a) Closed-cycle OTEC
b) Fracking
c) Ammonia
d) Open-cycle OTEC

View Answer

Answer: d
Explanation: Open-cycle OTEC produces desalinized fresh water because it directly uses the warm surface water to drive the turbines. Closed-cycle OTEC does not use the warm surface seawater directly. Ammonia is used as working fluid in closed-cycle OTEC.

9. Why does open-cycle OTEC produce desalinized fresh water?

c) Because the warm surface seawater is mixed with deep ocean water
d) Because of thermohaline circulation

View Answer

Answer: a
Explanation: Open-cycle OTECH produces desalinized fresh water because the vapourized surface seawater leaves all the salts and contaminants in the low-pressure container. Since the vapour is pure, it generates desalinized fresh water on condensation.

10. Where is the desalinized fresh water used?
a) Sent back into ocean
b) Used for irrigation and aquaculture
c) Used to generate electricity
d) Used to generate tides

View Answer

Answer: b
Explanation: Desalinized fresh water has many applications. It is suitable for irrigation and aquaculture. On further processing, it could also be used for drinking purposes. It is not used to generate electricity and tides.

11. Which of the following best describes hybrid ocean thermal energy conversion?
a) Warm surface seawater → low-pressure container → turbine/generator
b) Deep seawater → vacuum chamber → flash-evaporated → steam vapourises ammonia turbine

d) Deep seawater → low-pressure container → turbine/generator

View Answer

Answer: c
Explanation: In hybrid OTEC, warm surface seawater is pumped into a vacuum chamber. Due to low pressure, the water boils and expands into vapour. This vapour is then used to vapourise the working fluid which runs the turbine.

12. How does hybrid OTEC provide desalinized water?
a) By evaporating the warm surface seawater
b) By solidifying the warm surface seawater
c) By condensing the steam generated from deep seawater
d) By condensing the steam generated from warm surface seawater

View Answer

Answer: d
Explanation: Hybrid ocean thermal energy conversion systems generate desalinized water by condensing the steam generated from warm surface seawater. Due to low pressure in vacuum chamber, the incoming surface seawater is vapourised to generate steam. This steam does not contain salts and contaminants as it is left behind in the chamber.

13. Which of the following is a good choice for working fluid?
a) CFCs
b) Steam
c) Surface seawater
d) Deep seawater

View Answer

Answer: a
Explanation: CFCs are a good choice for working fluid. Unlike ammonia, they are not toxic or flammable. However, they contribute to ozone layer depletion.

14. As the vapour pressure of working fluid increases the size of turbine _____
a) increases
b) decreases
c) does not change
d) first increases then decreases

View Answer

Answer: b

15. The wall thickness of pipes used to transport the vapour increases as the vapour pressure of working fluid increases.
a) True
b) False

View Answer

Answer: a
Explanation: The wall thickness of pipes used to transport the vapour increases as the vapour pressure of working fluid increases. This is because these pipes need to support the vapours without breaking apart.

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Renewable Energy Questions and Answers – Hydrogen Energy – 1

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This set of Renewable Energy Multiple Choice Questions & Answers (MCQs) focuses on "Hydrogen Energy – 1".

1. Which of the following supplies maximum amount of hydrogen gas?
a) Natural gas
b) Anaerobic Digestion
c) Wastewater treatment
d) Electrolysis

View Answer

Answer: a
Explanation: All the four options produce hydrogen gas. However, fossil fuels, specifically natural gas is the major producer of hydrogen gas. Biomass and biogas are the also commonly used to produce hydrogen gas.

c) Lowest contributor of greenhouse gas emissions
d) Hydrogen cannot be used as fuel

View Answer

Answer: b
Explanation: Hydrogen fuel is a clean source of energy. It is a zero-emission fuel burned with oxygen and is used in different applications to generate electricity. Among all sources of energy, burning fossil fuels produces maximum amount of greenhouse gases.

3. Which of the following use hydrogen as fuel?
a) Fossil fuels
b) Anerobic digestion
c) Fuel cells
d) Cooking

View Answer

Answer: c
Explanation: Fuel cells and internal combustion engines used hydrogen as fuel cells. Anaerobic digestion requires biomass in the form of waste water to generate electricity. Though fossil fuels contain hydrogen atoms, they do not require external supply of hydrogen as fuels. Cooking does not require hydrogen as fuel.

4. Which of the following is the most popular application of hydrogen fuel cell?
a) Fuel cell vehicles
b) Fuel cell energy power plants

Answer: d

Explanation: Spacecraft propulsion uses hydrogen as fuel with the help of fuel cells. It is one of the most established techniques to deploy spacecrafts into outer-space. Though fuel cell vehicles are becoming popular, they are not well established yet.

5. How is hydrogen gas produced from fossil fuels?

a) Partial oxidation of methane

b) Electrolysis

c) Evaporation

d) Biomass gasification

View Answer

Answer: a

Explanation: Hydrogen gas is produced from fossil fuels by different techniques like partial oxidation of methane, steam reforming and coal gasification. Biomass gasification and electrolysis produce hydrogen gas in small quantities.

6. What is the major drawback of steam-methane reforming technique to produce hydrogen?

a) Capital intensive

b) Releases greenhouse gases into atmosphere

c) A niche technology

d) Poor efficiency

View Answer

Answer: b

7. How does electrolysis produce hydrogen?
a) By running electricity to combine hydrogen and water
b) By separating water into hydrogen and oxygen and generating electricity
c) By passing electricity into water to separate it into hydrogen and oxygen
d) By passing electricity into water to evaporate it into hydrogen

View Answer

Answer: c
Explanation: Electrolysis is one of the cleanest techniques to produce hydrogen. Electricity is passed through water to separate it into oxygen and hydrogen. In electrolysis, electricity is not generated and instead is used to perform a chemical reaction

8. Why is hydrogen hazardous as fuel?
a) Because of high ignition and low combustion energy
b) Because of high ignition and high combustion energy
c) Because low ignition and low combustion energy
d) Because of low ignition and high combustion energy

View Answer

Answer: d
Explanation: Hydrogen is extremely dangerous as fuel. This is because hydrogen has a low ignition temperature and releases large amounts of energy during burning – high combustion energy. Also, it is hard to store as it tends leak easily from storage tanks.

9. Traditionally, why is steam methane reforming preferred over electrolysis?

d) Because electrolysis produces greenhouse gases

View Answer

Answer: a
Explanation: Traditionally, steam methane reforming preferred over electrolysis. This is simply because electrolysis requires electricity. Currently, producing electricity is expensive. As the cost of producing a unit of electricity becomes cheaper, electrolysis will be favoured over steam methane reforming because it does not release greenhouse gases.

10. What is the main problem in using hydrogen as fuel for vehicles?
a) Capital intensive
b) Storage
c) Fuel cell technology is not well established
d) Cars will become heavy

View Answer

Answer: b
Explanation: The main problem in using hydrogen as fuel for vehicles is storage of hydrogen. Hydrogen is difficult to store because it leaks easily. Moreover, it is extremely hazardous as fuel due to its low ignition temperature and high combustion energy.

11. What is a fuel cell?
a) Converts heat energy to chemical energy
b) Converts heat energy to electrical energy
c) Converts chemical energy to electrical energy

Answer: c
Explanation: A fuel cell works just like a battery. It converts chemical energy to electrical energy. The chemical energy from a redox reaction occurring within the cell is converted to electrical energy due to the flow of electrons.

12. How does hydrogen fuel cell work?
a) Membrane → hydrogen ions → electric current and recombination with oxygen
b) Electric current and recombination with oxygen → hydrogen ions → membrane
c) Hydrogen ions → membrane → electric current and recombination with oxygen
d) Recombination with oxygen → electric current → membrane → hydrogen ions

View Answer

Answer: d
Explanation: The hydrogen ions in one chamber of the cell flow into the other chamber through a membrane to recombine with oxygen. Since this is a redox reaction, electric current is generated due to flow of electrons.

13. What does hydrogen fuel cell emit?
a) Water
b) Steam
c) Greenhouse gas
d) Methane

View Answer

Answer: a
Explanation: Hydrogen fuel cell produces water – its only emission. It does not release any greenhouse gases or carbon compounds like methane because the reaction occurs with two substances, hydrogen and oxygen.

14. Fuel cell vehicle is sourced by a battery.
a) True
b) False

View Answer

Answer: b
Explanation: A fuel cell vehicle (FEV) or a fuel cell electric vehicle (FCEV) is sourced by a fuel cell. It may work in combination with a battery to supply sufficient power to run the systems. But the source of the energy is a fuel cell.

15. High pressure containers are used to store hydrogen.

Answer: a
Explanation: Hydrogen is stored in a variety of ways to prevent hazards. One of them is by using high pressure containers. Another commonly used technique is cryogenics – low temperatures.

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Renewable Energy Questions and Answers – Hydrogen Energy – 2

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This set of Renewable Energy Questions and Answers for Aptitude test focuses on “Hydrogen Energy – 2”.

1. By what means can hydrogen be stored?
a) Physically and chemically
b) As atoms
c) As ions
d) As fuel cells

View Answer

Answer: a
Explanation: Hydrogen can be stored either by physical or chemical means. Hydrogen atoms cannot be stored. Ions are intermediate species and exist only in reactions. Fuel cells are not used to store hydrogen.

c) In the form of hydrides
d) In the form of water

View Answer

Answer: b
Explanation: For physical storage, the convention is to compress hydrogen gas and store it. Hydrogen atoms cannot be stored. Hydrogen is not stored as water. Besides, hydrides and water are not physical means of storing hydrogen.

3. How is hydrogen stored chemically?
a) As ions
b) By compressing hydrogen gas
c) In the form of hydrides
d) In the form of ice

View Answer

Answer: c
Explanation: Conventionally, hydrogen molecules are converted to hydrides and stored. Ions are intermediate species and cannot be stored. Compression of hydrogen gas is a physical means of storage.

4. Hydrogen molecules are dissociated either _____ or _____ to form hydrides.
a) under sunlight or cold temperatures
b) by substitution or electrolysis
c) by electrolysis or heterolytically

Answer: d
Explanation: Hydrogen molecules are dissociated either homolytically or heterolytically to form hydrides. This technique is a chemical means to store hydrogen. Electrolysis generates hydrogen. Substitution is a type of organic reaction.

5. Cryogenic adsorption is a physical means to store hydrogen.
a) True
b) False

View Answer

Answer: a
Explanation: Cryogenic adsorption is a physical means to store hydrogen. After adsorbing hydrogen at low temperatures, it is stored as liquid hydrogen.

6. What are the main components of a fuel cell?
a) Anode, cathode, electrolyte
b) Anode, cathode, membrane and electrolyte (including fuel)
c) Anode, cathode
d) Anode, cathode, electrolyte and connecting wires

View Answer

Answer: b
Explanation: Fuel cell is a device that converts chemical energy to electrical energy. It consists of the two electrodes namely, anode and cathode, a proton exchange membrane through w protons flow and the electrolyte in each chamber.

b) Decreases both pressure and volume
c) Increases pressure and decreases volume
d) Decreases pressure and increases volume

View Answer

Answer: c
Explanation: Hydrogen compressor is a device that increases the pressure of hydrogen by reducing its volume. This results in the formation of compressed hydrogen or liquid hydrogen.

8. What is photocatalytic water splitting?
a) Splitting of water using catalyst and electricity
b) Splitting of water using electricity
c) Combining hydrogen and oxygen to form water
d) Splitting of water using light as catalyst

View Answer

Answer: d
Explanation: Photocatalytic water splitting is an artificial photosynthesis process that is used to dissociate water into its constituents under the presence of natural or artificial light. It does not use chemical catalyst or electricity.

9. Which of the following uses hydrogen as fuel?
a) Vehicles
b) AA battery
c) AAA battery

Answer: a
Explanation: Among the given options, vehicles use hydrogen as fuel. They are generally called hydrogen vehicles or hydrogen powered vehicles. These vehicles are powered using fuel cells.

10. Efficiency of water electrolysis is greater than the efficiency of steam reforming.
a) True
b) False

View Answer

Answer: a
Explanation: Efficiency of water electrolysis is greater than the efficiency of steam reforming. However, electrolysis is not preferred because it is expensive.

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