SYDNEY INSTITUTE
TAFE NSW Ultimo College

Student Name : ___*KEY*_____

Class : _____PM_____

Date : __13/Mar/13_____

20222 Certificate III Electrotechnology Electrician

D.C. Circuits PRACTICAL TEST 1A

PHILIPS Chapters 1-4

Time allowed – 30 min

3 Pages in this Question Booklet

OBSERVE SAFE WORKING PRACTICES DURING THIS PRACTICAL TEST

Instructions:

- All answers to be entered on the answer sheet provided
- All work to be performed on an individual basis
- Total marks for this test is 15

Equipment Required:

- DC power supply
- 0-20V DC analog voltmeter
- 0 to 1A DC analog ammeter
- Lamp and lampholder – 12 V, 5 watt
- Single pole switch
- Connection leads – 4 mm banana leads

SECTION	Possible Marks	Actual Marks
Circuit Wiring	5	
Circuit Connection	5	
Readings/ Calculations	5	
Total	15	

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**

Verified by (print name) __M.A.James_____. Signature ___M.A.James___ Date 18/03/13

Procedure

Step 1: Neatly draw the wiring required to enable the components below to operate correctly as a series circuit.

Step 2: Arrange the equipment on the bench to match that shown in Figure 1, then connect the components as drawn. Choose leads of a suitable length to give a neat circuit layout.

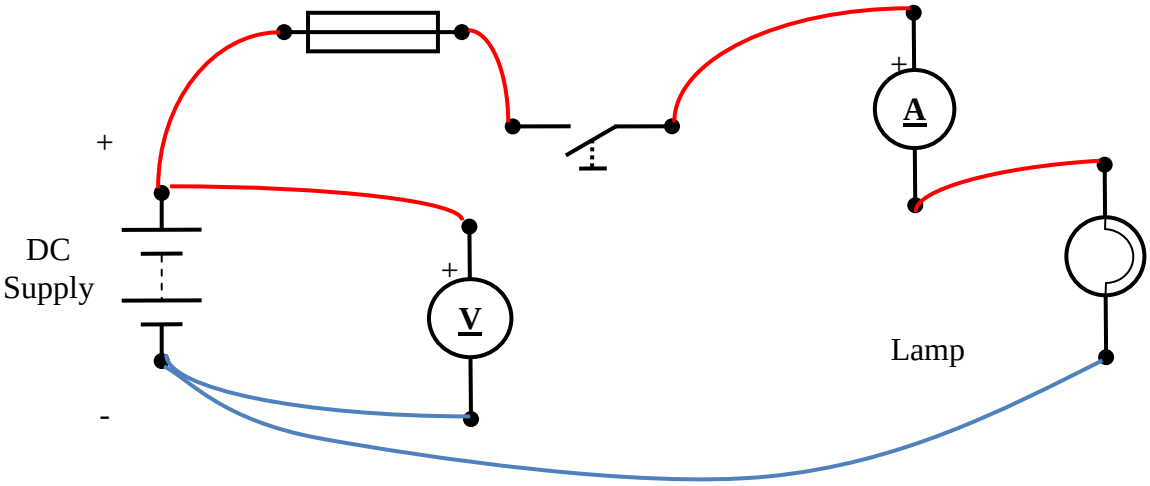

Figure 1 Electric Circuit Connections

☐ Do not proceed until the teacher has checked your circuit.

Step 3: (a) With the switch in the open position, turn on the power supply and adjust for a voltage output of **10 V.**

(b) Close the switch then measure and record (in space provided on the answer sheet) the circuit current as indicated by the ammeter.

☐ Do not proceed until the teacher has checked your results.

Step 4: Using your results from Step 3, calculate the resistance of the lamp and record it on the answer sheet in the space provided.

Step 5: Turn off the power supply, then disconnect the circuit and return all equipment to its proper place.

Practical Test 1A – Answer Sheet

Step 1: Circuit Wiring (Figure 1)

1st Try	2nd Try	Teacher Assist
5	2	0

Step 2: Circuit Connection

1st Try	2nd Try	Teacher Assist
5	2	0

Step 3: Supply Voltage V _____10Volts_____ (1 Mark)

Circuit Current I _____410-500mA___(depends on lamp) (2 Marks)

Step 4: Lamp Resistance (by calculation, show working) (2 Marks)

_____R = V/I_____

_____10/410mA_____

_____= 24.4Ω_____

Total Mark: _____/15

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20222 Certificate III Electrotechnology Electrician

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PHILIPS Chapters 1-4

Time allowed – 30 min

3 Pages in this Question Booklet

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Instructions:

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Verified by (print name) M.A.James. Signature *M.A.James* Date *18/03/13*

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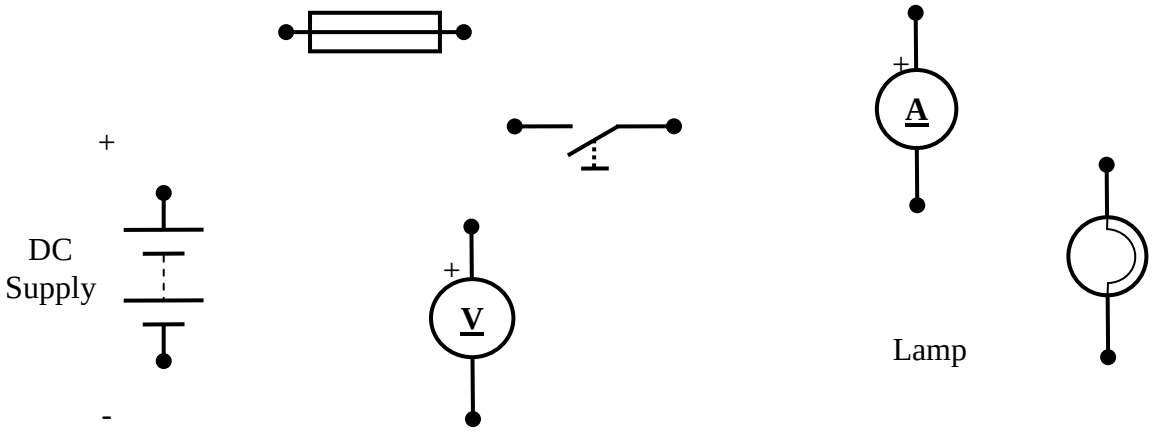

Figure 1 Electric Circuit Connections

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5	2	0

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1st Try	2nd Try	Teacher Assist
5	2	0

Step 3: Supply Voltage V _____ (1 Mark)

Circuit Current I _____ (2 Marks)

Step 4: Lamp Resistance (by calculation, show working) (2 Marks)

_____

_____

_____

Total Mark: _____/15

SYDNEY INSTITUTE
TAFE NSW Ultimo College

Student Name:_____
Class : _____
Date : _____

KEY
PM
2013

20222 Certificate III Electrotechnology Electrician

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.
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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. 12.57×10^{-7}
   C. 6.24
   D. 6.24×10^{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) ___Safety for Yourself & Others__

b) __Cooperate with Employer._____Report any H & S Issues

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

a) ___Renewable Energy_____

b) ___Energy Efficiency_____

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

a) ___Mechanical_____

b) ___Chemical_____

c) ___Light _____ Heat_____

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

a) _____Halved_____

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

b) __Wind____Wave____Hydro____Geothermal _____

c) ____Solar_____etc..._____

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

a) _____Photo Voltaic_____

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

a) _____Voltage applied_____

b) _____Resistance of the body (current path)_____

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

a) _____Electrical Supply_____

b) _____Industrial_____

c) _____Commercial & Domestic_____

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

a) _____Negative_____

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

a) _____Opposition to Current Flow_____

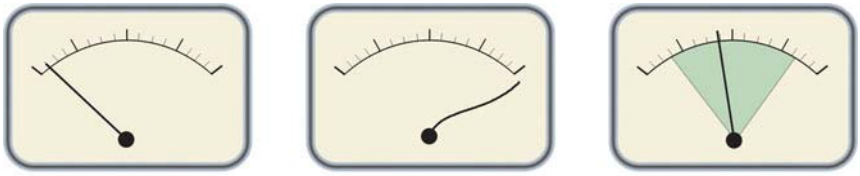
11. What is the relationship between kinetic and potential energy? (2)

a) _____Potential is Stored Energy_____

b) _____Kinetic is Energy in Motion_____

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

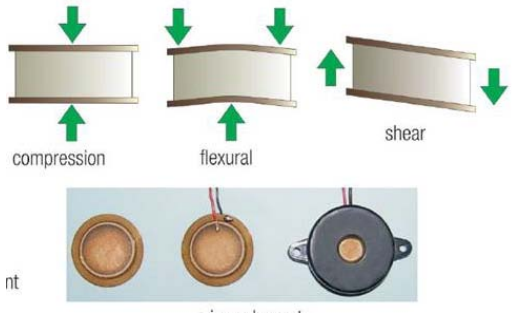
(2)

2. Complete the table below for electrical quantities.

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

(3)

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



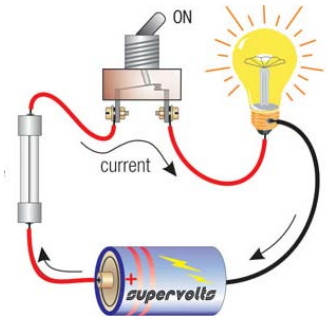
a. What is being produced by placing this material under pressure?
____Voltage_____

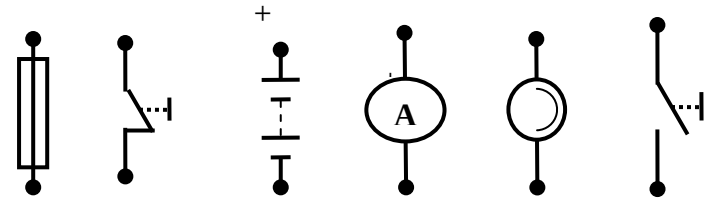
b. What effect is this known as?
_____Piezo Electric_____

c. State an electrical application for this effect.
_Microphone, _Guitar Pick Ups, _Electronic lighters,_ etc__

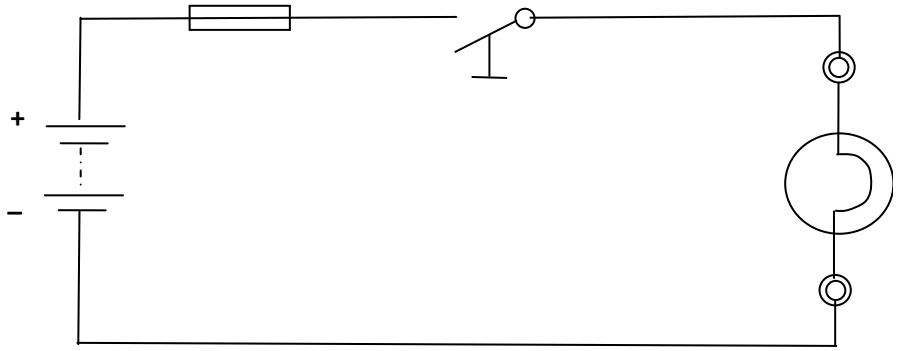
(3)

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





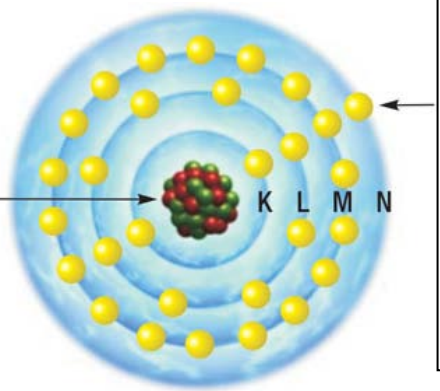
Circuit Diagram



(4)

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

Name the ***parts*** of the atom which make the nucleus.
____Protons
_____Neutrons_____
(1)

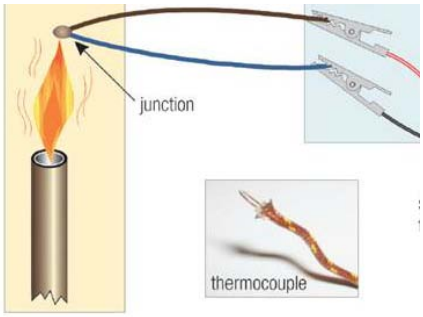


What part of an atom is this known as?
____Electron___

What shell is it placed in?
__Valence___

What charge does it hold?
___Negative____
(2)

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



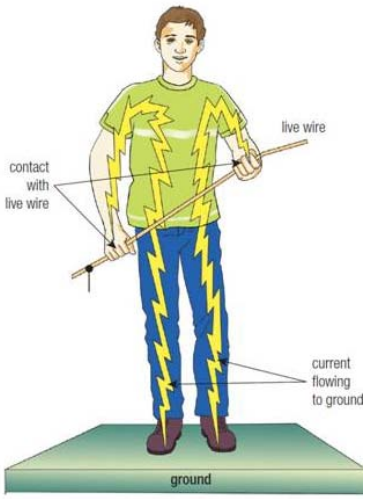
a)__Heat__

b)___Light___

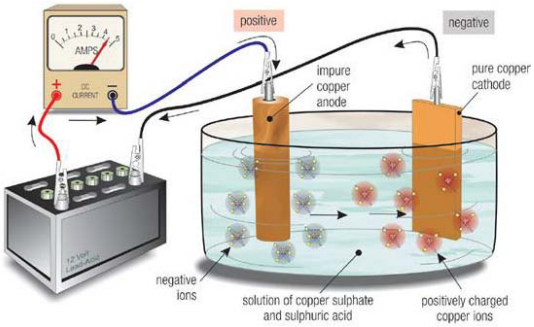
(2)

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

a)__Magnetic___



b)___Physiological_____



c)____Chemical____

(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	3.9M*W*
33,000 Volts	33kV
0.002Amps	2mA
0.000004 ohms	4μΩ

(4)

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

4600W. Preferred written as 4.6kW

(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.

80Ω

(2)

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

10.45A

(2)

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

48Nm

(3)

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

8888.88W. Prefered written as 8.9kW

(2)

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

1.1Amp

(3)

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

91.4%

(2)

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

1800C.

(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*)

Options a) Force = ma = 350 x 9.8 = 3430N

W = Fd = 3430 x 1.5 = 5145 Joules

Option b) *W* = mgh = 350 x 9.8 x 1.5 = 5145 Joules

(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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\cos\phi = \frac{P}{S} \qquad \cos\phi = \frac{R}{Z} \qquad S = \sqrt{P^2 + Q^2}$$

$$S = VI \qquad P = VI\cos\phi \qquad Q = VI\sin\phi$$

$$f_o = \frac{1}{2\pi\sqrt{LC}} \qquad V_L = \sqrt{3}V_P \qquad I_L = \sqrt{3}I_P$$

$$S = \sqrt{3}V_L I_L \qquad P = \sqrt{3}V_L I_L \cos\phi \qquad Q = \sqrt{3}V_L I_L \sin\phi$$

$$\tan\phi = \sqrt{3}\left(\frac{W_2 - W_1}{W_2 + W_1}\right) \qquad Q = mC\Delta t$$

$$V' = 4.44\Phi fN \qquad \frac{V_1}{V_2} = \frac{N_1}{N_2} \qquad \frac{I_2}{I_1} = \frac{N_1}{N_2}$$

$$N_{syn} = \frac{120f}{p} \qquad s\% = \frac{(n_{syn} - n)}{n_{syn}} \times \frac{100}{1} \qquad f_r = \frac{s\% \times f}{100}$$

$$V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{FL}} \times \frac{100}{1} \qquad V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{NL}} \times \frac{100}{1} \qquad T = \frac{\Phi ZIP}{2\pi a}$$

$$I_{ST} = \frac{1}{3} \times I_{DOL} \qquad T_{ST} = \frac{1}{3} \times T_{DOL} \qquad I_{ST} = \frac{V_{ST}}{V} \times I_{DOL}$$

$$T_{ST} = \left(\frac{V_{ST}}{V}\right)^2 \times T_{DOL} \qquad I_{motor\,st} = \frac{\%TAP}{100} \times I_{DOL} \qquad I_{line\,st} = \left(\frac{\%TAP}{100}\right)^2 \times I_{DOL}$$

$$E = \frac{\Phi_v}{A} \qquad E = \frac{I}{d^2} \qquad \eta_v = \frac{\Phi_v}{P}$$

$$V_L = 0.45V_{ac} \qquad V_L = 0.9V_{ac} \qquad V_L = 1.17V_{phase}$$

$$V_L = 1.35V_{line} \qquad PRV = \sqrt{2}V_{ac} \qquad PRV = 2\sqrt{2}V_{ac}$$

$$PRV = 2.45V_{ac} \qquad V_{ripple} = \sqrt{2}V_{ac} \qquad V_{ripple} = 0.707V_{phase}$$

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

Student Name : ____KEY____

Class : ____PM 2013_____

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				X
2	X			
3			X	
4			X	
5		X		
6	X			
7			X	
8				X
9				X
10		X		
Totals				

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

Total Marks Section A: _____

SYDNEY INSTITUTE
TAFE NSW
Ultimo College

Student Name:_____

Class : _____

Date : _____

20222 Certificate III Electrotechnology Electrician

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:

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Verified by (print name) M.A.James. Signature *M.A. James* Date 13/03/13

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^{x1018}

(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) _____

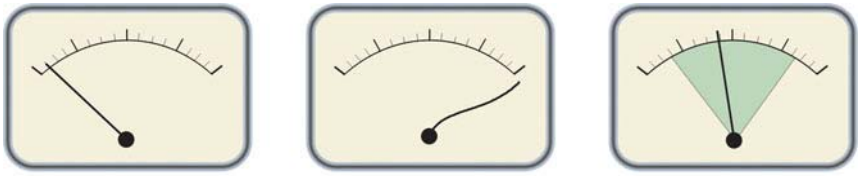
11. What is the relationship between kinetic and potential energy? (2)

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

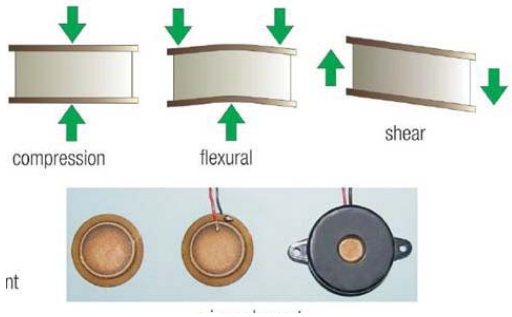
(2)

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?

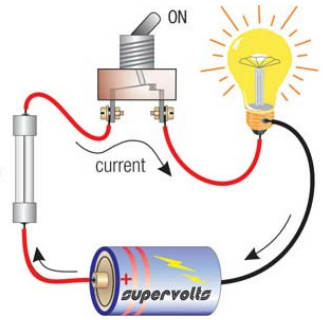
_____

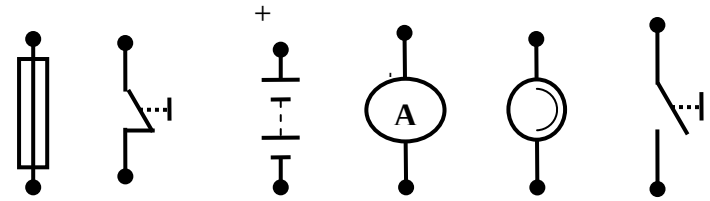
c. State an electrical application for this effect.

_____

(3)

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





Circuit Diagram

(4)

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

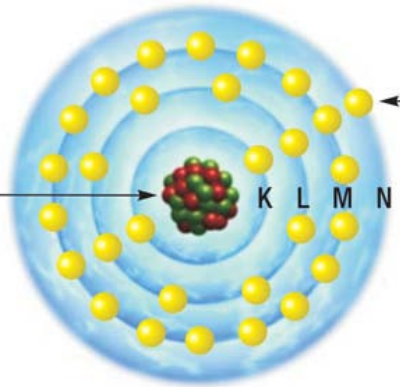
Name the ***parts*** of the atom which make the nucleus.

_____

_____

—

(1)



What part of an atom is this known as?

_____

What shell is it placed in?

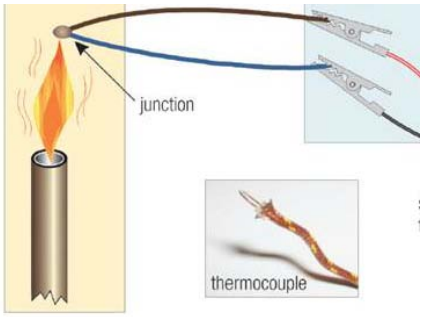
_____

What charge does it hold?

_____

(2)

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



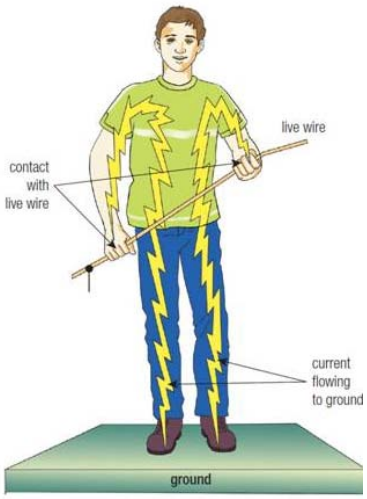
a)_____

b)_____

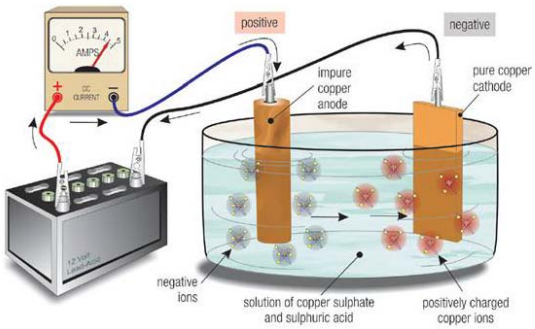
(2)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\cos\phi = \frac{P}{S} \qquad \cos\phi = \frac{R}{Z} \qquad S = \sqrt{P^2 + Q^2}$$

$$S = VI \qquad P = VI\cos\phi \qquad Q = VI\sin\phi$$

$$f_o = \frac{1}{2\pi\sqrt{LC}} \qquad V_L = \sqrt{3}V_P \qquad I_L = \sqrt{3}I_P$$

$$S = \sqrt{3}V_L I_L \qquad P = \sqrt{3}V_L I_L \cos\phi \qquad Q = \sqrt{3}V_L I_L \sin\phi$$

$$\tan\phi = \sqrt{3}\left(\frac{W_2 - W_1}{W_2 + W_1}\right) \qquad Q = mC\Delta t$$

$$V' = 4.44\Phi fN \qquad \frac{V_1}{V_2} = \frac{N_1}{N_2} \qquad \frac{I_2}{I_1} = \frac{N_1}{N_2}$$

$$N_{syn} = \frac{120f}{p} \qquad s\% = \frac{(n_{syn} - n)}{n_{syn}} \times \frac{100}{1} \qquad f_r = \frac{s\% \times f}{100}$$

$$V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{FL}} \times \frac{100}{1} \qquad V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{NL}} \times \frac{100}{1} \qquad T = \frac{\Phi ZIP}{2\pi a}$$

$$I_{ST} = \frac{1}{3} \times I_{DOL} \qquad T_{ST} = \frac{1}{3} \times T_{DOL} \qquad I_{ST} = \frac{V_{ST}}{V} \times I_{DOL}$$

$$T_{ST} = \left(\frac{V_{ST}}{V}\right)^2 \times T_{DOL} \qquad I_{motor\,st} = \frac{\%TAP}{100} \times I_{DOL} \qquad I_{line\,st} = \left(\frac{\%TAP}{100}\right)^2 \times I_{DOL}$$

$$E = \frac{\Phi_v}{A} \qquad E = \frac{I}{d^2} \qquad \eta_v = \frac{\Phi_v}{P}$$

$$V_L = 0.45V_{ac} \qquad V_L = 0.9V_{ac} \qquad V_L = 1.17V_{phase}$$

$$V_L = 1.35V_{line} \qquad PRV = \sqrt{2}V_{ac} \qquad PRV = 2\sqrt{2}V_{ac}$$

$$PRV = 2.45V_{ac} \qquad V_{ripple} = \sqrt{2}V_{ac} \qquad V_{ripple} = 0.707V_{phase}$$

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

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: _____

SYDNEY INSTITUTE
TAFE NSW Ultimo College

Student Name:___
Class : ___
Date : ___

KEY
PM
March 2013

20222 Certificate III Electrotechnology Electrician

D.C. Circuits PRACTICAL TEST 2A

PHILIPS Chapters 5-7

Time allowed – 45 Minutes

4 Pages in this Question Booklet

OBSERVE SAFE WORKING PRACTICES DURING THIS PRACTICAL TEST

Instructions:

- All answers to be entered on the answer sheet provided
- All work to be performed on an individual basis
- Total marks for this test is 10

Equipment Required:

- DC power supply
- 0-20V DC analog voltmeter
- 0 to 500 mA DC analog ammeter
- Multimeter
- Five resistors, R1, R2, R3, R4 and R5 all of unknown value
- Single pole switch
- Connection leads – 4 mm banana leads

SECTION	Possible Marks	Actual Marks
Series Circuit	15	
Parallel circuit	15	
Total	30	

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**

Verified by (print name) M.A.James. Signature M.A. James Date 18/03/13

Procedure

Step 1: Arrange the equipment on the bench in a neat and logical manner, and then connect the circuit shown in Figure 1. Choose leads of a suitable length to give a neat circuit layout.

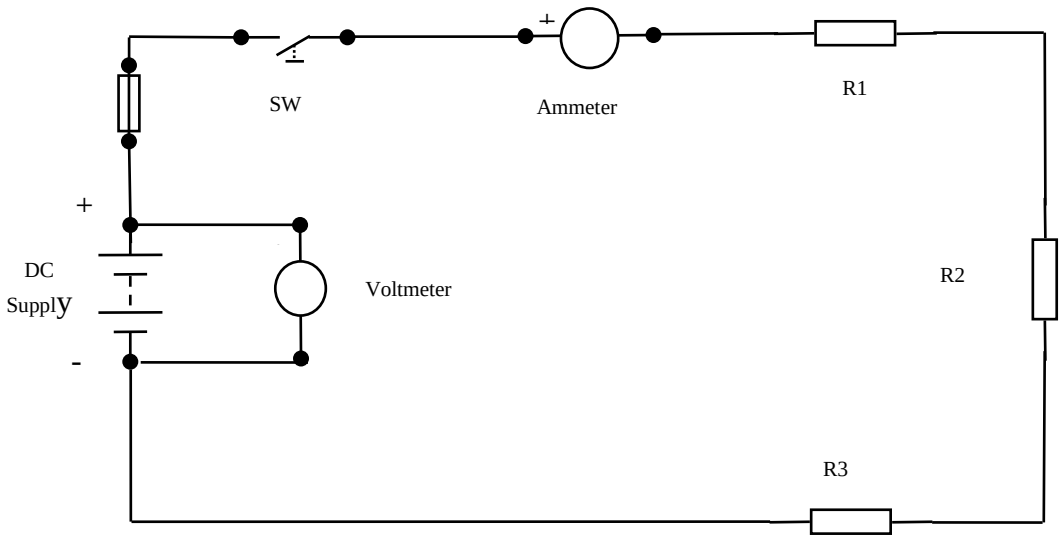


Figure 1

Do not proceed until the teacher has checked your circuit.

Step 2: With the switch in the open position, turn on the power supply and adjust it for an output voltage of **14.5 V.**

Close the switch then measure and record **(in the space provided on the answer sheet**) the circuit current (I).

Step 3: Open the switch and remove the ammeter from the circuit. Check that the output of the power supply has not changed, and readjust if necessary.

Close the switch then using the voltmeter, measure the voltage drop across each resistor (**V_{R1}, V_{R2} and V_{R3}**). Record these readings in the space provided on the answer sheet.

Step 4: Turn off the power supply and disconnect it from the circuit. Also disconnect the voltmeter from the circuit.

Using the multimeter, measure the total resistance (**R_T**) of the circuit and record the result in the space provided on the answer sheet.

Do not proceed until the teacher has checked your results.

Step 5: Connect the circuit shown in Figure 2 below.

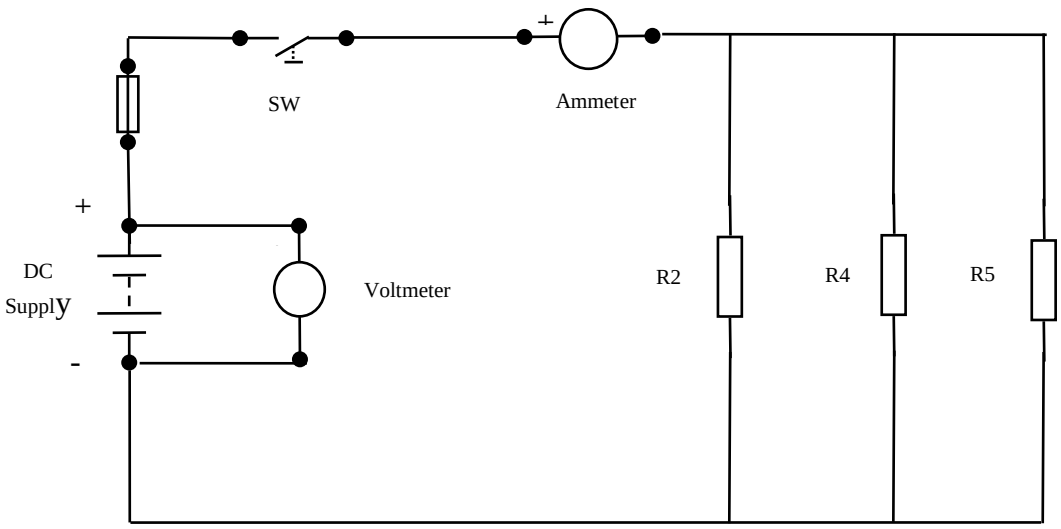


Figure 2

Do not proceed until the teacher has checked your circuit.

Step 6: Turn on the power supply, close the switch, and adjust the voltage output from the power supply to give a total circuit current of **450 mA**.

Measure the voltage ($\mathbf{V_S}$) supplying the circuit and record this value in the space provided on the answer sheet.

Step 7: Use the ammeter to measure the current flowing through the resistors **($\mathbf{I_{R2}}$, $\mathbf{I_{R4}}$ and $\mathbf{I_{R5}}$)** and record the values in the spaces provided on the answer sheet. ***(Note: open the switch before reconnecting the ammeter for each measurement).***

Turn off the power supply and disconnect it from the circuit. Also disconnect the voltmeter and ammeter from the circuit.

Using the multimeter, measure the total resistance ($\mathbf{R_T}$) of the circuit and record the result in the space provided on the answer sheet.

Do not proceed until the teacher has checked your results.

Step 8: Disconnect the circuit and return all the equipment to its proper place.

Practical Test 2A – Answer Sheet

Name: _____ Total Mark: _____/30

Class: KEY
PM
March 2013

Date : _____

Series circuit

CIRCUIT CONNECTION

1st Try	2nd Try	Teacher Assist
5	2	0

Measured Value	Measured Values & Units	Marks
I	250mA	2
V_{R1}	3.68V	2
V_{R2}	8.18V	2
V_{R3}	2.49V	2
R_T	58.7Ω	2

Parallel circuit

CIRCUIT CONNECTION

1st Try	2nd Try	Teacher Assist
5	2	0

Measured Value	Measured Values & Units	Marks
V_S	8.05V	2
I_{R2}	280mA	2
I_{R4}	130mA	2
I_{R5}	90mA	2
R_T	18Ω	2

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TAFE NSW Ultimo College

Student Name:_____

Class : _____

Date : _____

20222 Certificate III Electrotechnology Electrician

D.C. Circuits PRACTICAL TEST 2A

PHILIPS Chapters 5-7

Time allowed – 45 Minutes

4 Pages in this Question Booklet

OBSERVE SAFE WORKING PRACTICES DURING THIS PRACTICAL TEST

Instructions:

- All answers to be entered on the answer sheet provided
- All work to be performed on an individual basis
- Total marks for this test is 10

Equipment Required:

- DC power supply
- 0-20V DC analog voltmeter
- 0 to 500 mA DC analog ammeter
- Multimeter
- Five resistors, R1, R2, R3, R4 and R5 all of unknown value
- Single pole switch
- Connection leads – 4 mm banana leads

SECTION	Possible Marks	Actual Marks
Series Circuit	15	
Parallel circuit	15	
Total	30	

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**

Verified by (print name) M.A.James. Signature M.A.James Date 18/03/13

Procedure

Step 1: Arrange the equipment on the bench in a neat and logical manner, and then connect the circuit shown in Figure 1. Choose leads of a suitable length to give a neat circuit layout.

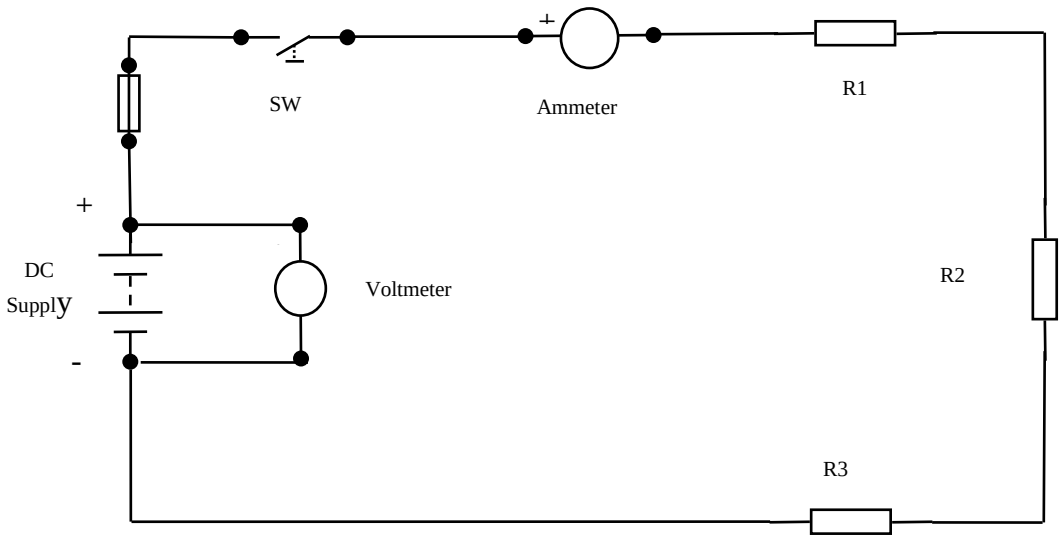


Figure 1

Do not proceed until the teacher has checked your circuit.

Step 2: With the switch in the open position, turn on the power supply and adjust it for an output voltage of **14.5 V.**

Close the switch then measure and record **(in the space provided on the answer sheet**) the circuit current (I).

Step 3: Open the switch and remove the ammeter from the circuit. Check that the output of the power supply has not changed, and readjust if necessary.

Close the switch then using the voltmeter, measure the voltage drop across each resistor (**V_{R1}, V_{R2} and V_{R3}**). Record these readings in the space provided on the answer sheet.

Step 4: Turn off the power supply and disconnect it from the circuit. Also disconnect the voltmeter from the circuit.

Using the multimeter, measure the total resistance (**R_T**) of the circuit and record the result in the space provided on the answer sheet.

Do not proceed until the teacher has checked your results.

Step 5: Connect the circuit shown in Figure 2 below.

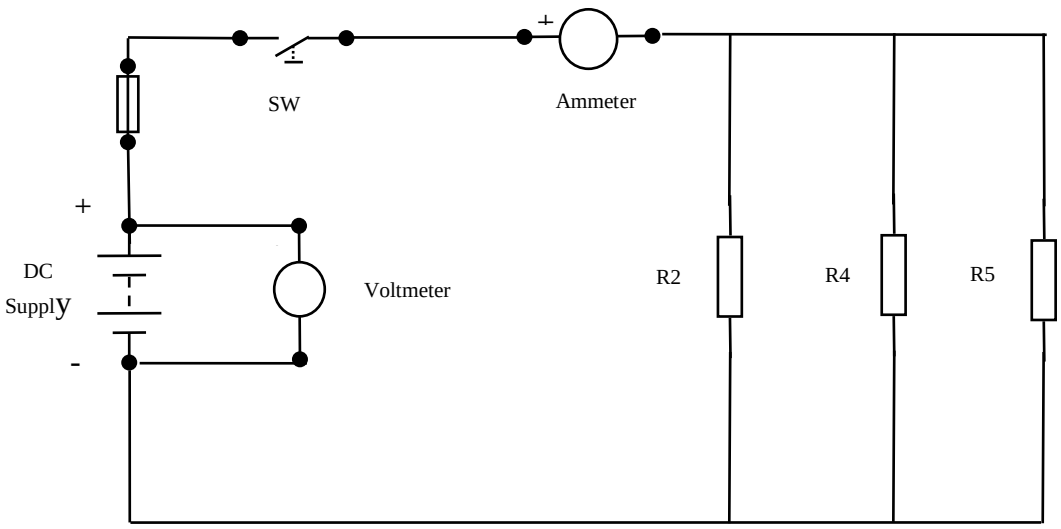


Figure 2

Do not proceed until the teacher has checked your circuit.

Step 6: Turn on the power supply, close the switch, and adjust the voltage output from the power supply to give a total circuit current of **450 mA**.

Measure the voltage ($\mathbf{V_S}$) supplying the circuit and record this value in the space provided on the answer sheet.

Step 7: Use the ammeter to measure the current flowing through the resistors **($\mathbf{I_{R2}}$, $\mathbf{I_{R4}}$ and $\mathbf{I_{R5}}$)** and record the values in the spaces provided on the answer sheet. ***(Note: open the switch before reconnecting the ammeter for each measurement).***

Turn off the power supply and disconnect it from the circuit. Also disconnect the voltmeter and ammeter from the circuit.

Using the multimeter, measure the total resistance ($\mathbf{R_T}$) of the circuit and record the result in the space provided on the answer sheet.

Do not proceed until the teacher has checked your results.

Step 8: Disconnect the circuit and return all the equipment to its proper place.

Practical Test 2A – Answer Sheet

Name: _____ Total Mark: _____/30

Class: _____

Date : _____

Series circuit

CIRCUIT CONNECTION

1st Try	2nd Try	Teacher Assist
5	2	0

Measured Value	Measured Values & Units	Marks
I		2
V_{R1}		2
V_{R2}		2
V_{R3}		2
R_T		2

Parallel circuit

CIRCUIT CONNECTION

1st Try	2nd Try	Teacher Assist
5	2	0

Measured Value	Measured Values & Units	Marks
V_S		2
I_{R2}		2
I_{R4}		2
I_{R5}		2
R_T		2

SYDNEY INSTITUTE TAFE NSW Ultimo College

Student Name : __
Class : __
Date : __

KEY
P.Murray
March 2013

20222 Certificate III Electrotechnology Electrician

D.C. Circuits TEST 2A

PHILIPS Chapters 5-7

Time allowed – 2 hours
17 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	25	
B	20	
C	18	
D	26	
TOTAL	89	

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**

Verified by (print name) M.A.James. Signature *M.A.James* Date 13/03/13

SECTION A – (25 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. A piezo-electric material will produce an e.m.f when:

   A. exposed to sunlight
   B. subjected to mechanical pressure
   C. heated
   D. passed through a magnetic field.

   (1 Mark)

2. The ability of a conductor to permit the flow of electricity is called its:

   A. conductance
   B. resistance
   C. reluctance
   D. Capacitance.

   (1 Mark)

3. A VDR is a device that changes its properties when:

   A. current varies
   B. temperature varies
   C. voltage varies
   D. light varies.

   (1 Mark)

4. The proportion of what we get out of a machine or system for what we put into it is termed the:

   A. output of the system
   B. efficiency
   C. operating losses of the system
   D. proficiency of the system.

   (1 Mark)

5. The metal often used in heating elements is

   A. nichrome
   B. copper
   C. aluminium
   D. Silver.

   (1 Mark)

Cont....

6. If the cross sectional area is increased, the resistance will be:

A. doubled
B. halved
C. increased
D. Decreased.

(1 Mark)

7. Total resistance in a series circuit is equal to the:

A. largest value resistor
B. lowest value resistor
C. sum of the resistor values connected in series
D. average of the resistors connected.

(1 Mark)

8. An open circuit in a series circuit will cause:

A. current to remain the same
B. current to stop flowing
C. current to rise
D. a doubling of the current

(1 Mark)

9. The relationship between current and voltage in a series circuit is considered:

A. logarithmic
B. inversely proportional
C. non proportional
D. proportional

(1 Mark)

10. When there's an open circuit in a branch of a parallel circuit the total power will:

A. decrease
B. increase
C. remain the same
D. stop flowing

(1 Mark)

11. The total power consumed in a parallel circuit is the:

A. sum of the power consumed by all branches of the circuit
B. voltage divided by the total resistance
C. current multiplied by the total resistance
D. Equivalent to one branch of the circuit

(1 Mark)

Cont....

12. As the temperature of a copper conductor increases, its resistance:

A. increases
B. remains unchanged
C. decreases
D. reaches a minimum value

(1 Mark)

13. If five lamps are connected in series and the second lamp develops an open circuit, there is:

A. no current flow in lamps three, four and five only
B. current flow in lamp one only
C. no current flow in lamp two only
D. no current flow in all lamps

(1 Mark)

14. If the length of a conductor is doubled and its cross sectional area is halved, its resistance would:

A. remain unchanged
B. double
C. decrease
D. quadruple

(1 Mark)

15. When selecting a resistor for a circuit, the two factors which must be considered are:

A. the resistance and the current rating
B. the resistance and the voltage rating
C. the current and the voltage rating
D. the resistance and the power rating

(1 Mark)

16. When three 30Ω Resistors are connected in parallel to each other the equivalent circuit resistance is

A. 3Ω
B. 90Ω
C. 30Ω
D. 10Ω

(1 Mark)

17. What would be the value of a resistor if it had 4K7 written on it?

A. 47 ohms
B. 0.0047 ohms
C. 4700 ohms
D. 4.7 ohms

(1 Mark)

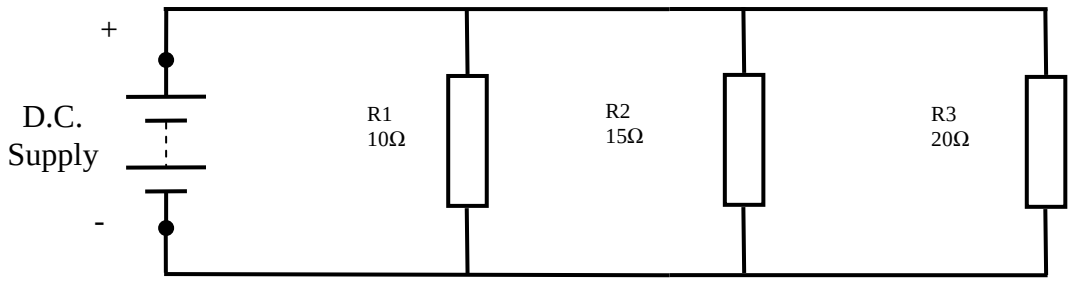


Figure 1

18. For the circuit shown in Fig.1, which resistance would have the most current flowing through it?

A. R1
B. R2
C. R3
D. the same current will flow through each resistor

(1 Mark)

19. The equivalent resistance of the circuit in Fig. 1 would be:

A. greater than R3
B. less than R1
C. greater than R1
D. the sum of R1, R2 and R3

(1 Mark)

20. If a conductor has a negative temperature coefficient, it's resistance will:

A. increase with an increase in temperature
B. decrease with an increase in temperature
C. be unaffected by a change in temperature
D. remain constant throughout the negative temperature range

(1 Mark)

21. Resistivity's unit of measurement is:

A. Degrees centigrade (℃)
B. Ohms (Ω)
C. Ohms per metre (Ω/m)
D. Metres (m)

(1 Mark)

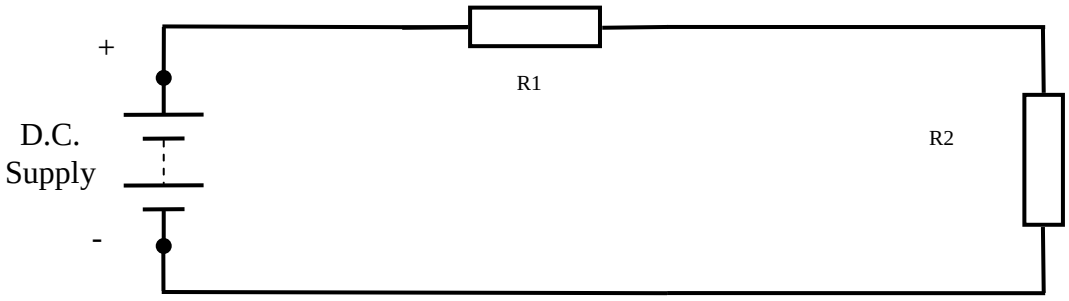


Figure 2

22. The equivalent resistance of the resistors R1 and R2 shown in Fig. 2:

A. is always smaller than the lowest value of resistance
B. is calculated by adding the two resistances
C. can only be found be using Ohm's Law
D. can only be found by using an ohmmeter

(1 Mark)

23. If resistor R2 in Fig. 2 was to develop a short circuit the equivalent resistance would:

A. increase
B. decrease
C. remain unchanged
D. quadruple

(1 Mark)

24. If the voltage applied to the circuit Fig. 2 was to be doubled, the total power consumed by the circuit would:

A. quadruple
B. halve
C. double
D. triple

(1 Mark)

25. If resistor R2 in Fig. 2 was to become an open circuit, the total resistance of the circuit would:

A. be infinity
B. decrease
C. remain unchanged
D. equal R1

(1 Mark)

SECTION B – (20 Marks)

Place the answer to each of the following questions in the appropriate place on the answer sheet.

Questions 1 to 3 refer to table 1 below.

COLOUR	VALUE	MULTIPLIER	TOLERANCE
Black	0	1	-
Brown	1	10	1%
Red	2	100	2%
Orange	3	1,000	-
Yellow	4	10,000	-
Green	5	100,000	0.5%
Blue	6	1,000,000	0.25%
Violet	7	-	0.1%
Grey	8	-	-
White	9	-	-
Gold	-	0.1	5%
Silver	-	0.01	10%

1.

(a) Using Table 1, determine the value of a resistor with the following colour bands: - Brown, Black, Red, Red

1000 +/- 2% (2)

(b) Determine the tolerance range for the resistor in question 1a

1020Ω to 980Ω (2)

2.

(a) Determine the value of a resistor with the following colour bands:- White, Grey, Blue, Red, Gold

98600 +/- 5% (2)

(b) Determine the tolerance range for the resistor in question 2a

93670Ω to 103530Ω (2)

3. Identify the colours of the four bands that would be found on a 120 Ω resistor with a range of 108 Ω to 132 Ω.

Brown Red Brown Silver (2)

4. How many current paths does a series circuit have?

One (1)

5. If four identical resistors are connected in parallel and have a total resistance of 25Ω. What are the four individual resistance values?

100Ω (1)

6. What is a common semiconductor material?

Carbon, Silicon, Germanium, etc (1)

7. What is the tolerance range of an E12 resistor?

10% (1)

8. What is the typical emf per cell of a standard lead-acid battery?

2Volts (1)

9. List the four (4) factors that affect the resistance of a conductor.

Length, C.S.A, Material, Temperature (2)

10. Give an example of where a thermistor is used and why?

Application Motor control (1)

Purpose Over temperature protection (1)

11. What type of temperature coefficient does “Constantan” have?

ZTC (1)

SECTION C – (18 Marks)

INSTRUCTIONS:
The question in this section requires some simple drawing and calculations. Ensure that the drawing is neat and legible. The use of pencil on the drawing is acceptable in this section only.

Q.1

The diagram drawn below shows the components of a circuit. Draw the connections that are required to meet the following description:

(a) R1, R2, R3 and R4 are connected in parallel

(b) The ammeter measures total circuit current

(c) The voltmeter measures the voltage across R4

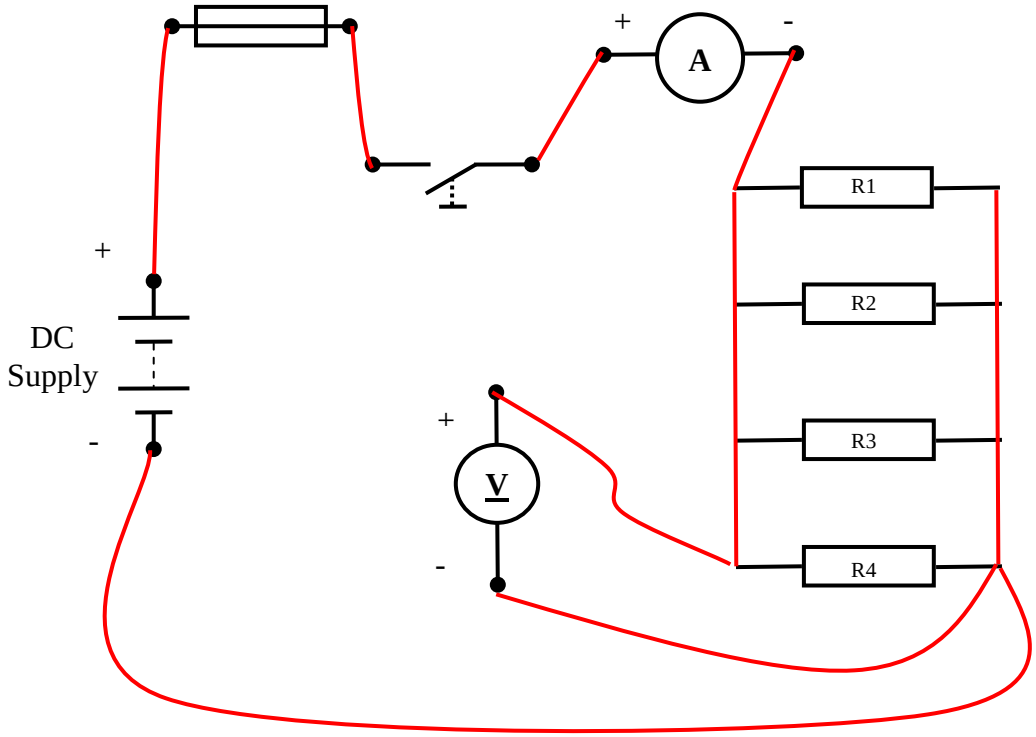


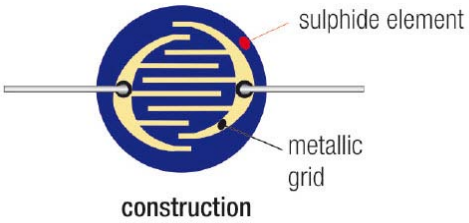
Figure 5 Electric Circuit Connections

(6)

QUESTION 2

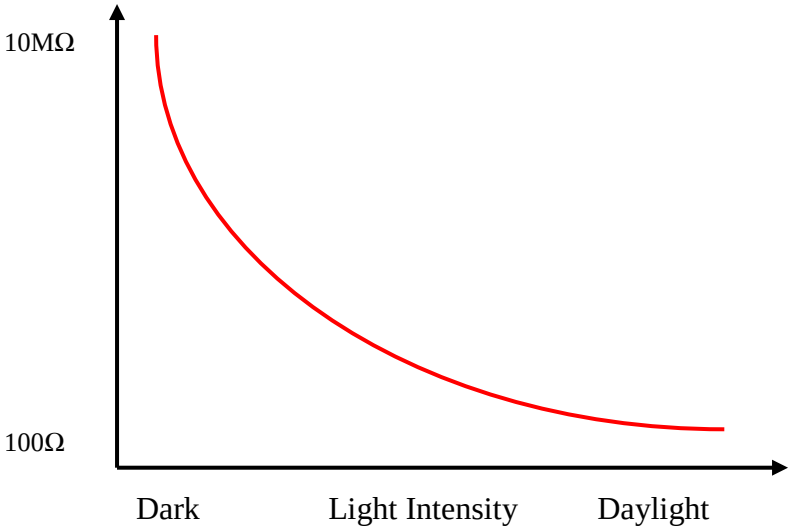
Identify the following component and sketch the resistance/light response curve and symbol.

Actual Size



Component name_____

Light Dependant Resistor



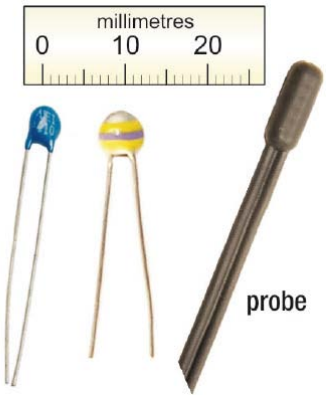
Draw its response curve

Draws its SI symbol

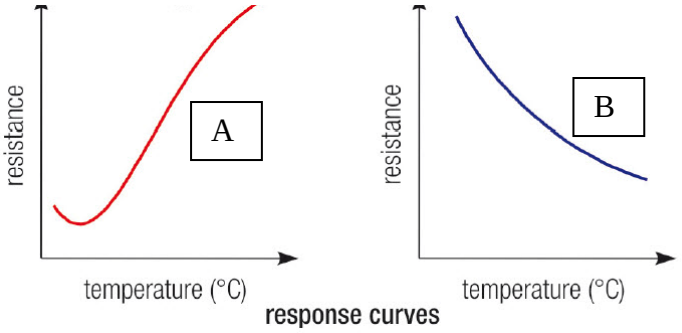
(6)

QUESTION 3

Identify the following component, temperature/resistance, response curve and draw its symbol.



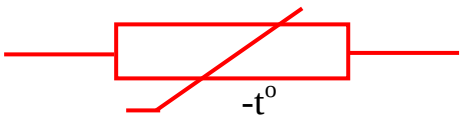
Component name_Thermistor / VDR_____



Which curve has a PTC, A or B

Curve A

Draws the symbol for response curve B



(6)

SECTION D Calculations – (26 Marks)

Show **ALL** working for your calculations.

1. A 12VdD.C supply is connected to a series circuit containing a 10Ω and a 27Ω resistor. Determine the value of current drawn.

R_T = 37Ω I_T = 324mA

(3)

2. Determine the resistance of a 180 metre length of 1.5mm^2 conductor. The resistivity of this aluminium is 2.83^{x10-8}

(2)

3.4Ω

3. If the branches of a parallel circuit dissipate 10W, 20W and 30W respectively, what amount of power is dissipated by the entire circuit?

(2)

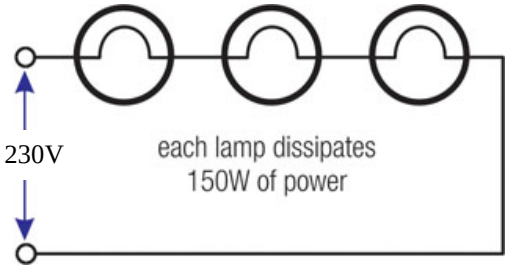
60W

4. A 160 metre long ***copper*** cable is allowed a maximum resistance of 1Ω. Determine the minimum cross sectional area of a suitable cable. The resistivity of copper is 1.72^{x10-8}

2.75mm^2

(3)

5. The circuit below has three identical lamps. Find the current flowing in the circuit



$P_T = 450W$ $I_T = 1.96A$

(3)

6. Calculate the cost of running of 1200 watt electric heater for eight hours. The cost of electricity is $0.12 per kWh.

(3)

$P_T = 1.2kw$ Energy = 9.6kWh Cost = $1.15

7. Determine the total power dissipated in a 230V parallel circuit with three resistor of value, R_1 =120 Ω, R2 = 60 Ω and R_3 = 47 Ω.

$R_T = 21.61\Omega$ $P_T = 2.45kW$

(3)

8. Find the resistance of a copper conductor at 120^0C, if it has a resistance of 25Ω at 20oC. The coefficient for copper is $0.004\Omega/^0C$.

$R_C = Rh /(1 + (0.004 \times 80)) = 18.94\Omega$

(3)

9. Calculate the following values in figure 1

a) Total resistance R_T

$R_T = 58.3\Omega$

b) Supply Voltage V_T

$V_T = I_T \times R_T = 17.5V$

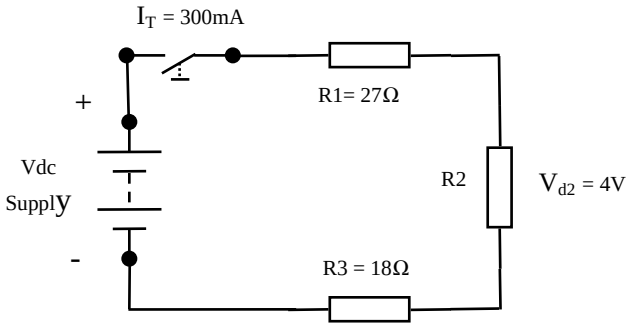


Figure 1

(4)

_____END_____

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\cos\phi = \frac{P}{S} \qquad \cos\phi = \frac{R}{Z} \qquad S = \sqrt{P^2 + Q^2}$$

$$S = VI \qquad P = VI\cos\phi \qquad Q = VI\sin\phi$$

$$f_o = \frac{1}{2\pi\sqrt{LC}} \qquad V_L = \sqrt{3}V_P \qquad I_L = \sqrt{3}I_P$$

$$S = \sqrt{3}V_L I_L \qquad P = \sqrt{3}V_L I_L \cos\phi \qquad Q = \sqrt{3}V_L I_L \sin\phi$$

$$\tan\phi = \sqrt{3}\left(\frac{W_2 - W_1}{W_2 + W_1}\right) \qquad Q = mC\Delta t$$

$$V' = 4.44\Phi fN \qquad \frac{V_1}{V_2} = \frac{N_1}{N_2} \qquad \frac{I_2}{I_1} = \frac{N_1}{N_2}$$

$$N_{syn} = \frac{120f}{p} \qquad s\% = \frac{(n_{syn} - n)}{n_{syn}} \times \frac{100}{1} \qquad f_r = \frac{s\% \times f}{100}$$

$$V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{FL}} \times \frac{100}{1} \qquad V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{NL}} \times \frac{100}{1} \qquad T = \frac{\Phi ZIP}{2\pi a}$$

$$I_{ST} = \frac{1}{3} \times I_{DOL} \qquad T_{ST} = \frac{1}{3} \times T_{DOL} \qquad I_{ST} = \frac{V_{ST}}{V} \times I_{DOL}$$

$$T_{ST} = \left(\frac{V_{ST}}{V}\right)^2 \times T_{DOL} \qquad I_{motor\,st} = \frac{\%TAP}{100} \times I_{DOL} \qquad I_{line\,st} = \left(\frac{\%TAP}{100}\right)^2 \times I_{DOL}$$

$$E = \frac{\Phi_v}{A} \qquad E = \frac{I}{d^2} \qquad \eta_v = \frac{\Phi_v}{P}$$

$$V_L = 0.45V_{ac} \qquad V_L = 0.9V_{ac} \qquad V_L = 1.17V_{phase}$$

$$V_L = 1.35V_{line} \qquad PRV = \sqrt{2}V_{ac} \qquad PRV = 2\sqrt{2}V_{ac}$$

$$PRV = 2.45V_{ac} \qquad V_{ripple} = \sqrt{2}V_{ac} \qquad V_{ripple} = 0.707V_{phase}$$

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

Student Name : KEY
P.Murray
March 2013

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		X		
2	X			
3			X	
4		X		
5	X			
6				X
7			X	
8		X		
9				X
10	X			
11	X			
12	X			
13				X
Totals				

Question	A.	B.	C.	D.
14				X
15				X
16				X
17			X	
18	X			
19		X		
20		X		
21			X	
22		X		
23		X		
24	X			
25	X			
Totals				

Total Marks Section A: _____

SYDNEY INSTITUTE TAFE NSW Ultimo College

Student Name : _____

Class : _____

Date : _____

20222 Certificate III Electrotechnology Electrician

D.C. Circuits TEST 2A

PHILIPS Chapters 5-7

Time allowed – 2 hours
17 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	25	
B	20	
C	18	
D	26	
TOTAL	89	

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.
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No	**Yes**	**No**	**No**	**Yes**	**No**	**No**

Verified by (print name) M.A.James. Signature *M.A.James* Date 13/03/13

SECTION A – (25 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. A piezo-electric material will produce an e.m.f when:

   A. exposed to sunlight
   B. subjected to mechanical pressure
   C. heated
   D. passed through a magnetic field.

(1 Mark)

2. The ability of a conductor to permit the flow of electricity is called its:

   A. conductance
   B. resistance
   C. reluctance
   D. Capacitance.

(1 Mark)

3. A VDR is a device that changes its properties when:

   A. current varies
   B. temperature varies
   C. voltage varies
   D. light varies.

(1 Mark)

4. The proportion of what we get out of a machine or system for what we put into it is termed the:

   A. output of the system
   B. efficiency
   C. operating losses of the system
   D. proficiency of the system.

(1 Mark)

5. The metal often used in heating elements is

   A. nichrome
   B. copper
   C. aluminium
   D. Silver.

(1 Mark)

Cont....

6. If the cross sectional area is increased, the resistance will be:

   A. doubled
   B. halved
   C. increased
   D. Decreased.

(1 Mark)

7. Total resistance in a series circuit is equal to the:

   A. largest value resistor
   B. lowest value resistor
   C. sum of the resistor values connected in series
   D. average of the resistors connected.

(1 Mark)

8. An open circuit in a series circuit will cause:

   A. current to remain the same
   B. current to stop flowing
   C. current to rise
   D. a doubling of the current

(1 Mark)

9. The relationship between current and voltage in a series circuit is considered:

   A. logarithmic
   B. inversely proportional
   C. non proportional
   D. proportional

(1 Mark)

10. When there's an open circuit in a branch of a parallel circuit the total power will:

   A. decrease
   B. increase
   C. remain the same
   D. stop flowing

(1 Mark)

11. The total power consumed in a parallel circuit is the:

   A. sum of the power consumed by all branches of the circuit
   B. voltage divided by the total resistance
   C. current multiplied by the total resistance
   D. Equivalent to one branch of the circuit

(1 Mark)

Cont....

12. As the temperature of a copper conductor increases, its resistance:

A. increases
B. remains unchanged
C. decreases
D. reaches a minimum value

(1 Mark)

13. If five lamps are connected in series and the second lamp develops an open circuit, there is:

A. no current flow in lamps three, four and five only
B. current flow in lamp one only
C. no current flow in lamp two only
D. no current flow in all lamps

(1 Mark)

14. If the length of a conductor is doubled and its cross sectional area is halved, its resistance would:

A. remain unchanged
B. double
C. decrease
D. quadruple

(1 Mark)

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A. the resistance and the current rating
B. the resistance and the voltage rating
C. the current and the voltage rating
D. the resistance and the power rating

(1 Mark)

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A. 3Ω
B. 90Ω
C. 30Ω
D. 10Ω

(1 Mark)

17. What would be the value of a resistor if it had 4K7 written on it?

A. 47 ohms
B. 0.0047 ohms
C. 4700 ohms
D. 4.7 ohms

(1 Mark)

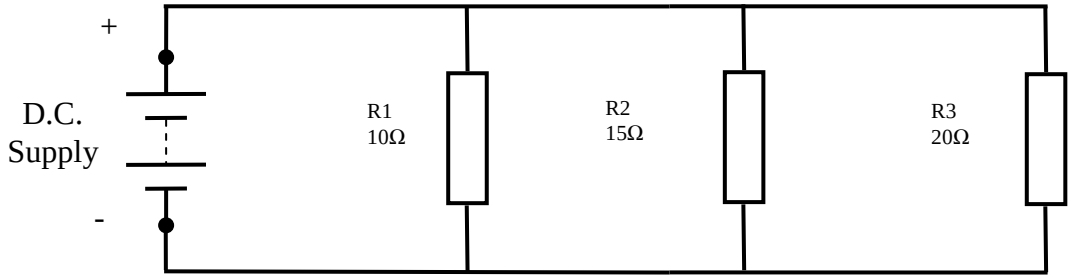


Figure 1

18. For the circuit shown in Fig.1, which resistance would have the most current flowing through it?

    A. R1
    B. R2
    C. R3
    D. the same current will flow through each resistor

(1 Mark)

19. The equivalent resistance of the circuit in Fig. 1 would be:

    A. greater than R3
    B. less than R1
    C. greater than R1
    D. the sum of R1, R2 and R3

(1 Mark)

20. If a conductor has a negative temperature coefficient, it's resistance will:

    A. increase with an increase in temperature
    B. decrease with an increase in temperature
    C. be unaffected by a change in temperature
    D. remain constant throughout the negative temperature range

(1 Mark)

21. Resistivity's unit of measurement is:

    A. Degrees centigrade (℃)
    B. Ohms (Ω)
    C. Ohms per metre (Ω/m)
    D. Metres (m)

(1 Mark)

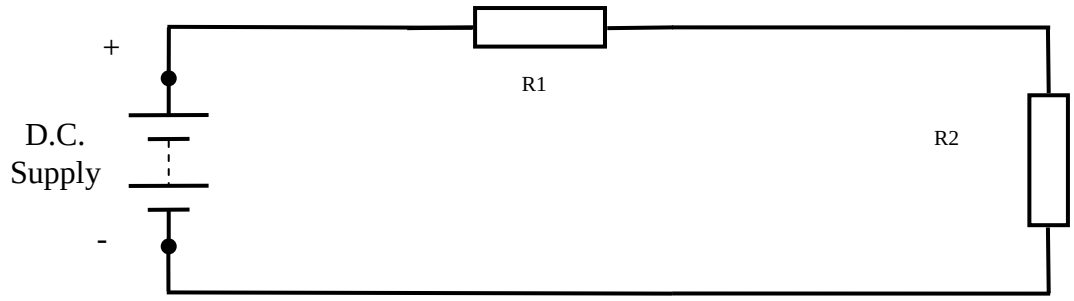


Figure 2

22. The equivalent resistance of the resistors R1 and R2 shown in Fig. 2:

A. is always smaller than the lowest value of resistance
B. is calculated by adding the two resistances
C. can only be found be using Ohm's Law
D. can only be found by using an ohmmeter

(1 Mark)

23. If resistor R2 in Fig. 2 was to develop a short circuit the equivalent resistance would:

A. increase
B. decrease
C. remain unchanged
D. quadruple

(1 Mark)

24. If the voltage applied to the circuit Fig. 2 was to be doubled, the total power consumed by the circuit would:

A. quadruple
B. halve
C. double
D. triple

(1 Mark)

25. If resistor R2 in Fig. 2 was to become an open circuit, the total resistance of the circuit would:

A. be infinity
B. decrease
C. remain unchanged
D. equal R1

(1 Mark)

SECTION B – (20 Marks)

Place the answer to each of the following questions in the appropriate place on the answer sheet.

Questions 1 to 3 refer to table 1 below.

COLOUR	VALUE	MULTIPLIER	TOLERANCE
Black	0	1	-
Brown	1	10	1%
Red	2	100	2%
Orange	3	1,000	-
Yellow	4	10,000	-
Green	5	100,000	0.5%
Blue	6	1,000,000	0.25%
Violet	7	-	0.1%
Grey	8	-	-
White	9	-	-
Gold	-	0.1	5%
Silver	-	0.01	10%

1.

(a) Using Table 1, determine the value of a resistor with the following colour bands: - Brown, Black, Red, Red

_____ (2)

(b) Determine the tolerance range for the resistor in question 1a

_____to _____ (2)

2.

(a) Determine the value of a resistor with the following colour bands:- White, Grey, Blue, Red, Gold

_____ (2)

(b) Determine the tolerance range for the resistor in question 2a

_____to_____ (2)

3. Identify the colours of the four bands that would be found on a 120 Ω resistor with a range of 108 Ω to 132 Ω.

_____

_____ (2)

4. How many current paths does a series circuit have?

_____(1)

5. If four identical resistors are connected in parallel and have a total resistance of 25Ω. What are the four individual resistance values?

_____(1)

6. What is a common semiconductor material?

_____(1)

7. What is the tolerance range of an E12 resistor?

_____(1)

8. What is the typical emf per cell of a standard lead-acid battery?

_____(1)

9. List the four (4) factors that affect the resistance of a conductor.

_____

_____ (2)

10. Give an example of where a thermistor is used and why?

Application_____(1)

Purpose _____(1)

11. What type of temperature coefficient does “Constantan” have?

_____(1)

SECTION C – (18 Marks)

INSTRUCTIONS:
The question in this section requires some simple drawing and calculations. Ensure that the drawing is neat and legible. The use of pencil on the drawing is acceptable in this section only.

Q.1

The diagram drawn below shows the components of a circuit. Using all components draw the connections that are required to meet the following description:

(a) R1, R2, R3 and R4 are connected in parallel

(b) The ammeter measures total circuit current

(c) The voltmeter measures the voltage across R4

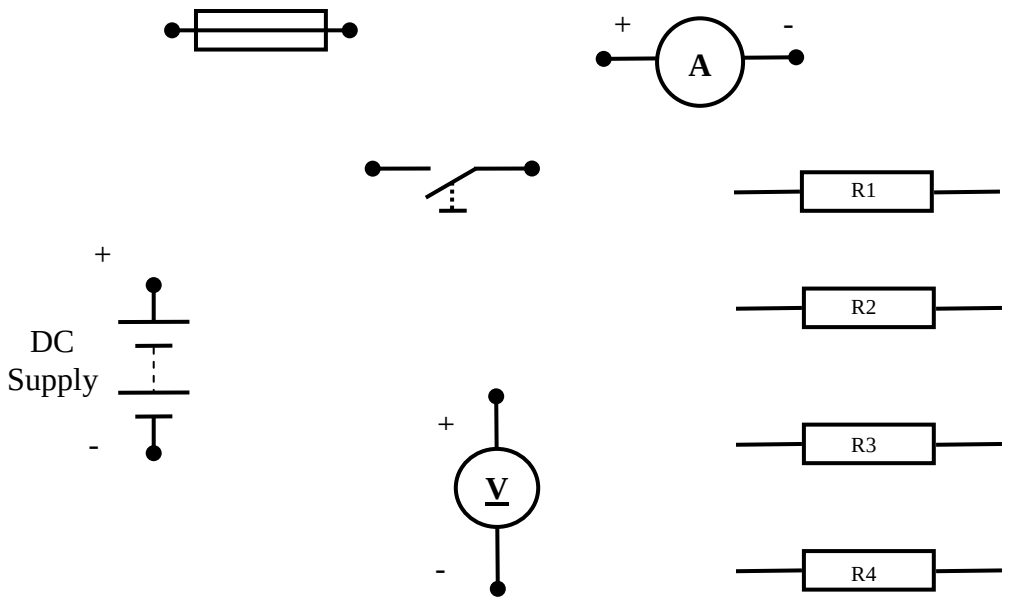


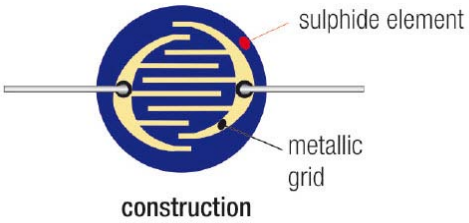
Figure 5 Electric Circuit Connections

(6)

QUESTION 2

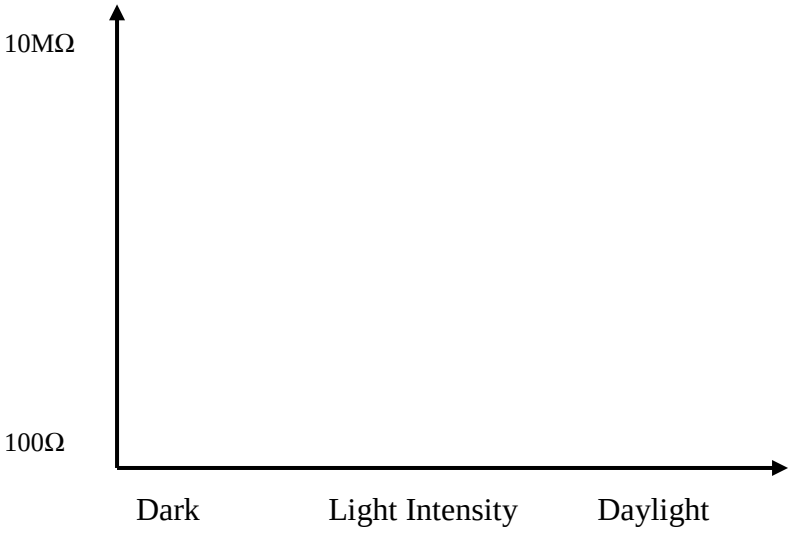
Identify the following component and sketch the resistance/light response curve and symbol.

Actual Size



Component name_____

_____



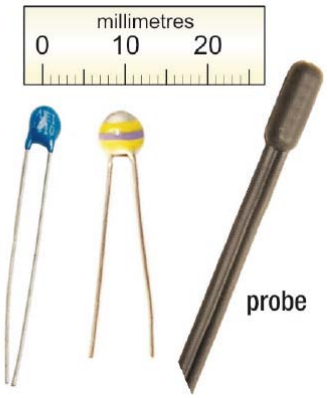
Draw its response curve

Draws its SI symbol

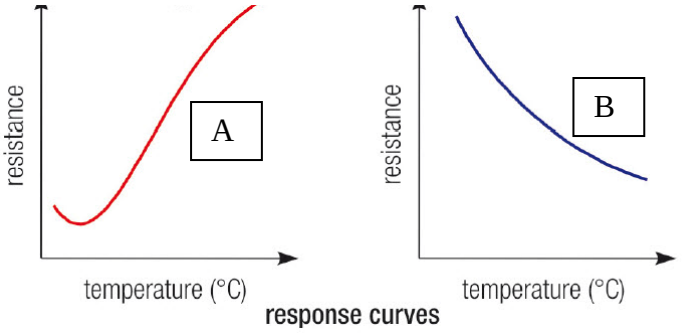
(6)

QUESTION 3

Identify the following component, temperature/resistance, response curve and draw its symbol.



Component name_____



Which curve has a PTC, A or B

_____

Draws the symbol for response curve B

(6)

SECTION D Calculations – (26 Marks)

Show **ALL** working for your calculations.

1. A 12VdD.C supply is connected to a series circuit containing a 10Ω and a 27Ω resistor. Determine the value of current drawn.

(3)

2. Determine the resistance of a 180 metre length of 1.5mm^2 conductor. The resistivity of this aluminium is 2.83^{x10-8}

(2)

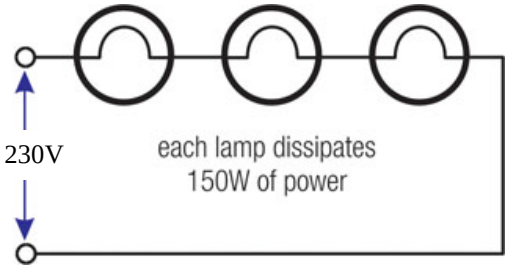
3. If the branches of a parallel circuit dissipate 10W, 20W and 30W respectively, what amount of power is dissipated by the entire circuit?

(2)

4. A 160 metre long ***copper*** cable is allowed a maximum resistance of 1Ω. Determine the minimum cross sectional area of a suitable cable. The resistivity of copper is 1.72^{x10-8}

(3)

5. The circuit below has three identical lamps. Find the current flowing in the circuit



(3)

6. Calculate the cost of running of 1200 watt electric heater for eight hours. The cost of electricity is $0.12 per kWh.

(3)

7. Determine the total power dissipated in a 230V parallel circuit with three resistor of value, R_1 =120 Ω, R2 = 60 Ω and R_3 = 47 Ω.

(3)

8. Find the resistance of a copper conductor at 120^0C, if it has a resistance of 25Ω at 200C. The coefficient for copper is $0.004\Omega/^0$C .

(3)

9. Calculate the following values in figure 1

a) Total resistance R_T

b) Supply Voltage V_T

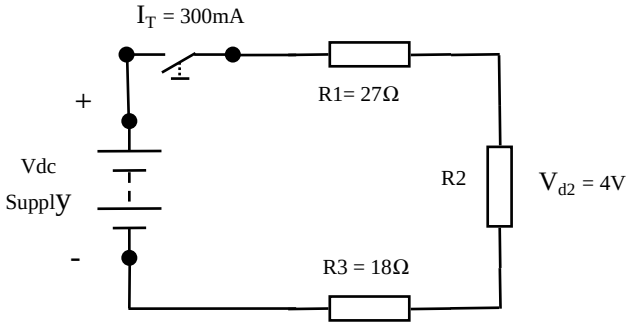


Figure 1

(4)

_____END_____

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

$Q = It$	$v = \frac{s}{t}$	$a = \frac{\Delta v}{t}$
$F = ma$	$W = Fs$	$W = mgh$
$W = Pt$	$\eta\% = \frac{output}{input} \times \frac{100}{1}$	$I = \frac{V}{R}$
$P = VI$	$P = I^2R$	$P = \frac{V^2}{R}$
$R_2 = \frac{R_1 A_1 l_2}{A_2 l_1}$	$R_h = R_c(1 + \alpha\Delta t)$	$R = \frac{\rho l}{A}$
$R_T = R_1 + R_2 + R_3$	$V_T = V_1 + V_2 + V_3$	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
$I_T = I_1 + I_2 + I_3$	$V_2 = V_T \frac{R_2}{R_1 + R_2}$	$I_2 = I_T \frac{R_1}{R_1 + R_2}$
$R_x = \frac{R_A R}{R_B}$	$C = \frac{Q}{V}$	$\tau = RC$
$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$	$C_T = C_1 + C_2 + C_3$	$C = \frac{A\varepsilon_o\varepsilon_r}{d}$
$F_m = IN$	$H = \frac{F_m}{l}$	$B = \frac{\Phi}{A}$
$\Phi = \frac{F_m}{S}$	$S = \frac{l}{\mu_o \mu_r A}$	$V = N\frac{\Delta\Phi}{\Delta t}$
$e = Blv$	$L = \frac{\mu_o \mu_r A N^2}{l}$	$L = N\frac{\Delta\Phi}{\Delta I}$
$V = L\frac{\Delta I}{\Delta t}$	$\tau = \frac{L}{R}$	$F = BIl$
$T = Fr$	$E_g = \frac{\Phi ZnP}{60a}$	$P = \frac{2\pi nT}{60}$
$t = \frac{1}{f}$	$f = \frac{np}{120}$	$V = 0.707V_{\max}$
$I = 0.707I_{\max}$	$V_{ave} = 0.637V_{\max}$	$I_{ave} = 0.637I_{\max}$
$v = V_{\max}\sin\phi$	$i = I_{\max}\sin\phi$	$I = \frac{V}{Z}$
$Z = \sqrt{R^2 + (X_L - X_C)^2}$	$X_L = 2\pi fL$	$X_C = \frac{1}{2\pi fC}$

$$\cos\phi = \frac{P}{S} \qquad \cos\phi = \frac{R}{Z} \qquad S = \sqrt{P^2 + Q^2}$$

$$S = VI \qquad P = VI\cos\phi \qquad Q = VI\sin\phi$$

$$f_o = \frac{1}{2\pi\sqrt{LC}} \qquad V_L = \sqrt{3}V_P \qquad I_L = \sqrt{3}I_P$$

$$S = \sqrt{3}V_L I_L \qquad P = \sqrt{3}V_L I_L \cos\phi \qquad Q = \sqrt{3}V_L I_L \sin\phi$$

$$\tan\phi = \sqrt{3}\left(\frac{W_2 - W_1}{W_2 + W_1}\right) \qquad Q = mC\Delta t$$

$$V' = 4.44\Phi fN \qquad \frac{V_1}{V_2} = \frac{N_1}{N_2} \qquad \frac{I_2}{I_1} = \frac{N_1}{N_2}$$

$$N_{syn} = \frac{120f}{p} \qquad s\% = \frac{(n_{syn} - n)}{n_{syn}} \times \frac{100}{1} \qquad f_r = \frac{s\% \times f}{100}$$

$$V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{FL}} \times \frac{100}{1} \qquad V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{NL}} \times \frac{100}{1} \qquad T = \frac{\Phi ZIP}{2\pi a}$$

$$I_{ST} = \frac{1}{3} \times I_{DOL} \qquad T_{ST} = \frac{1}{3} \times T_{DOL} \qquad I_{ST} = \frac{V_{ST}}{V} \times I_{DOL}$$

$$T_{ST} = \left(\frac{V_{ST}}{V}\right)^2 \times T_{DOL} \qquad I_{motor\,st} = \frac{\%TAP}{100} \times I_{DOL} \qquad I_{line\,st} = \left(\frac{\%TAP}{100}\right)^2 \times I_{DOL}$$

$$E = \frac{\Phi_v}{A} \qquad E = \frac{I}{d^2} \qquad \eta_v = \frac{\Phi_v}{P}$$

$$V_L = 0.45V_{ac} \qquad V_L = 0.9V_{ac} \qquad V_L = 1.17V_{phase}$$

$$V_L = 1.35V_{line} \qquad PRV = \sqrt{2}V_{ac} \qquad PRV = 2\sqrt{2}V_{ac}$$

$$PRV = 2.45V_{ac} \qquad V_{ripple} = \sqrt{2}V_{ac} \qquad V_{ripple} = 0.707V_{phase}$$

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

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				
11				
12				
13				
Totals				

Question	A.	B.	C.	D.
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
Totals				

Total Marks Section A: _____

SYDNEY INSTITUTE TAFE NSW Ultimo College

Student Name:____
Class : ____
Date : ____

KEY
PM
March 2013

20222 Certificate III Electrotechnology Electrician

D.C. Circuits ***Practical Test 3A***

PHILIPS Chapters 8-10

Time allowed – 45 Minutes

3 Pages in this Question Booklet

OBSERVE SAFE WORKING PRACTICES DURING THIS PRACTICAL TEST

Instructions:

- All answers to be entered on the answer sheet provided
- All work to be performed on an individual basis
- Total marks for this test is 30

Equipment Required:

- DC power supply
- 0 to 500 mA DC analog ammeter
- Multimeter
- Five resistors, R1, R2, R3, R4 and R5, all of unknown value
- Single pole switch
- Connection leads

SECTION	Possible Marks	Actual Marks
Circuit Wiring	8	
Circuit Readings	13	
Observations/Calculations	9	
Total	30	

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**

Verified by (print name) M.A.James. Signature M.A. James Date 18/03/13

Procedure

Step 1: Arrange the equipment on the bench in a neat and logical manner, and then connect the circuit shown in Figure 1.
Connect Ammeter to measure I_T **Voltmeter to measure V_S**

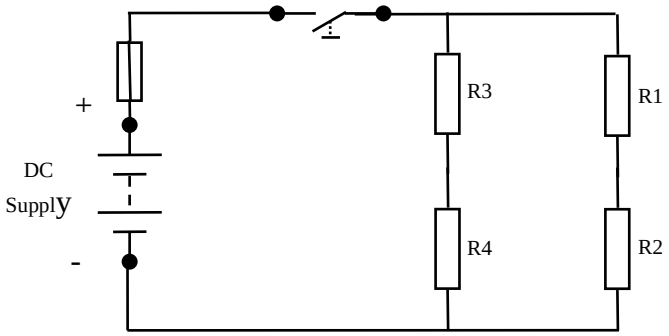


Figure 1

Circuit Connections

1st Try	2nd Try	Teacher Assist
5	3	0

Do not proceed until the teacher has checked your circuit.

Step 2: Turn on the power supply, close the circuit switch and adjust the total circuit voltage to **10 V.D.C**. Ensure that this voltage is maintained through the test.

Complete the tables below

Table 1 (2 Marks)

Supply Voltage - Vt	Circuit Current - I_T
10Vdc	320mA

Table 2 (4 Marks)

Voltage Drop – V_{R1}	Voltage Drop – V_{R2}	Voltage Drop – V_{R3}	Voltage Drop – V_{R4}
3V	7V	1.25V	8.75

Table 3 (4 Marks)

Current – I_{R1}	Current – I_{R2}	Current – I_{R3}	Current – I_{R4}
195mA	195mA	125mA	125mA

Step 3: Turn the circuit switch off. Connect resistor R_5 to the circuit as shown in Figure 2 below.

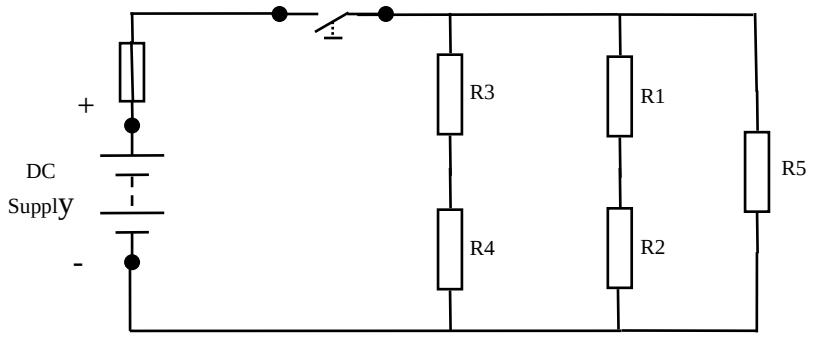


Figure 2

Circuit Connections R_5

1st Try	2nd Try	Teacher Assist
3	1	0

☐ Do not proceed until the teacher has checked your circuit and results.

Step 4: Turn the circuit switch on and adjust the total circuit voltage to 10 V.D.C. and complete table 4

Table 4 (3 Marks)

Voltage across R_5	Circuit Current - I_T
10V	440mA

Step 5: Observations – (*not calculations*)

1 *In reference to your results* which circuit dissipated the most power**,** explain your answer.

Circuit two, has lowest resistance therefore higher current & more power

(3 Marks)

2 In *reference to your results* what is the effect of adding R5 to your circuit?

a. To the supply current

Draws more current and decreases resistance

(3 Marks)

b. To equivalent resistance.

Decreases equivalent resistance

(3 Marks)

SYDNEY INSTITUTE TAFE NSW Ultimo College

Student Name:_____

Class : _____

Date : _____

20222 Certificate III Electrotechnology Electrician

D.C. Circuits Practical Test 3A

Philips Chapters 8-10

Time allowed – 45 Minutes

3 Pages in this Question Booklet

OBSERVE SAFE WORKING PRACTICES DURING THIS PRACTICAL TEST

Instructions:

- All answers to be entered on the answer sheet provided
- All work to be performed on an individual basis
- Total marks for this test is 30

Equipment Required:

- DC power supply
- 0 to 500 mA DC analog ammeter
- Multimeter
- Five resistors, R1, R2, R3, R4 and R5, all of unknown value
- Single pole switch
- Connection leads

SECTION	Possible Marks	Actual Marks
Circuit Wiring	8	
Circuit Readings	13	
Observations/Calculations	9	
Total	30	

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**

Verified by (print name) M.A.James. Signature M.A.James Date 18/03/13

Procedure

Step 1: Arrange the equipment on the bench in a neat and logical manner, and then connect the circuit shown in Figure 1.
Connect Ammeter to measure I_T **Voltmeter to measure V_S**

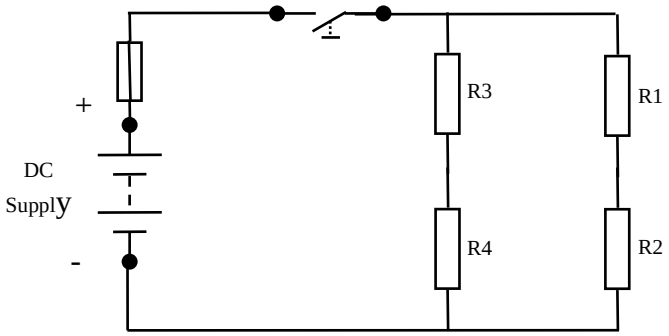


Figure 1

Circuit Connections

1st Try	2nd Try	Teacher Assist
5	3	0

Do not proceed until the teacher has checked your circuit.

Step 2: Turn on the power supply, close the circuit switch and adjust the total circuit voltage to **10 V.D.C**. Ensure that this voltage is maintained through the test.

Complete the tables below

Table 1 (2 Marks)

Supply Voltage - Vt	Circuit Current - I_T

Table 2 (4 Marks)

Voltage Drop – V_{R1}	Voltage Drop – V_{R2}	Voltage Drop – V_{R3}	Voltage Drop – V_{R4}

Table 3 (4 Marks)

Current – I_{R1}	Current – I_{R2}	Current – I_{R3}	Current – I_{R4}

Step 3: Turn the circuit switch off. Connect resistor R_5 to the circuit as shown in Figure 2 below.

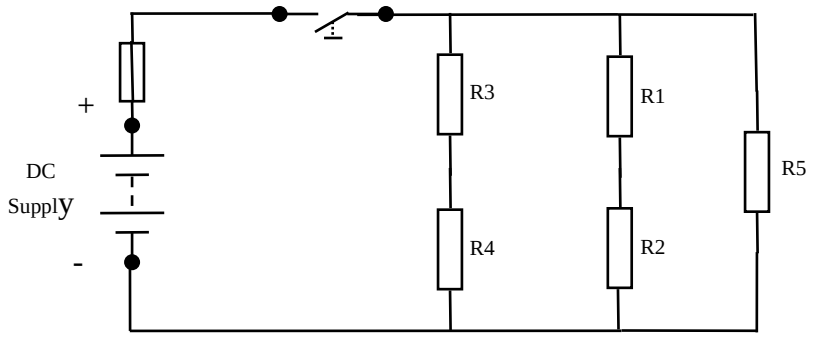


Figure 2

Circuit Connections R_5

1st Try	2nd Try	Teacher Assist
3	1	0

□ Do not proceed until the teacher has checked your circuit and results.

Step 4: Turn the circuit switch on and adjust the total circuit voltage to **10 V.D.C**. and complete table 4

Table 4 (3 Marks)

Voltage across R_5	Circuit Current - I_T

Step 5: Observations – (*not calculations*)

1 *In reference to your results* which circuit dissipated the most power**,** explain your answer.

_____

_____

_____(3 Marks)

2 In *reference to your results* what is the effect of adding R5 to your circuit?

a. To the supply current

_____

_____(3 Marks)

b. To equivalent resistance.

_____

_____(3 Marks)

SYDNEY INSTITUTE TAFE NSW Ultimo College

Student Name:___KEY_____
Class : ___P. Murray_____
Date : ___2013_____

20222 Certificate III Electrotechnology Electrician

D.C. Circuits TEST 3A

PHILIPS Chapters 8-10

Time allowed – 2 hours
18 Pages in this Question Booklet

TOTAL MARKS AVAILABLE

Aids to be supplied by College:

None

Aids to be supplied by Students:

Pen, pencil, eraser, rule, calculator

SECTION	Possible Marks	Actual Marks
A	20	
B	25	
C	28	
D	22	
TOTAL	95	

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**

Verified by (print name) __M.A.James_____. Signature ___M.A.James___ Date __12/03/2013_

SECTION A – MULTIPLE CHOICE

(1 mark per question = 20 marks)

For each question in Section A, identify the response you consider to be the best answer by placing its identifying letter in the space provided at the end of each question.

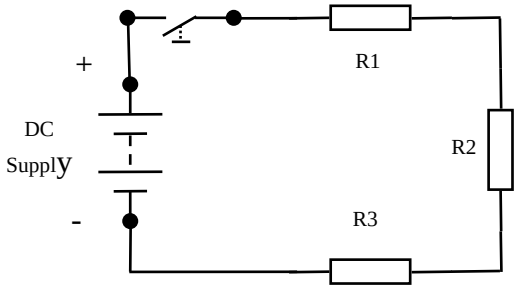


Figure 1

1. For the circuit in Figure 1, the voltage drops across R1, R2 and R3:

   A. are equal in every resistor
   B. sum to equal to the supply voltage
   C. are inversely proportional to the resistor values
   D. are inversely proportional to the value of circuit current

   (1 Mark)

2. For the circuit of Figure 1, if R1 is a 220 Ω resistor, R2 a 110 Ω and R3 a 470 Ω, the resistor which would have the largest voltage drop would be:

   A. the 220 Ω resistor
   B. the 470 Ω resistor
   C. the 110 Ω resistor
   D. they would all have the same voltage drop

   (1 Mark)

3. If resistor R1 in the circuit of Figure 1 becomes short circuited, the equivalent circuit resistance would

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

   (1 Mark)

4. The equivalent resistance (R_{EQ}) of the resistors in the circuit of Figure 1 is:

A. always less than the smallest value of resistance
B. only obtainable by measuring with an ohmmeter
C. equal to the sum of the individual resistance values
D. only obtainable by applying Ohm's Law.

(1 Mark)

5. When an analog needle moves to its furthest point this is called:

A. full scale deflection
B. maximum deflection
C. moving coil
D. fixed coil.

(1 Mark)

6. Ammeters use what to allow them to measure high currents:

A. moving iron
B. series resistor
C. capacitor
D. shunt resistor.

(1 Mark)

7. To increase the capacitance of a circuit you would:

A. use an iron core in the existing capacitor
B. connect a second capacitor in series with the existing capacitor
C. reverse the polarity of the existing capacitor
D. connect a second capacitor in parallel with the existing capacitor

(1 Mark)

8. What factor ***does not*** determine the capacitance of the capacitor

A. time constant
B. dielectric thickness
C. dielectric type
D. plate surface area

(1 Mark)

9. The thinner the dielectric of a capacitor the greater the:

A. capacitance
B. voltage rating
C. size
D. surface area

(1 Mark)

10. The symbol for a variable capacitor is a standard capacitor symbol:

A. with a cross through it
B. with a circle around it
C. with an arrow diagonally through it
D. does not exist

(1 Mark)

11. A parallel circuit is different from a series circuit as it has:

A. fewer current paths
B. more than one current path
C. only one current path
D. no current paths

(1 Mark)

12. Measuring instruments are specified by their sensitivity, resolution and:

A. size
B. accuracy
C. calibration
D. power

(1 Mark)

13. Two resistors R_A and R_B are connected in parallel. If resistor R_A has twice the resistance of resistor R_B, the current taken by resistor R_A is:

A. two thirds of the supply current
B. twice that taken by resistor R_B
C. one third of the supply current
D. one half of the supply current

(1 Mark)

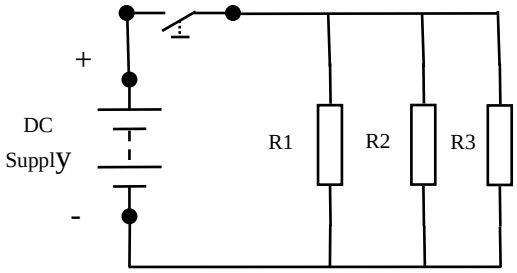


Figure 2

14. The equivalent resistance (R_{EQ}) of the resistors connected in the circuit of Figure 2 is:

A. always less than the smallest value of resistance
B. only obtainable by measuring with an ohmmeter
C. equal to the sum of the individual resistance values
D. only obtainable by applying Ohm's Law

(1 Mark)

15. If an open circuit occurs in resistor R1 of the circuit of Figure 2, the equivalent resistance will:

A. Decrease
B. remain the same
C. Increase
D. cannot tell without knowing circuit values

(1 Mark)

16. If an extra resistor R4 is connected in parallel to resistor R3 in the circuit of Figure 2, the equivalent resistance will:

A. Increase
B. Decrease
C. remain the same
D. cannot tell without knowing circuit values

(1 Mark)

17. In the circuit of Figure 2, the current taken from the supply is:

A. the same as the currents in resistor R1, R2 and R3
B. the difference of the currents in resistor R1, R2 and R3
C. only able to be determined by Ohm's Law
D. the sum of the currents in resistor R1, R2 and R3

(1 Mark)

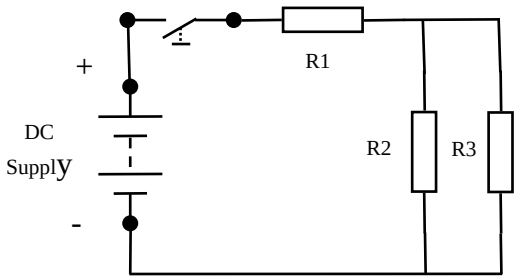


Figure 3

18. The resistor configuration of the circuit of Figure 3 is:

A. R1 in series with R2
B. R1 in series with R3
C. R1 in series with parallel resistors R2 & R3
D. R1, R2 & R3 all connected in parallel.

(1 Mark)

19. If the value of the series connected resistor in the circuit of Figure 3 is increased, the equivalent circuit resistance will:

A. increase
B. decrease
C. remain the same
D. cannot tell without knowing circuit values

(1 Mark)

20. If the resistor R2 of Figure 3 was bypassed by a short circuit connection, the overall power consumed by the circuit will:

A. increase
B. decrease
C. remain the same
D. cannot tell without knowing circuit values

(1 Mark)

SECTION B – Short Answer (25 Marks)

INSTRUCTIONS:
Blank spaces in the following statements represent omissions. Complete the statements with the word phrase or answer that you think fits best in the blank spaces.

1 What essential precaution must be taken before measuring resistance on a suspected live circuit?

_____Ensure Circuit Isolated_____

_____ (2)

2. Name two types of capacitors

__Ceramic, Power, Electrolytic, Thin film, Carbon Composite_

_____Variable_____ (2)

3 What category of meter would be suitable for use on the load side of the service fuse in a domestic installation

_____CAT 3_____ (1)

4. What type of capacitor must be connected with the correct polarity:

_____Electrolytic_____ (2)

5. Analog meters use magnetism to measure values. True or False

_____True_____ (1)

6. What two functions are performed by the hair springs in a moving coil meter:

(A) _____Provide Current Path To Coil____

(B) _____Provide Torque Against Magnetic field___ (2)

7. How many time constants does it take for a capacitor to be fully charged or discharged?

_____FIVE_____ (1)

8. If a conductor has a PTC characteristic, its resistance _*Increases*_ with an increase in __*Temperature*___.

(2)

9. The resistance of a light dependent resistor will _____*Decrease*___ with an increase in ___*daylight*___ falling on the resistor.

(2)

10. When reading an anolog meter what type of error can occur by incorrectly aligning your eye with the pointer? ___*Parallax*___ (2)

11 Total resistance in a series-parallel circuit can be calculated by just adding up the values. True or False

_____*False*_____ (1)

12 Capacitance of a capacitor is__*Inversely*___ proportional to the distance between the plates.

_____ (1)

13 How would you safely discharge a capacitor?

____By placing an appropriate rated resistor across the terminals_____ (2)

14 What effect does a capacitor have on a D.C. current?

_____*Blocks D.C. Current*_____ (2)

15 If three 15Ω Resistors are connected in parallel what is the equivalent resistance?

_____*5 Ω* _____ (2)

SECTION C – CALCULATIONS - (28 Marks)

The following questions are to be answered in the spaces provided on the question sheet. The marks are shown for each question.

For all questions the following is required:

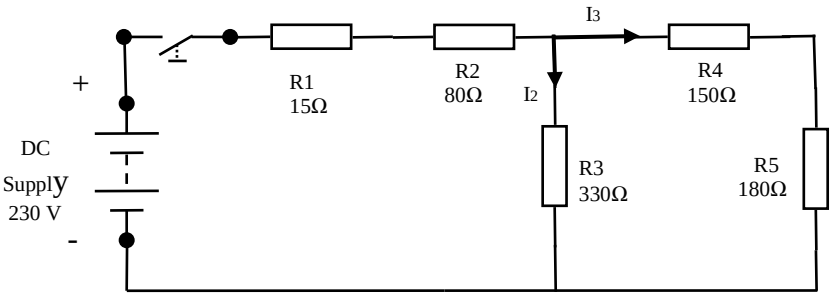


Figure 5

1. Determine the equivalent resistance (R_{EQ}) of the circuit of Figure 5.

$R_4 + R_5 = 330$ $R_P = 165$ $Rtotal = R_1 + R_2 + R_P = 260\Omega$

(3)

2. In the circuit Figure 5, determine the current $I_{T,}$

885mA

(2)

3. In the circuit of Figure 5, determine the current I_3.

443mA

(2)

4. A simple circuit which contains three capacitors of values C_1, 25µf, C_2, 50µF and C_3, 75µF are connected in series to an 85 Volt supply determine,

a). the equivalent circuit capacitance.

13.64µF

(2)

b). the total charged stored by your circuit.

1.16mC

(2)

c). the voltage drops across each capacitor.

V_1 = 46.4V

V_2 = 23.2V

V_3 = 15.5V

(3)

5. A simple circuit which contains three capacitors of values C_1, 15µf, C_2, 35µF and C_3, 45µF are connected in parallel to an 60 Volt supply, determine;

a). The equivalent circuit capacitance.

95µF

(2)

b). Calculate the total charged stored by your circuit.

5.7mC

(2)

c). the charge across each capacitor.

$Q_1 = 900\mu C$

$Q_2 = 2.1mC$

$Q_3 = 2.7mC$

(3)

6 An RC circuit consists of a resistance of 120kΩ and a capacitance of 36µF. Determine the:

a) time constant of the circuit. (2)

b) time taken for the capacitor to fully charge. (1)

a) T = RC = 4.32 seconds

b) 4.32 x 5 = 21.6 seconds

(3)

7. An RC circuit has an applied voltage of 30V. What is the voltage across the capacitor after 1 time constant?

V = 30 x 63.2% = 18.96V

(2)

8. How much energy is stored in a 22µF capacitor charges to 400V.

E = 1/2CV2 0.5 x 22µF x 400^2 = 1.76 Joules

(2)

SECTION D – Drawings & Symbols - (22 Marks)

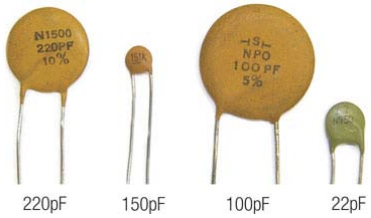
1. Identify the symbols below from the selection given in table 1.

variable	C
trimmer	D
fixed non-polarised	A
fixed polarised	B
thermister	
varistor	

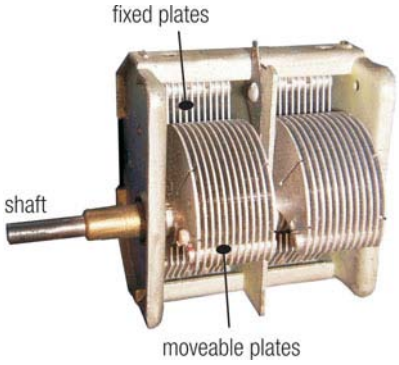
A B C D

(4 marks)

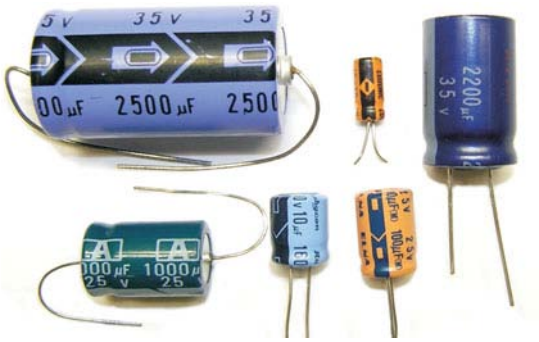
2. Identify the following capacitor types



a) CERAMIC



b) VARIABLE



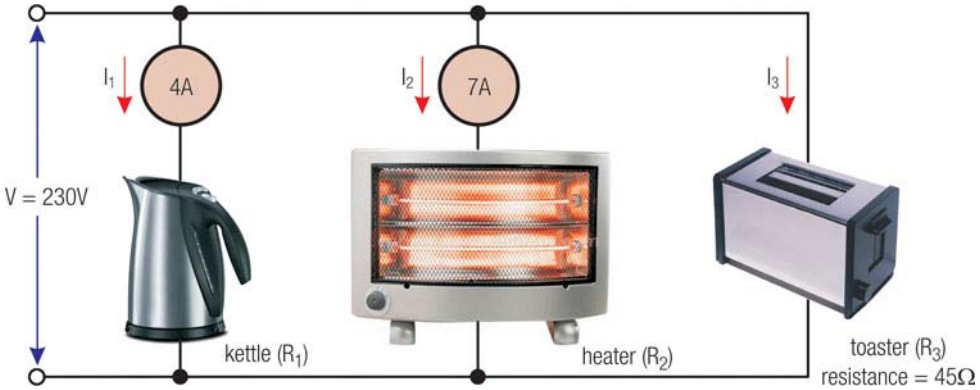
c) ELECTROLYTIC

(6 marks)

3. In reference to the diagram below answer the following;

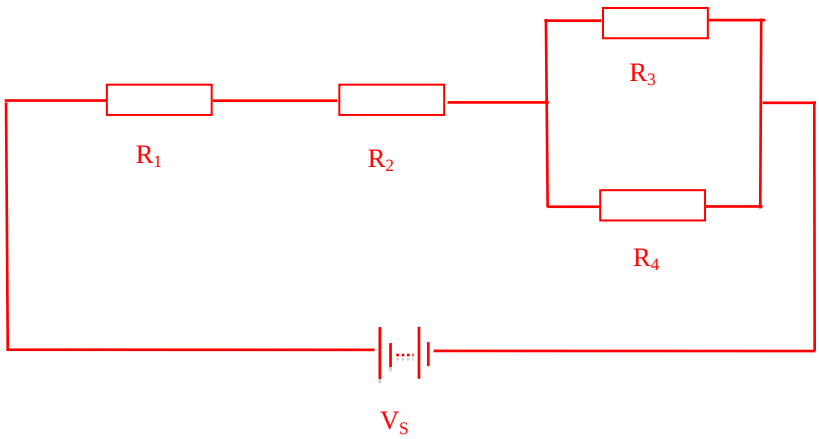
a) Are the appliances connected in series or parallel __Parallel_____(1)

b) Determine the power drawn by the toaster._____1.18kW_____(3)



4. From the following description sketch a circuit containing series resistors, R_1 & R_2 connected to a parallel branch containing R_3 and R_4. The supply voltage is 30V.

Series / parallel circuit



(3 Marks)

5. Refer to the graph below and answer the following questions.

   a. What is the graph below commonly known as?

      Universal Time Constant Curve (2)

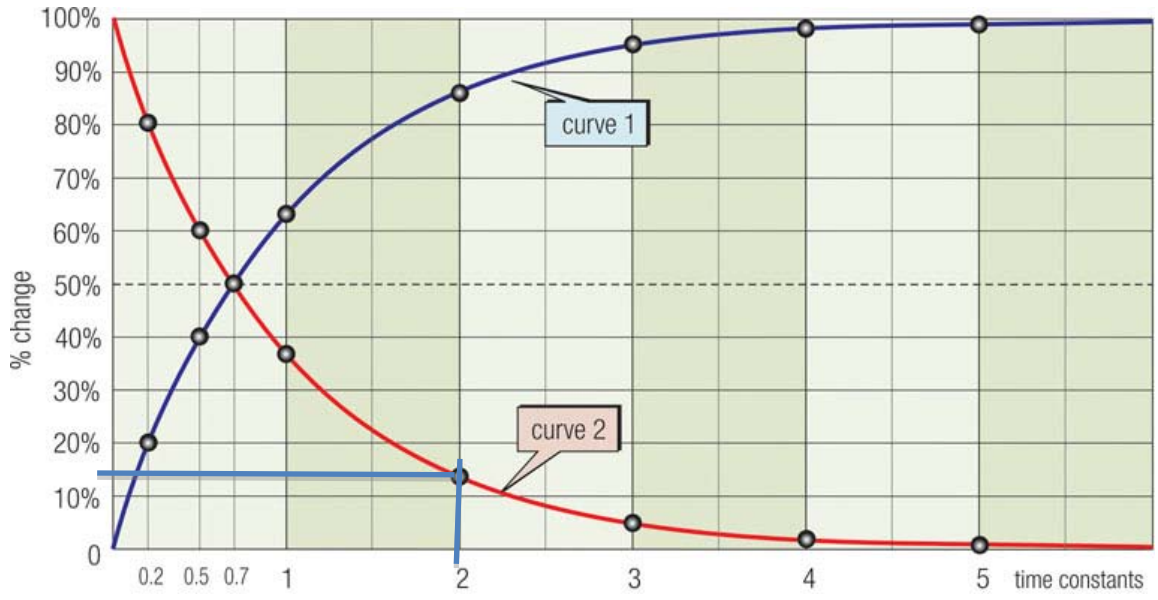
   b. Which curve represents the voltage *discharging*?

      _____Curve 2_____ (1)

   c. Which curve represents the current *discharging?*

      _____Curve 2_____ (1)

   d. Mark on the graph the percentage after two time constants for current *CHARGING* a capacitor. (1)



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\cos\phi = \frac{P}{S} \qquad \cos\phi = \frac{R}{Z} \qquad S = \sqrt{P^2 + Q^2}$$

$$S = VI \qquad P = VI\cos\phi \qquad Q = VI\sin\phi$$

$$f_o = \frac{1}{2\pi\sqrt{LC}} \qquad V_L = \sqrt{3}V_P \qquad I_L = \sqrt{3}I_P$$

$$S = \sqrt{3}V_L I_L \qquad P = \sqrt{3}V_L I_L \cos\phi \qquad Q = \sqrt{3}V_L I_L \sin\phi$$

$$\tan\phi = \sqrt{3}\left(\frac{W_2 - W_1}{W_2 + W_1}\right) \qquad Q = mC\Delta t$$

$$V' = 4.44\Phi fN \qquad \frac{V_1}{V_2} = \frac{N_1}{N_2} \qquad \frac{I_2}{I_1} = \frac{N_1}{N_2}$$

$$N_{syn} = \frac{120f}{p} \qquad s\% = \frac{(n_{syn} - n)}{n_{syn}} \times \frac{100}{1} \qquad f_r = \frac{s\% \times f}{100}$$

$$V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{FL}} \times \frac{100}{1} \qquad V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{NL}} \times \frac{100}{1} \qquad T = \frac{\Phi ZIP}{2\pi a}$$

$$I_{ST} = \frac{1}{3} \times I_{DOL} \qquad T_{ST} = \frac{1}{3} \times T_{DOL} \qquad I_{ST} = \frac{V_{ST}}{V} \times I_{DOL}$$

$$T_{ST} = \left(\frac{V_{ST}}{V}\right)^2 \times T_{DOL} \qquad I_{motor\,st} = \frac{\%TAP}{100} \times I_{DOL} \qquad I_{line\,st} = \left(\frac{\%TAP}{100}\right)^2 \times I_{DOL}$$

$$E = \frac{\Phi_v}{A} \qquad E = \frac{I}{d^2} \qquad \eta_v = \frac{\Phi_v}{P}$$

$$V_L = 0.45V_{ac} \qquad V_L = 0.9V_{ac} \qquad V_L = 1.17V_{phase}$$

$$V_L = 1.35V_{line} \qquad PRV = \sqrt{2}V_{ac} \qquad PRV = 2\sqrt{2}V_{ac}$$

$$PRV = 2.45V_{ac} \qquad V_{ripple} = \sqrt{2}V_{ac} \qquad V_{ripple} = 0.707V_{phase}$$

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

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		X		
2		X		
3				X
4			X	
5	X			
6				X
7				X
8	X			
9	X			
10			X	
Totals				

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

Total Marks Section A: _____

SYDNEY INSTITUTE
TAFE NSW
Ultimo College

Student Name:_____

Class : _____

Date : _____

30811 Certificate III Electrotechnology Electrician

D.C. Circuits TEST 3A

PHILIPS Chapters 8-10

Time allowed – 2 hours
18 Pages in this Question Booklet

TOTAL MARKS AVAILABLE

Aids to be supplied by College:

None

Aids to be supplied by Students:

Pen, pencil, eraser, rule, calculator

SECTION	Possible Marks	Actual Marks
A	20	
B	25	
C	28	
D	22	
TOTAL	95	

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**

Verified by (print name) _M.A.James_. Signature _*M.A.James*_ Date _12/03/2013_

SECTION A – MULTIPLE CHOICE

(1 mark per question = 20 marks)

For each question in Section A, identify the response you consider to be the best answer by placing its identifying letter in the space provided at the end of each question.

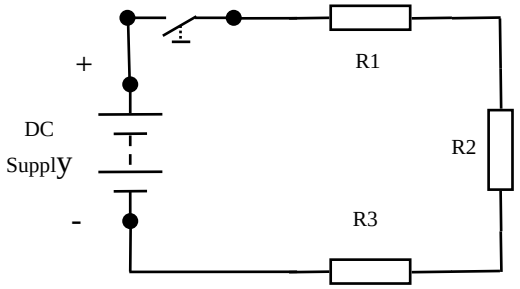


Figure 1

1. For the circuit in Figure 1, the voltage drops across R1, R2 and R3:

   A. are equal in every resistor
   B. sum to equal to the supply voltage
   C. are inversely proportional to the resistor values
   D. are inversely proportional to the value of circuit current

   (1 Mark)

2. For the circuit of Figure 1, if R1 is a 220 Ω resistor, R2 a 110 Ω and R3 a 470 Ω, the resistor which would have the largest voltage drop would be:

   A. the 220 Ω resistor
   B. the 470 Ω resistor
   C. the 110 Ω resistor
   D. they would all have the same voltage drop

   (1 Mark)

3. If resistor R1 in the circuit of Figure 1 becomes short circuited, the equivalent circuit resistance would

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

   (1 Mark)

4. The equivalent resistance (R_{EQ}) of the resistors in the circuit of Figure 1 is:

   A. always less than the smallest value of resistance
   B. only obtainable by measuring with an ohmmeter
   C. equal to the sum of the individual resistance values
   D. only obtainable by applying Ohm's Law.

(1 Mark)

5. When an analog needle moves to its furthest point this is called:

   A. full scale deflection
   B. maximum deflection
   C. moving coil
   D. fixed coil.

(1 Mark)

6. Ammeters use what to allow them to measure high currents:

   A. moving iron
   B. series resistor
   C. capacitor
   D. shunt resistor.

(1 Mark)

7. To increase the capacitance of a circuit you would:

   A. use an iron core in the existing capacitor
   B. connect a second capacitor in series with the existing capacitor
   C. reverse the polarity of the existing capacitor
   D. connect a second capacitor in parallel with the existing capacitor

(1 Mark)

8. What factor ***does not*** determine the capacitance of the capacitor

   A. time constant
   B. dielectric thickness
   C. dielectric type
   D. plate surface area

(1 Mark)

9. The thinner the dielectric of a capacitor the greater the:

A. capacitance
B. voltage rating
C. size
D. surface area

(1 Mark)

10. The symbol for a variable capacitor is a standard capacitor symbol:

A. with a cross through it
B. with a circle around it
C. with an arrow diagonally through it
D. does not exist

(1 Mark)

11. A parallel circuit is different from a series circuit as it has:

A. fewer current paths
B. more than one current path
C. only one current path
D. no current paths

(1 Mark)

12. Measuring instruments are specified by their sensitivity, resolution and:

A. size
B. accuracy
C. calibration
D. power

(1 Mark)

13. Two resistors R_A and R_B are connected in parallel. If resistor R_A has twice the resistance of resistor R_B, the current taken by resistor R_A is:

A. two thirds of the supply current
B. twice that taken by resistor R_B
C. one third of the supply current
D. one half of the supply current

(1 Mark)

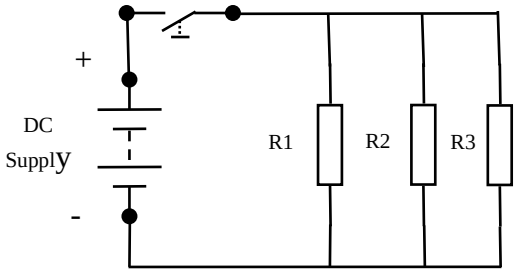


Figure 2

14. The equivalent resistance (R_{EQ}) of the resistors connected in the circuit of Figure 2 is:

    A. always less than the smallest value of resistance
    B. only obtainable by measuring with an ohmmeter
    C. equal to the sum of the individual resistance values
    D. only obtainable by applying Ohm's Law

    (1 Mark)

15. If an open circuit occurs in resistor R1 of the circuit of Figure 2, the equivalent resistance will:

    A. Decrease
    B. remain the same
    C. Increase
    D. cannot tell without knowing circuit values

    (1 Mark)

16. If an extra resistor R4 is connected in parallel to resistor R3 in the circuit of Figure 2, the equivalent resistance will:

    A. Increase
    B. Decrease
    C. remain the same
    D. cannot tell without knowing circuit values

    (1 Mark)

17. In the circuit of Figure 2, the current taken from the supply is:

    A. the same as the currents in resistor R1, R2 and R3
    B. the difference of the currents in resistor R1, R2 and R3
    C. only able to be determined by Ohm's Law
    D. the sum of the currents in resistor R1, R2 and R3

    (1 Mark)

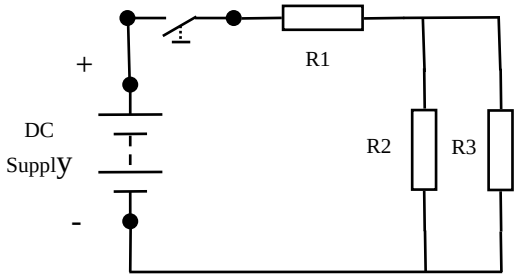


Figure 3

18. The resistor configuration of the circuit of Figure 3 is:

    A. R1 in series with R2
    B. R1 in series with R3
    C. R1 in series with parallel resistors R2 & R3
    D. R1, R2 & R3 all connected in parallel.

(1 Mark)

19. If the value of the series connected resistor in the circuit of Figure 3 is increased, the equivalent circuit resistance will:

    A. increase
    B. decrease
    C. remain the same
    D. cannot tell without knowing circuit values

(1 Mark)

20. If the resistor R2 of Figure 3 was bypassed by a short circuit connection, the overall power consumed by the circuit will:

    A. increase
    B. decrease
    C. remain the same
    D. cannot tell without knowing circuit values

(1 Mark)

SECTION B – Short Answer (25 Marks)

INSTRUCTIONS:
Blank spaces in the following statements represent omissions. Complete the statements with the word phrase or answer that you think fits best in the blank spaces.

1 What essential precaution must be taken before measuring resistance on a suspected live circuit?

_____

_____ (2)

2. Name two types of capacitors

_____

_____ (2)

3 What category of meter would be suitable for use on the load side of the service fuse in a domestic installation

_____ (1)

4. What type of capacitor must be connected with the correct polarity:

_____ (2)

5. Analog meters use magnetism to measure values. True or False

_____ (1)

6. What two functions are performed by the hair springs in a moving coil meter:

(A) _____

(B) _____ (2)

7. How many time constants does it take for a capacitor to be fully charged or discharged?

_____ (1)

8. If a conductor has a PTC characteristic, its resistance _____ with an increase in _____.

(2)

9. The resistance of a light dependent resistor will _____ with an increase in _____ falling on the resistor.

(2)

10. When reading an anolog meter what type of error can occur by incorrectly aligning your eye with the pointer? _____ (2)

11 Total resistance in a series-parallel circuit can be calculated by just adding up the values. True or False

_____ (1)

12 Capacitance of a capacitor is _____ proportional to the distance between the plates.

_____ (1)

13 How would you safely discharge a capacitor?

_____ (2)

14 What effect does a capacitor have on a D.C. current?

_____ (2)

15 If three 15Ω Resistors are connected in parallel what is the equivalent resistance?

_____ (2)

SECTION C – CALCULATIONS - (28 Marks)

The following questions are to be answered in the spaces provided on the question sheet. The marks are shown for each question.

For all questions the following is required:

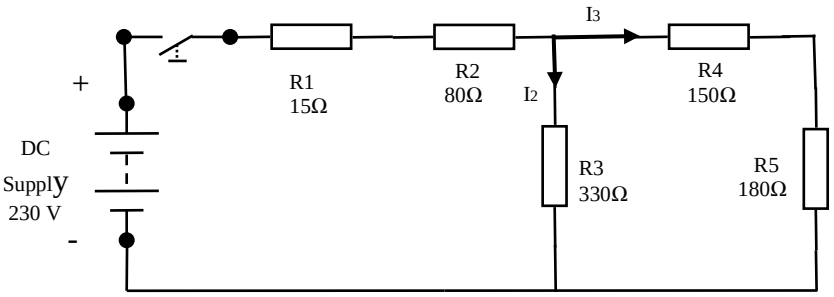


Figure 5

1. Determine the equivalent resistance (R_{EQ}) of the circuit of Figure 5.

(3)

2. In the circuit Figure 5, determine the current $I_{T,}$

(2)

3. In the circuit of Figure 5, determine the current I_3.

(2)

4. A simple circuit which contains three capacitors of values C_1, 25µf, C_2, 50µF and C_3, 75µF are connected in series to an 85 Volt supply determine,

a). the equivalent circuit capacitance.

(2)

b). the total charged stored by your circuit.

(2)

c). the voltage drops across each capacitor.

(3)

5. A simple circuit which contains three capacitors of values C_1, 15µf, C_2, 35µF and C_3, 45µF are connected in parallel to an 60 Volt supply, determine;

a). The equivalent circuit capacitance.

(2)

b). Calculate the total charged stored by your circuit.

(2)

c). the charge across each capacitor.

(3)

6 An RC circuit consists of a resistance of 120kΩ and a capacitance of 36μF. Determine the:

a) time constant of the circuit. (2)
b) time taken for the capacitor to fully charge. (1)

(3)

7. An RC circuit has an applied voltage of 30V. What is the voltage across the capacitor after 1 time constant?

(2)

8. How much energy is stored in a 22μF capacitor charges to 400V.

(2)

SECTION D – Drawings & Symbols - (22 Marks)

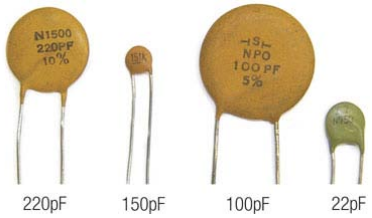
1. Identify the symbols below from the selection given in table 1.

variable	
trimmer	
fixed non-polarised	
fixed polarised	
thermister	
varistor	

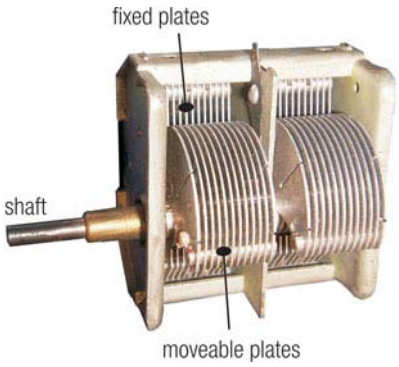
A B C D

(4 marks)

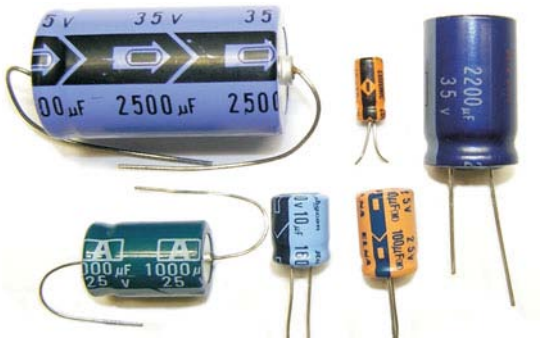
2. Identify the following capacitor types



a)



b)



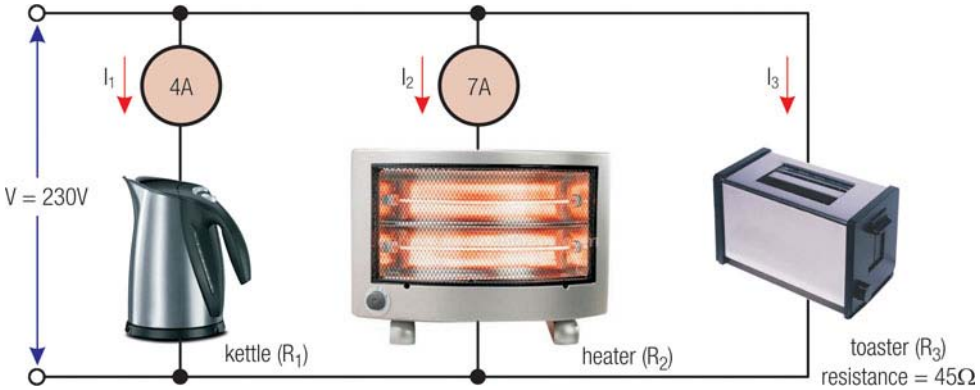
c)

(6 marks)

3. In reference to the diagram below answer the following;

a) Are the appliances connected in series or parallel _____(1)

b) Determine the power drawn by the toaster._____(3)



4. From the following description sketch a circuit containing series resistors, R_1 & R_2 connected to a parallel branch containing R_3 and R_4. The supply voltage is 30V.

Series / parallel circuit

(3 Marks)

5. Refer to the graph below and answer the following questions.

   a. What is the graph below commonly known as?

   _ _ _ _ _ _ _ _ _   _ _ _ _   _ _ _ _ _ _ _ _   _ _ _ _ _ (2)

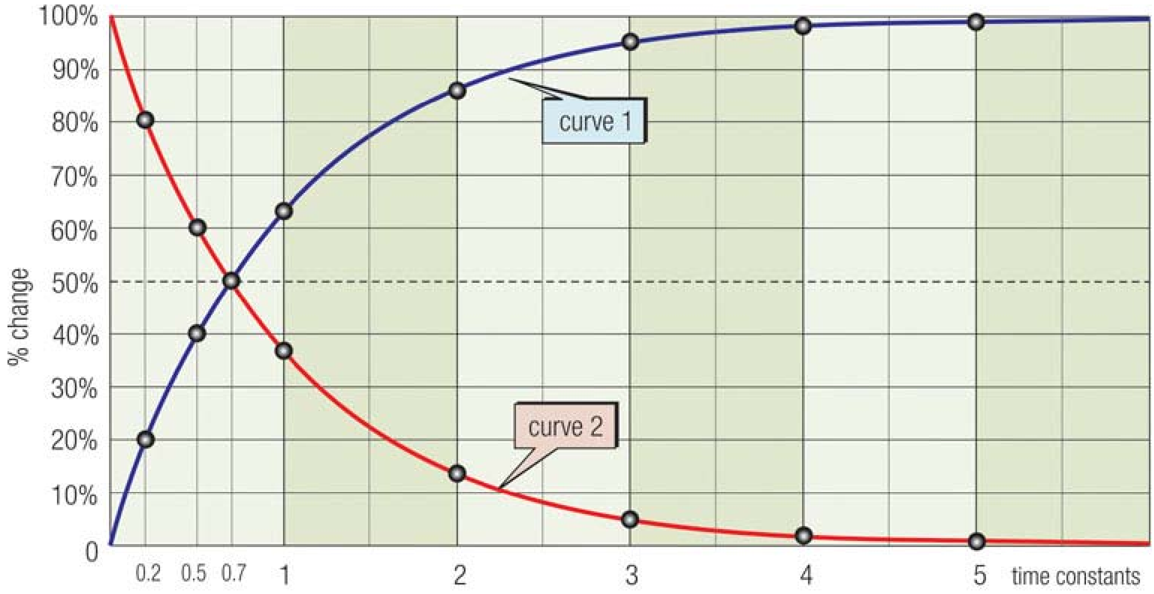
   b. Which curve represents the voltage *discharging*?

   ____ (1)

   c. Which curve represents the current *discharging?*

   ____ (1)

   d. Mark on the graph the percentage after two time constants for current *CHARGING* a capacitor. (1)



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\cos\phi = \frac{P}{S} \qquad \cos\phi = \frac{R}{Z} \qquad S = \sqrt{P^2 + Q^2}$$

$$S = VI \qquad P = VI\cos\phi \qquad Q = VI\sin\phi$$

$$f_o = \frac{1}{2\pi\sqrt{LC}} \qquad V_L = \sqrt{3}V_P \qquad I_L = \sqrt{3}I_P$$

$$S = \sqrt{3}V_L I_L \qquad P = \sqrt{3}V_L I_L \cos\phi \qquad Q = \sqrt{3}V_L I_L \sin\phi$$

$$\tan\phi = \sqrt{3}\left(\frac{W_2 - W_1}{W_2 + W_1}\right) \qquad Q = mC\Delta t$$

$$V' = 4.44\Phi fN \qquad \frac{V_1}{V_2} = \frac{N_1}{N_2} \qquad \frac{I_2}{I_1} = \frac{N_1}{N_2}$$

$$N_{syn} = \frac{120f}{p} \qquad s\% = \frac{(n_{syn} - n)}{n_{syn}} \times \frac{100}{1} \qquad f_r = \frac{s\% \times f}{100}$$

$$V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{FL}} \times \frac{100}{1} \qquad V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{NL}} \times \frac{100}{1} \qquad T = \frac{\Phi ZIP}{2\pi a}$$

$$I_{ST} = \frac{1}{3} \times I_{DOL} \qquad T_{ST} = \frac{1}{3} \times T_{DOL} \qquad I_{ST} = \frac{V_{ST}}{V} \times I_{DOL}$$

$$T_{ST} = \left(\frac{V_{ST}}{V}\right)^2 \times T_{DOL} \qquad I_{motor\,st} = \frac{\%TAP}{100} \times I_{DOL} \qquad I_{line\,st} = \left(\frac{\%TAP}{100}\right)^2 \times I_{DOL}$$

$$E = \frac{\Phi_v}{A} \qquad E = \frac{I}{d^2} \qquad \eta_v = \frac{\Phi_v}{P}$$

$$V_L = 0.45V_{ac} \qquad V_L = 0.9V_{ac} \qquad V_L = 1.17V_{phase}$$

$$V_L = 1.35V_{line} \qquad PRV = \sqrt{2}V_{ac} \qquad PRV = 2\sqrt{2}V_{ac}$$

$$PRV = 2.45V_{ac} \qquad V_{ripple} = \sqrt{2}V_{ac} \qquad V_{ripple} = 0.707V_{phase}$$

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

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: _____

SYDNEY INSTITUTE TAFE NSW Ultimo College

Student Name:_____

Class : _____

Date : _____

20222 Certificate III Electrotechnology Electrician

D.C. Circuits TEST 3A

PHILIPS Chapters 8-10

Time allowed – 2 hours
18 Pages in this Question Booklet

TOTAL MARKS AVAILABLE

Aids to be supplied by College:

None

Aids to be supplied by Students:

Pen, pencil, eraser, rule, calculator

SECTION	Possible Marks	Actual Marks
A	17	
B	21	
C	28	
D	22	
TOTAL	88	

_____%

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**

Verified by (print name) _M.A.James_. Signature _M.A.James_ Date _12/03/2013_

SECTION A – MULTIPLE CHOICE

(1 mark per question = 17 marks)

For each question in Section A, identify the response you consider to be the best answer by placing its identifying letter in the space provided at the end of each question.

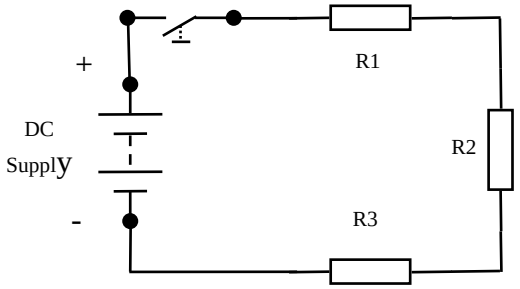


Figure 1

1. For the circuit in Figure 1, the voltage drops across R1, R2 and R3:

   A. are equal in every resistor
   B. sum to equal to the supply voltage
   C. are inversely proportional to the resistor values
   D. are inversely proportional to the value of circuit current

   (1 Mark)

2. For the circuit of Figure 1, if R1 is a 220 Ω resistor, R2 a 110 Ω and R3 a 470 Ω, the resistor which would have the largest voltage drop would be:

   A. the 220 Ω resistor
   B. the 470 Ω resistor
   C. the 110 Ω resistor
   D. they would all have the same voltage drop

   (1 Mark)

3. If resistor R1 in the circuit of Figure 1 becomes short circuited, the equivalent circuit resistance would

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

   (1 Mark)

4. The equivalent resistance (R_{EQ}) of the resistors in the circuit of Figure 1 is:

   A. always less than the smallest value of resistance
   B. only obtainable by measuring with an ohmmeter
   C. equal to the sum of the individual resistance values
   D. only obtainable by applying Ohm's Law.

(1 Mark)

5. [redacted]

(1 Mark)

6. [redacted]

(1 Mark)

7. To increase the capacitance of a circuit you would:

   A. use an iron core in the existing capacitor
   B. connect a second capacitor in series with the existing capacitor
   C. reverse the polarity of the existing capacitor
   D. connect a second capacitor in parallel with the existing capacitor

(1 Mark)

8. What factor ***does not*** determine the capacitance of the capacitor

   A. time constant
   B. dielectric thickness
   C. dielectric type
   D. plate surface area

(1 Mark)

9. The thinner the dielectric of a capacitor the greater the:

A. capacitance
B. voltage rating
C. size
D. surface area

(1 Mark)

10. The symbol for a variable capacitor is a standard capacitor symbol:

A. with a cross through it
B. with a circle around it
C. with an arrow diagonally through it
D. does not exist

(1 Mark)

11. A parallel circuit is different from a series circuit as it has:

A. fewer current paths
B. more than one current path
C. only one current path
D. no current paths

(1 Mark)

12. Measuring instruments are specified by their sensitivity, resolution and:

A. size
B. accuracy
C. calibration
D. power

(1 Mark)

13. Two resistors R_A and R_B are connected in parallel. If resistor R_A has twice the resistance of resistor R_B, the current taken by resistor R_A is:

A. two thirds of the supply current
B. twice that taken by resistor R_B
C. one third of the supply current
D. one half of the supply current

(1 Mark)

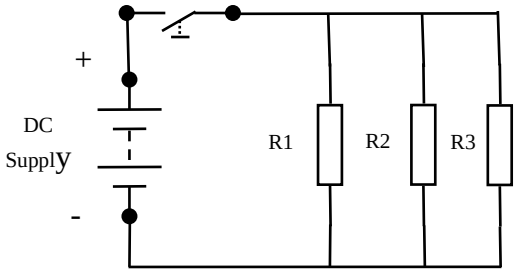


Figure 2

14. The equivalent resistance (R_{EQ}) of the resistors connected in the circuit of Figure 2 is:

    A. always less than the smallest value of resistance
    B. only obtainable by measuring with an ohmmeter
    C. equal to the sum of the individual resistance values
    D. only obtainable by applying Ohm's Law

    (1 Mark)

15. If an open circuit occurs in resistor R1 of the circuit of Figure 2, the equivalent resistance will:

    A. Decrease
    B. remain the same
    C. Increase
    D. cannot tell without knowing circuit values

    (1 Mark)

16. If an extra resistor R4 is connected in parallel to resistor R3 in the circuit of Figure 2, the equivalent resistance will:

    A. Increase
    B. Decrease
    C. remain the same
    D. cannot tell without knowing circuit values

    (1 Mark)

17. In the circuit of Figure 2, the current taken from the supply is:

    A. the same as the currents in resistor R1, R2 and R3
    B. the difference of the currents in resistor R1, R2 and R3
    C. only able to be determined by Ohm's Law
    D. the sum of the currents in resistor R1, R2 and R3

    (1 Mark)

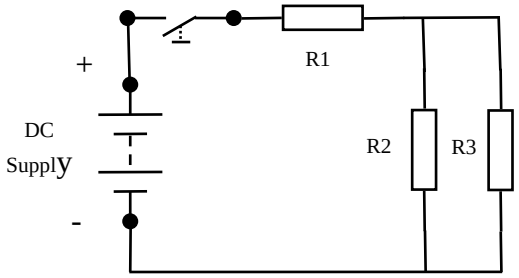


Figure 3

18. The resistor configuration of the circuit of Figure 3 is:

    A. R1 in series with R2
    B. R1 in series with R3
    C. R1 in series with parallel resistors R2 & R3
    D. R1, R2 & R3 all connected in parallel.

(1 Mark)

19. If the value of the series connected resistor in the circuit of Figure 3 is increased, the equivalent circuit resistance will:

    A. increase
    B. decrease
    C. remain the same
    D. cannot tell without knowing circuit values

(1 Mark)

20. If the resistor R2 of Figure 3 was bypassed by a short circuit connection, the overall power consumed by the circuit will:

    A. increase
    B. decrease
    C. remain the same
    D. cannot tell without knowing circuit values

(1 Mark)

SECTION B – Short Answer (21 Marks)

INSTRUCTIONS:
Blank spaces in the following statements represent omissions. Complete the statements with the word phrase or answer that you think fits best in the blank spaces.

1 What essential precaution must be taken before measuring resistance on a suspected live circuit?

_____

_____ (2)

2. Name two types of capacitors

_____

_____ (2)

3 What category of meter would be suitable for use on the load side of the service fuse in a domestic installation

_____ (1)

4. What type of capacitor must be connected with the correct polarity:

_____ (2)

5. Analog meters use magnetism to measure values. True or False

_____ (1)

6. What two functions are performed by the hair springs in a moving coil meter:

(A) _____

(B) _____ (2)

7. How many time constants does it take for a capacitor to be fully charged or discharged?

_____ (1)

8. If a conductor has a PTC characteristic, its resistance _____ with an increase in _____.

(2)

9. The resistance of a light dependent resistor will _____ with an increase in _____ falling on the resistor.

(2)

10. When reading an anolog meter what type of error can occur by incorrectly aligning your eye with the pointer? _____ (2)

11 Total resistance in a series-parallel circuit can be calculated by just adding up the values. True or False

_____ (1)

12 Capacitance of a capacitor is _____ proportional to the distance between the plates.

_____ (1)

13 How would you safely discharge a capacitor?

_____ (2)

14 What effect does a capacitor have on a D.C. current?

_____ (2)

15 If three 15Ω Resistors are connected in parallel what is the equivalent resistance?

_____ (2)

SECTION C – CALCULATIONS - (28 Marks)

The following questions are to be answered in the spaces provided on the question sheet. The marks are shown for each question.

For all questions the following is required:

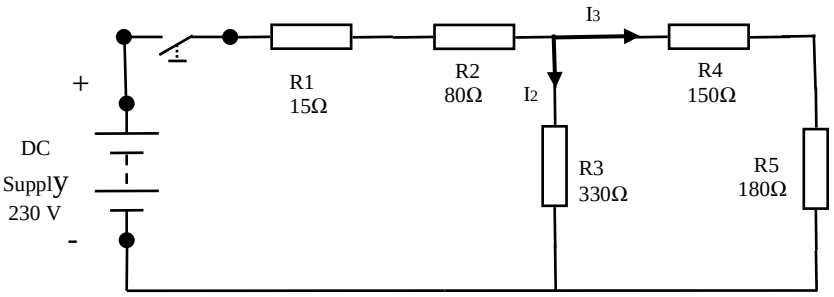


Figure 5

1. Determine the equivalent resistance (R_{EQ}) of the circuit of Figure 5.

(3)

2. In the circuit Figure 5, determine the current $I_{T,}$

(2)

3. In the circuit of Figure 5, determine the current I_3.

(2)

4. A simple circuit which contains three capacitors of values C_1, 25µf, C_2, 50µF and C_3, 75µF are connected in series to an 85 Volt supply determine,

a). the equivalent circuit capacitance.

(2)

b). the total charged stored by your circuit.

(2)

c). the voltage drops across each capacitor.

(3)

5. A simple circuit which contains three capacitors of values C_1, 15µf, C_2, 35µF and C_3, 45µF are connected in parallel to an 60 Volt supply, determine;

a). The equivalent circuit capacitance.

(2)

b). Calculate the total charged stored by your circuit.

(2)

c). the charge across each capacitor.

(3)

6 An RC circuit consists of a resistance of 120kΩ and a capacitance of 36μF. Determine the:

a) time constant of the circuit. (2)
b) time taken for the capacitor to fully charge. (1)

(3)

7. An RC circuit has an applied voltage of 30V. What is the voltage across the capacitor after 1 time constant?

(2)

8. How much energy is stored in a 22μF capacitor charges to 400V.

(2)

SECTION D – Drawings & Symbols - (22 Marks)

1. Identify the symbols below from the selection given in table 1.

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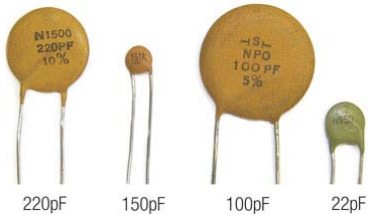
trimmer	
fixed non-polarised	
fixed polarised	
thermister	
varistor	

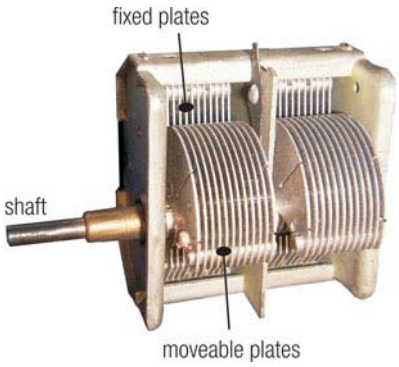
A B C D

(4 marks)

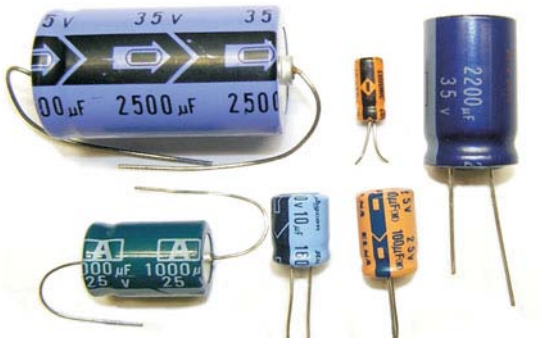
2. Identify the following capacitor types



a)



b)



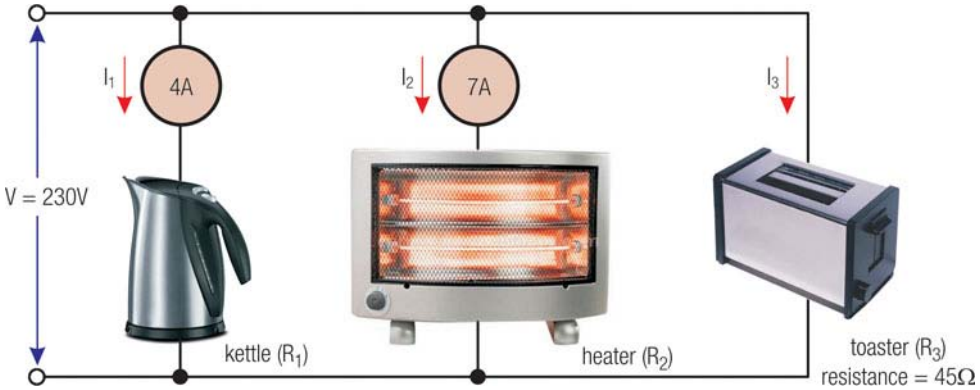
c)

(6 marks)

3. In reference to the diagram below answer the following;

a) Are the appliances connected in series or parallel _____(1)

b) Determine the power drawn by the toaster._____(3)



4. From the following description sketch a circuit containing series resistors, R_1 & R_2 connected to a parallel branch containing R_3 and R_4. The supply voltage is 30V.

Series / parallel circuit

(3 Marks)

5. Refer to the graph below and answer the following questions.

   a. What is the graph below commonly known as?

   _ _ _ _ _ _ _ _ _   _ _ _ _   _ _ _ _ _ _ _ _   _ _ _ _ _ (2)

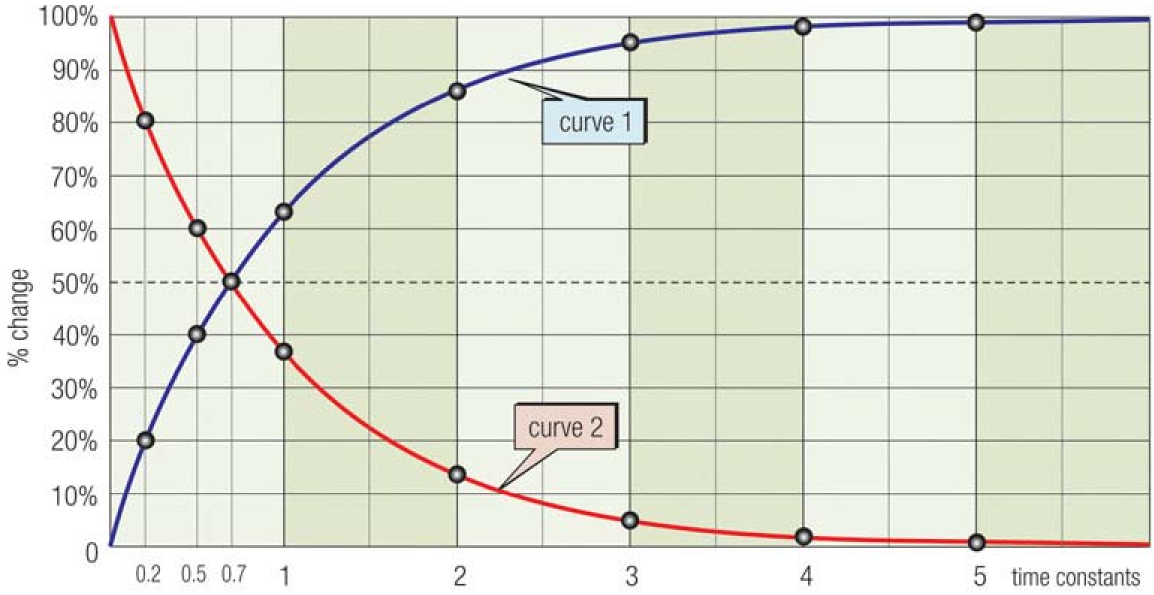
   b. Which curve represents the voltage *discharging*?

   ____ (1)

   c. Which curve represents the current *discharging?*

   ____ (1)

   d. Mark on the graph the percentage after two time constants for current *CHARGING* a capacitor. (1)



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\cos\phi = \frac{P}{S} \qquad \cos\phi = \frac{R}{Z} \qquad S = \sqrt{P^2 + Q^2}$$

$$S = VI \qquad P = VI\cos\phi \qquad Q = VI\sin\phi$$

$$f_o = \frac{1}{2\pi\sqrt{LC}} \qquad V_L = \sqrt{3}V_P \qquad I_L = \sqrt{3}I_P$$

$$S = \sqrt{3}V_L I_L \qquad P = \sqrt{3}V_L I_L \cos\phi \qquad Q = \sqrt{3}V_L I_L \sin\phi$$

$$\tan\phi = \sqrt{3}\left(\frac{W_2 - W_1}{W_2 + W_1}\right) \qquad Q = mC\Delta t$$

$$V' = 4.44\Phi fN \qquad \frac{V_1}{V_2} = \frac{N_1}{N_2} \qquad \frac{I_2}{I_1} = \frac{N_1}{N_2}$$

$$N_{syn} = \frac{120f}{p} \qquad s\% = \frac{(n_{syn} - n)}{n_{syn}} \times \frac{100}{1} \qquad f_r = \frac{s\% \times f}{100}$$

$$V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{FL}} \times \frac{100}{1} \qquad V_{reg}\% = \frac{(V_{NL} - V_{FL})}{V_{NL}} \times \frac{100}{1} \qquad T = \frac{\Phi ZIP}{2\pi a}$$

$$I_{ST} = \frac{1}{3} \times I_{DOL} \qquad T_{ST} = \frac{1}{3} \times T_{DOL} \qquad I_{ST} = \frac{V_{ST}}{V} \times I_{DOL}$$

$$T_{ST} = \left(\frac{V_{ST}}{V}\right)^2 \times T_{DOL} \qquad I_{motor\,st} = \frac{\%TAP}{100} \times I_{DOL} \qquad I_{line\,st} = \left(\frac{\%TAP}{100}\right)^2 \times I_{DOL}$$

$$E = \frac{\Phi_v}{A} \qquad E = \frac{I}{d^2} \qquad \eta_v = \frac{\Phi_v}{P}$$

$$V_L = 0.45V_{ac} \qquad V_L = 0.9V_{ac} \qquad V_L = 1.17V_{phase}$$

$$V_L = 1.35V_{line} \qquad PRV = \sqrt{2}V_{ac} \qquad PRV = 2\sqrt{2}V_{ac}$$

$$PRV = 2.45V_{ac} \qquad V_{ripple} = \sqrt{2}V_{ac} \qquad V_{ripple} = 0.707V_{phase}$$

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

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: _____