D.C. Circuits TEST 1A

PHILIPS Chapters 1-4

Time allowed – 1.5 hours

16 Pages in this Question Booklet

Aids to be supplied by College:

None

Aids to be supplied by Students:

Pen, pencil, eraser, rule, calculator

TOTAL MARKS AVAILABLE

SECTION	Possible Marks	Actual Marks
A	20	
B	20	
C	20	
D	25	
TOTAL	85	

Instructions to Students:

- **Electronic devices are to be turned off and removed from your person.**
  You cannot access an electronic device during this examination.
- All questions are to be answered in the space provided in this Question Booklet.
  Answers to Section A – Multi-choice Questions, are to be recorded on the Answer Sheet attached to this Question Booklet.
- You are not to use any reference book in this examination.
- The whole of this Question Booklet is to be handed to the Supervisor upon completion.

Aids permitted where indicated:

Standard Dictionaries	Bilingual Dictionaries	Technical Dictionaries	Programmable Calculators	Non-programmable Calculators	Mobile Phones	MP3 Players
No	**Yes**	**No**	**No**	**Yes**	**No**	**No**

SECTION A – (20 Marks)

INSTRUCTIONS:
Select the best answer for the following statements and place the identifying letter in the bracket. Each correct answer is worth 1 mark.

1. How many electrons are there in one Coulomb:

   A. 3.14
   B. 12.57^{x10-7}
   C. 6.24
   D. $6.24^{x10}18$

(1 Mark)

2. Current in a circuit is a direct result of applying:

   A. an e.m.f. to the circuit
   B. Ohm's Law to the circuit
   C. an ammeter to the circuit
   D. resistance to the circuit.

(1 Mark)

3. Current in a solid conductor is the:

   A. ionisation of molecules in one direction
   B. movement of ions in one direction
   C. movement of electrons
   D. ionisation of atoms in one direction

(1 Mark)

4. To measure the voltage across a load, A voltmeter should be connected in:

   A. series with a load
   B. series with an ammeter
   C. parallel with a load
   D. parallel with an ammeter.

(1 Mark)

5. Power is defined as the:

   A. amount of energy to do work
   B. rate at which the work is done
   C. ability to do work
   D. amount of heat dissipated.

(1 Mark)

6. If the resistance of a circuit is halved while the applied e.m.f. remains constant, the current will be:

A. doubled
B. halved
C. the same
D. higher.

(1 Mark)

7. To protect the circuit wiring and the load, a fuse is connected in:

A. parallel with the supply
B. series with the voltmeter
C. series with the load
D. parallel with the load.

(1 Mark)

8. The voltage measured across a open switch will equal:

A. approximately 12 volts
B. zero volt
C. half the supply voltage
D. the total supply voltage.

(1 Mark)

9. A battery provides a source of:

A. electrical opposition
B. reluctance
C. resistance
D. electrical pressure.

(1 Mark)

10. The electric charge created by rubbing two surfaces together is called:

A. moving electricity
B. static electricity
C. a battery
D. photo-voltaic.

(1 Mark)

11. To measure the current through a load, the ammeter should be connected in:

A. series with the load
B. series with a voltmeter
C. parallel with a load
D. parallel with a voltmeter

(1 Mark)

12. The term “work” is directly related to:

A. the distance a force moves a body
B. the rate at which energy is used
C. how quickly a body accelerates
D. how heavy a body is.

(1 Mark)

13. The LED that produces light from current is a:

A. luminous enhancing device
B. long extended lamp
C. light emitting diode
D. large electric devices.

(1 Mark)

14. Which metal has the ***least*** resistance and is commonly used in electrical wiring:

A. aluminium
B. steel
C. gold
D. copper.

(1 Mark)

15. Energy can be measured in:

A. joules
B. watts
C. ohms
D. pascals.

(1 Mark)

16. If the electrical pressure applied to a circuit is decreased, the electric current will:

A. decrease
B. remain the same
C. increase
D. decrease to zero.

(1 Mark)

17. The unit for charge is:

A. amperes
B. coulombs
C. joules
D. pascals.

(1 Mark)

18. In the atomic structure of an element, a positive charge is exhibited by a:

A. proton
B. atom
C. electron
D. neutron.

(1 Mark)

19. 400mA is equal to:

A. 4 amps
B. 0.4amps
C. 40amps
D. 400000amps.

(1 Mark)

20. Lifting a 200kg load in two different amounts of time uses

A. two different amounts of energy
B. the same amount of energy
C. slightly different amounts of energy
D. less Joules of energy.

(1 Mark)

SECTION B – (20 Marks)

INSTRUCTIONS:
Answer the following questions in the space provided:

1. State two employee obligations under current safety laws. (2)

a) _____

b) _____

2. Sustainable energy is made up of two parts, what are they (2)

a) _____

b) _____

3. State three forms of energy that can be converted to electrical energy? (3)

a) _____

b) _____

c) _____

4. If the resistance of a circuit is doubled what is the effect on the circuit current. (1)

a) _____

5. Name two renewable energy sources which are commonly used to produce electrical power. (2)

b) _____

c) _____

6. Name the device which produces a voltage when exposed to light. (1)

a) _____

7. State two factors which determine the ***value*** of current flowing through your body when you get an electric shock. (2)

a) _____

b) _____

8. The electrical industry can be divided into three main areas, what are they? (3)

a) _____

b) _____

c) _____

9. What charge does an electron hold? (1)

a) _____

10. Define the term, 'Resistance'. (1)

a) _____

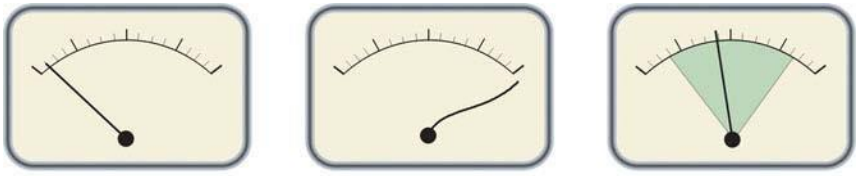
11. What is the relationship between kinetic and potential energy? (2)

a) _____

b) _____

SECTION C Drawings and Diagrams – (20 Marks)

1. Circle the appropriate letter which indicates the correct meter range for accuracy and to prevent damaging the meter.



A	B	C

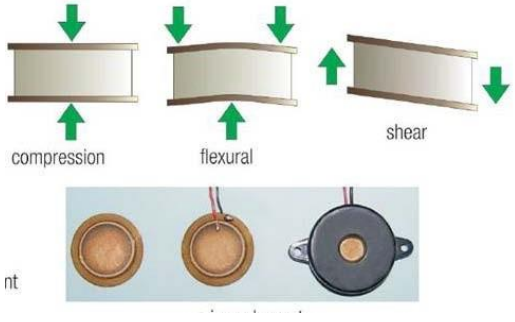
(2)

2. Complete the table below for electrical quantities.

Quantity	**Symbol**	**Measurement Unit**
Voltage	**V**	**Volt**
	I	Amps
Resistance		Ohms
Charge	Q	

(3)

3. Study the picture below and answer the related questions.



a. What is being produced by placing this material under pressure?

_____

b. What effect is this known as?

_____

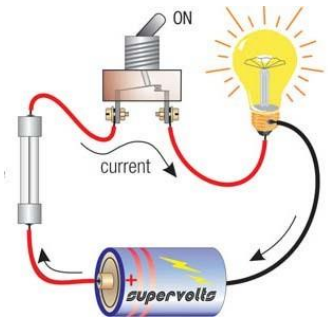
c. State an electrical application for this effect.

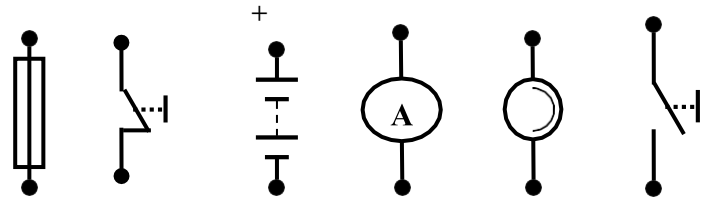
_____

(3)

_____

4. Draw a Circuit Diagram from the basic wiring diagram using the correct component symbols. ***<u>Use a ruler or marks will be deducted.</u>***





Circuit Diagram

(4)

5. Study the picture below and answer the related questions.

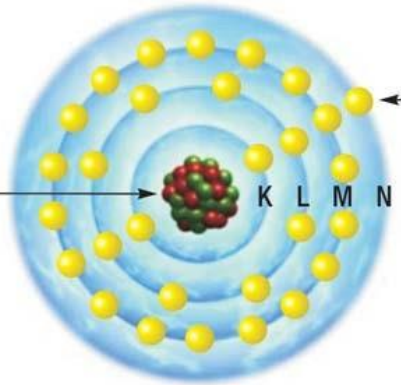
Name the ***<u>parts</u>*** of the atom which make the nucleus.

_____

_____

__

(1)



What part of an atom is this known as?

_____

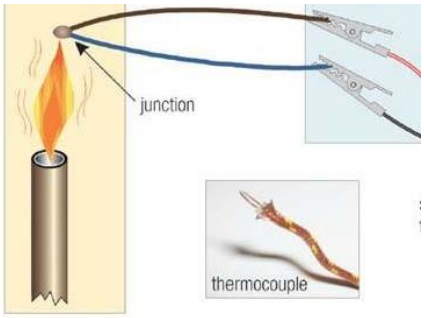
What shell is it placed in?

_____

What charge does it hold?

_____ (2)

6. Study the pictures below and state what form of energy is being converted to electrical.



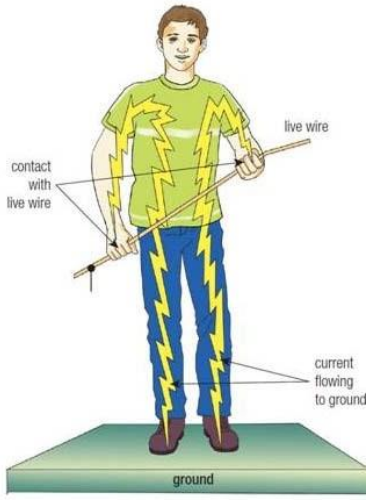
a)_____

b)_____

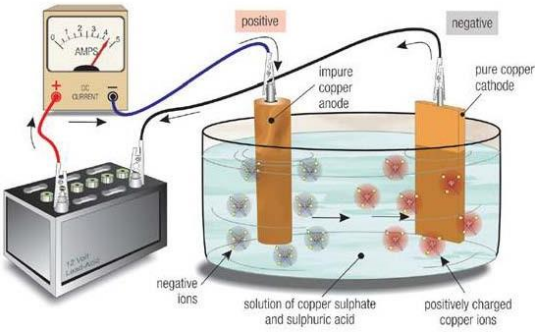
(2)

7. Electric current causes a number of effects. Name the three effects demonstrated by the images below.

a)_____



b)_____



c)_____

(3)

SECTION D – Calculations (20 Marks)

INSTRUCTIONS:
All working out must be shown ***or marks will be deducted***.

1. Convert the standard numbers to an appropriate metric prefix.

Standard Notation	**Metric prefix**
2,000,000,000 Watts	**2GW (example)**
3,900,000 Watts	
33,000 Volts	
0.002Amps	
0.000004 ohms	

(4)

2. Calculate the power consumed when a water heater draws 20 amperes from a 230V supply.

(2)

3. When a potential difference of 400 volts is applied to a resistor the current is five amperes. Calculate the value of the resistor.

(2)

4. A 230 volt supply is connected to an electric heater, with an element resistance of 22Ω. Calculate the current drawn.

(2)

5. Determine the torque, when a force of 400N is applied to a spanner with a radius of 120mm.

(3)

6. An oven is rated at 400V and its combined element resistance is 18Ω. Calculate the power dissipated.

(2)

7. Calculate the current drawn by a 15Ω, 18W resistor.

(3)

8. A Motor takes 700W of electrical power and delivers 640W of mechanical power. Calculate the efficiency.

(2)

9. Calculate the value of ***Charge*** if a lighting circuit draws 3amp for a period of 10 minutes.

(2)

10. An electric forklift truck lifts a 350kg load vertically through a distance of 1.5 metres. Calculate the work done? (*note: gravity = 9.8m/s^2*)

(3)

Note: The symbols used on this sheet follow AS1046 pt 1. There are alternate recognised symbols in use. The list does not contain every equation used in the course. Transposition of equations will be necessary to solve problems

$$Q = It \qquad v = \frac{s}{t} \qquad a = \frac{\Delta v}{t}$$

$$F = ma \qquad W = Fs \qquad W = mgh$$

$$W = Pt \qquad \eta\% = \frac{output}{input} \times \frac{100}{1} \qquad I = \frac{V}{R}$$

$$P = VI \qquad P = I^2R \qquad P = \frac{V^2}{R}$$

$$R_2 = \frac{R_1 A_1 l_2}{A_2 l_1} \qquad R_h = R_c(1 + \alpha\Delta t) \qquad R = \frac{\rho l}{A}$$

$$R_T = R_1 + R_2 + R_3 \qquad V_T = V_1 + V_2 + V_3 \qquad \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$I_T = I_1 + I_2 + I_3 \qquad V_2 = V_T \frac{R_2}{R_1 + R_2} \qquad I_2 = I_T \frac{R_1}{R_1 + R_2}$$

$$R_x = \frac{R_A R}{R_B} \qquad C = \frac{Q}{V} \qquad \tau = RC$$

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \qquad C_T = C_1 + C_2 + C_3 \qquad C = \frac{A\varepsilon_o\varepsilon_r}{d}$$

$$F_m = IN \qquad H = \frac{F_m}{l} \qquad B = \frac{\Phi}{A}$$

$$\Phi = \frac{F_m}{S} \qquad S = \frac{l}{\mu_o \mu_r A} \qquad V = N\frac{\Delta\Phi}{\Delta t}$$

$$e = Blv \qquad L = \frac{\mu_o \mu_r A N^2}{l} \qquad L = N\frac{\Delta\Phi}{\Delta I}$$

$$V = L\frac{\Delta I}{\Delta t} \qquad \tau = \frac{L}{R} \qquad F = BIl$$

$$T = Fr \qquad E_g = \frac{\Phi ZnP}{60a} \qquad P = \frac{2\pi nT}{60}$$

$$t = \frac{1}{f} \qquad f = \frac{np}{120} \qquad V = 0.707V_{\max}$$

$$I = 0.707I_{\max} \qquad V_{ave} = 0.637V_{\max} \qquad I_{ave} = 0.637I_{\max}$$

$$v = V_{\max}\sin\phi \qquad i = I_{\max}\sin\phi \qquad I = \frac{V}{Z}$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} \qquad X_L = 2\pi fL \qquad X_C = \frac{1}{2\pi fC}$$

$$\cos\phi = \frac{P}{S}$$

$$\cos\phi = \frac{R}{Z}$$

$$S = \sqrt{P^2 + Q^2}$$

$$S = VI$$

$$P = VI\cos\phi$$

$$Q = VI\sin\phi$$

$$f_o = \frac{1}{2\pi\sqrt{LC}}$$

$$V_L = \sqrt{3}V_P$$

$$I_L = \sqrt{3}I_P$$

$$S = \sqrt{3}V_L I_L$$

$$P = \sqrt{3}V_L I_L \cos\phi$$

$$Q = \sqrt{3}V_L I_L \sin\phi$$

$$\tan\phi = \sqrt{3}\left(\frac{W_2 - W_1}{W_2 + W_1}\right)$$

$$Q = mC\Delta t$$

$$V' = 4.44\Phi fN$$

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$

$$\frac{I_2}{I_1} = \frac{N_1}{N_2}$$

$$N_{syn} = \frac{120f}{p}$$

$$s\% = \frac{(n_{syn} - n)}{n_{syn}} \times \frac{100}{1}$$

$$f_r = \frac{s\% \times f}{100}$$

$$V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{FL}} \times \frac{100}{1}$$

$$V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{NL}} \times \frac{100}{1}$$

$$T = \frac{\Phi ZIP}{2\pi a}$$

$$I_{ST} = \frac{1}{3} \times I_{DOL}$$

$$T_{ST} = \frac{1}{3} \times T_{DOL}$$

$$I_{ST} = \frac{V_{ST}}{V} \times I_{DOL}$$

$$T_{ST} = \left(\frac{V_{ST}}{V}\right)^2 \times T_{DOL}$$

$$I_{motor\,st} = \frac{\%TAP}{100} \times I_{DOL}$$

$$I_{line\,st} = \left(\frac{\%TAP}{100}\right)^2 \times I_{DOL}$$

$$E = \frac{\Phi_v}{A}$$

$$E = \frac{I}{d^2}$$

$$\eta_v = \frac{\Phi_v}{P}$$

$$V_L = 0.45V_{ac}$$

$$V_L = 0.9V_{ac}$$

$$V_L = 1.17V_{phase}$$

$$V_L = 1.35V_{line}$$

$$PRV = \sqrt{2}V_{ac}$$

$$PRV = 2\sqrt{2}V_{ac}$$

$$PRV = 2.45V_{ac}$$

$$V_{ripple} = \sqrt{2}V_{ac}$$

$$V_{ripple} = 0.707V_{phase}$$

$$V_{ripple} = 0.1895V_{line}$$

Student Name : _____

Class : _____

ANSWER SHEET

Section A (Multi-choice Questions)

Instructions:

Enter your personal details in the top right hand corner of this sheet.
Place an **X** in box of your choice. If you make a mistake, circle your answer ⊗ and choose again.

Question	A.	B.	C.	D.
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Totals				

Question	A.	B.	C.	D.
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
Totals				

Total Marks Section A:_____