Chapter = 1

Electricity

Assignment

Ques 1- Is electric potential a scaler or vector quantity?
Ans- It is a scaler quantity because it has no direction.

Ques 2 Name the istrument that measure the electric current?
Ans. An Ammeter is used to measure the electric current

Ques 3. Define the unit of electric current?
Ans. 1 Ampere = 1 Coulomb / 1 Sec.

Ques 4 what is the resisdance of air gap?
Ans. The Resisdance of air gap is (∞) infinity.

Ques 5. How resisdance change with increase of temp.?
Ans. Residance × Temp.
when the electron move to get heat energy then the amount of moving elutron is faster when residence is high.

Ques 6. what constitues the current?
Ans. It is the rate of moving electron per unit time.

Ques 7. How are convential & electronic current related?
Ans. In convential current to direction of moving current is opposite to electronic current.

Ques 8. What does an electric circuit mean?
Ans. It is a path in which electron flow from a voltage or current source

Ques 9. What is the S.I. unit of Resistance?
Ans. ohms (Ω).

Ques 10. What is measured by voltmeter?
Ans. It is used to measure electric potential difference b/w two point in an electric current.

Ques 11. Among Silver & copper which one is better conductor?
Ans. Silver is better because of its lower resistivity.

Ques 12. State the name of instrument which produce electric current?
Ans. Electrical Generator.

Ques 13. Name the physical Quantity whose unit is joule Coulomb.
Ans. Electrical potential difference.

Ques 14. One ampere of current can also be represented by?
Ans. One Coulomb Sec^{-1}

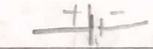
Ques 15. write the energy transformed into electric cell?
Ans. Chemical energy to electrical energy.

Ques 16. In Resistance box, the resistance are connected in?
Ans. It is connected in Series.

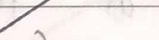
Ques 17. Best Conductor whose returity is:
Ans. Silver = 1.6×10^{-8} ohmsmeter.

Ques 18. Electron contained in one coulomb of electric charge is what?
Ans. 1.6×10^{-18}

Ques 19. write Components of :

i) Electric cell : 

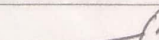
ii Battery.

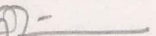
iii open key 

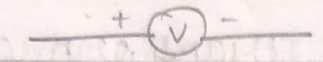
iv closed key

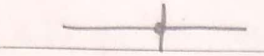
v Resistance

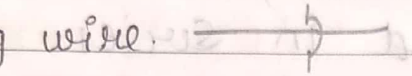
vi Variable resistance

vii Galvometer 

viii Ammeter 

ix Voltmeter 

x Joint wire 

xi ~~Cont~~ Crossing wire. 

Benefits of Electricity.

→ It is used in Home applinces.
→ It is used in our daily working places like offices.
→ We use it for AC, computer, fan, mobile etc.
→ We also use it for heating.
→ It is used on roads on street light.
→ We use it in our school in many ways like projector, computer, AC etc.
→ We use electricity in vehicle like, light, horn
→ It is also use in satellite and networking areas.
→ We use electricity in factories and industries to prepare goods.
→ We use it for supplying water.

Electricity = It is form of electrical energy. It is controlable & Convetent from of energy.
Ex - Lightining of bulb etc.

Electric charge.

* They are of three types

(i) Electron - Negative
(ii) Proton - Positive
(iii) Neutron - neutral.

* Electron: It is defined as negative charge.
(i) Magnitude of charge: 1.6×10^{-19} C.
(ii) Mass - ~~1.6×10^{-31} kg.~~ ~~1.673×10^{-27} kg~~
$= 9.1 \times 10^{-31}$ kg.

* Proton: It is defined as Positive charge.
(i) Magnitude of charge: 1.6×10^{-19} C.
(ii) Mass - 1.673×10^{-27} kg.

* Neutron - It is defined as neutrual charge.
(i) Magnitude of charge. 0 C.
(ii) Mass: 1.672×10^{-27} kg.

Property of charge:
All the charges in the universe contain two type of properties:-

1. Like
2. Unlike.

i) Like - when same charges placed together, they will show repulsion property.

← ⊕ Repel ⊕ →

← ⊖ Repel ⊖ →

(ii) Unlike: when opposite charges place together they will show attraction property.

⊕ → ← ⊖

⊖ → ← ⊕

Electric Current: It is defined as the movement of electric charge flowing through a particular area per unit time.

★ Formula =

$$I = \frac{Q}{t}$$

Symbol Naming

I = Current

Q = Charge

t = time.

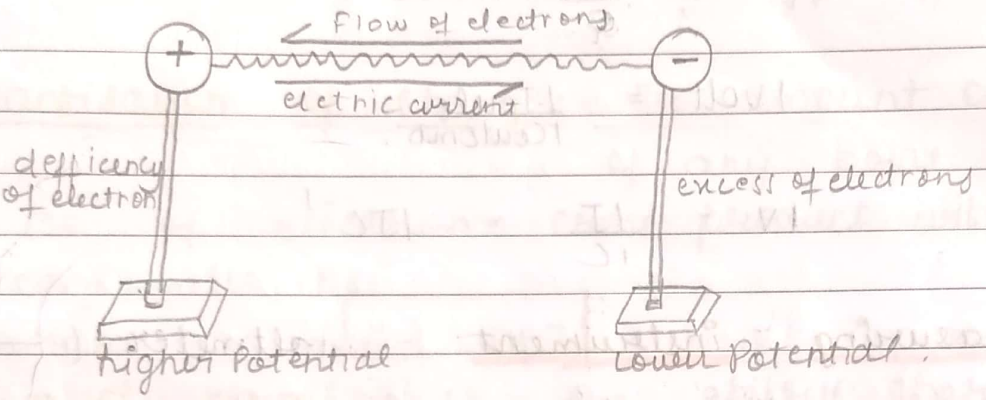
Dimension = ~~MLTA~~

= [M L T A' Kan]

3. S.I. Unit = "Amphere"

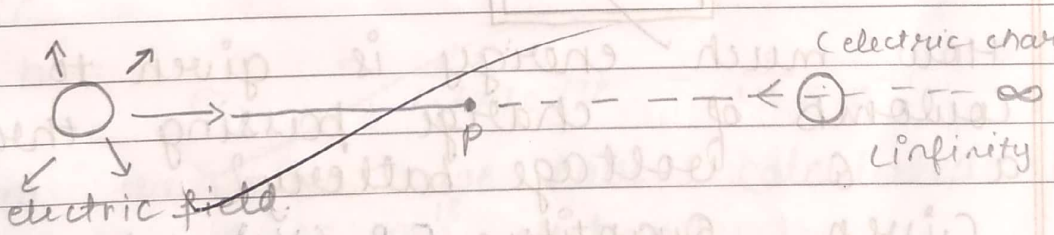
Measuring instrument for current :- Ammeter.

★ Symbol :- 



★ In fig. Convential current flows from A to B
Electronic current flows from B to A.

Electric Potential :- The electric current of any point in electric field is defined as work done to bring a unit positive charge ∞ to a fixed point.



→ Formula of electric Potential.

Electric Potential (V) = $\frac{\text{work done}}{\text{Charge}} = \frac{W}{Q}$

$$V = \frac{W}{Q}$$

2. Symbol. 'V'
3. S.I. unit = 'Volt'.

We know that

Electric Potential = $\frac{\text{work}}{\text{Charge}}$.

$$V = \frac{W}{Q}$$

$$1 \text{ Volt} = \frac{1 \text{ Joule}}{1 \text{ Coulomb}}.$$

$$1V = \frac{1J}{1C} = 1JC^{-1}$$

Measuring instrument - voltmeter (—⁺Ⓥ⁻—)

★ **Electric Potential difference** : The electric potential b/w two points in any electric circuit is defined as amount of work done is moving a unit charge from a point to another point

Formula $\frac{W_2 - W_1}{Q}$

Qus 1 How much energy is given to each Coulomb of charge passing through a 6 Voltage battery?

Sol. Given Quantity : E.P. (V) = 6 V
charge (Q) = 1C

Find - Energy = work

We know that

Electric potential = $\frac{\text{work done}}{\text{charge}}$

$$V = \frac{W}{Q}$$

$$\boxed{VQ = W}$$

6 V/C	=	W
6 J	=	W.

The work done on each coulomb is 6J. So, we can say that the energy require 6J.

Quantisation of charge :- The amount of charge of any point is equal to no. of electron cross product with single charge value $1e^-$

* Formula = $\boxed{Q = ne^-}$

# Symbol naming : Q = eletric charge.
n = no. of electron
e^- = charge on electron.

S.I. Unit : 1Q = 1 Coulomb.

Ques - Calculate the no. of e^- constituting 1C of charge.

Ans : $1C = ne^-$

$$n = \frac{1C}{e^-} = \frac{1C}{1.6 \times 10^{-19} C} = \frac{1}{1.6 \times 10^{-19}} = 6.25 \times 10^{-18}.$$

From the above we have calculated 1C contain $6.25\ 10^{-18}$ electrons.

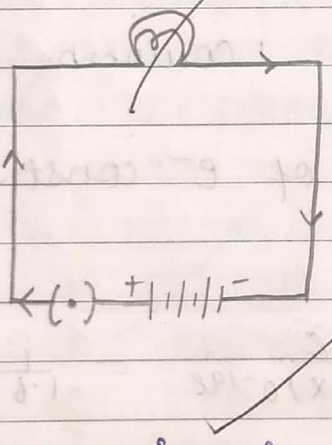
Electric circuit :-

It is defined as the flowing of electric charge from one point to another point. we can say that charge is flowing +ve to -ve.

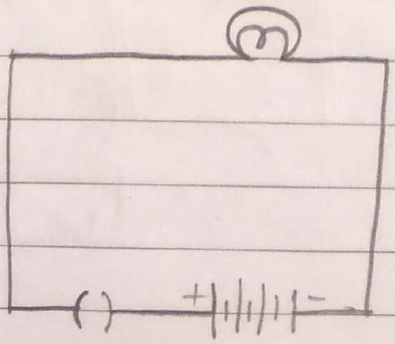
Types of Electric circuit :

(a) Closed :-

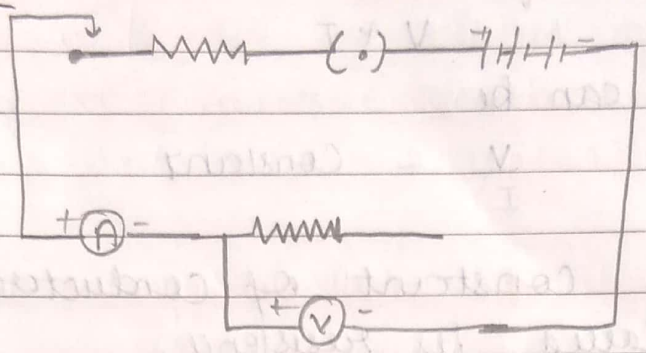
The electric circuit in which electric charge will flow from one point to another without any breaking of electric potential difference b/w these source and instrument.



(b) open :- Electric circuit in which electric charge will not flow from one point to another point due to breaking i.e. cutting of electric potential diff. b/w the source and instrument

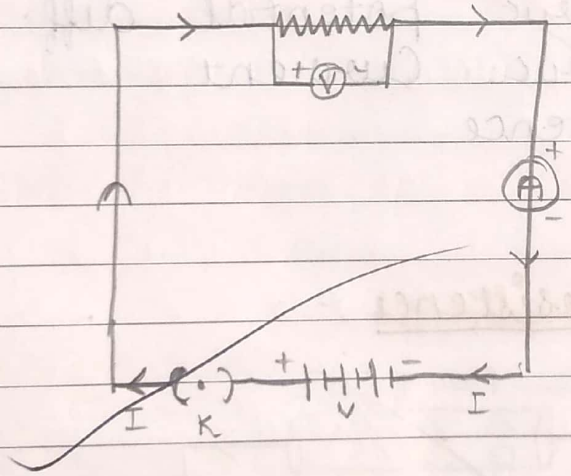


Circuit Diagram.



The System arrangement of electric component for measuring the electric current and electric potential with help of reheostate, resistor, voltmeter, amemeter, in electric circuit.

Ohm's Law.



Symbol naming.

1. —(+V−)— = voltmeter
2. —(+A−)— = Ameter
3. I = electric circuit
4. V = Voltage
5. K = Key.
6. R. = Resistance.

from definition =>

V & I

This can be.

$$\frac{V}{I} = \text{Constant}$$

The constant of conductor at a given temp. is called its resistence.

$$\frac{V}{I} = R.$$

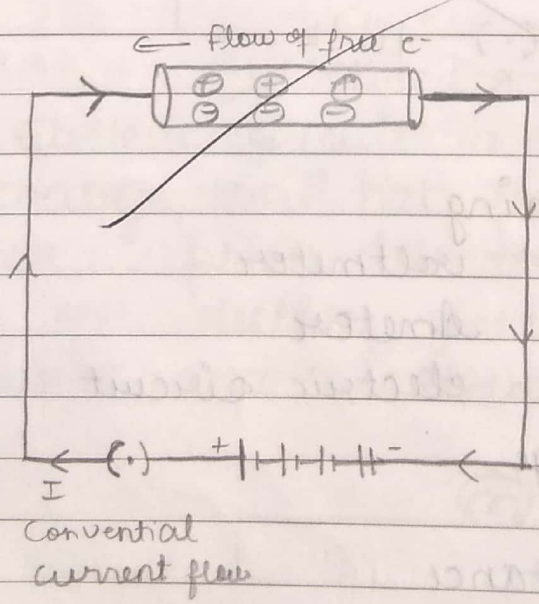
$$\boxed{V = IR.}$$

Hence, this is ohm's Law.

Symbol Naming.

V = Electric potential diff.
I = Electric Current
R = Resistence

Electric Resistence :-



⇒ Property of a conductor by virtue of which it oppose the flow of electric current through it

* Formula.

$$R = \frac{V}{I}$$

Resistance = $\frac{\text{voltage}}{\text{Electric current}}$

formula.

$$R = \rho \frac{l}{A}$$

→ Symbol Naming -

R = Restivity.
l = Length
A = Area.

S.I unit : 'ohm'
→ Symbol = Ω

$$R = \frac{V}{I}$$

$$1\,\Omega = \frac{1V}{1A}$$

Quantity = It is scaler quantity.

Ques 1 What are the relation b/w current and potent

Ans $V = IR$

$V \propto I$

The current is directly proportional to potential d

1. If the potential diff. across the end, of a Conductor is double, the current flowing through it, it also get doubled

2. If the potential diff. across the end of a conductor is halved, the current flowing through it, also get halved (half).

Ques 2. What is relation of Current and Resistance?

Sol Current is inversly Proportional to Resistance.

$$I \propto \frac{1}{R}.$$

1. If the current is flowing through the end of conductor is halved, then the Resistence get doubled

2. If the Resistence is halved, then current get doubled.

Ques 3. what are the factor which affect Current?

Ans :- Resistence and Potential diff. are the factor affect current

Ques 4 Define 1 ohm?

Ans 1 ohm of circuit is defined as the potential diff. of 1 volt is applied to its end, a current of 1 ampere flows through it.

Ques 1: A electric meter draws a current of 10. when connected to 220 volt. Calculate the Resistance

Ans: Given :-

Current (I) = 10 amp.

Voltage (V) = 220 volt.

Find —

Resistence (R) = —— Ω

we know

$$R = \frac{V}{I}$$

$$R = \frac{220}{10}$$

$$R = 22 \text{ ohm}$$

Ques 2: what are the high and low resistance value as well as current?

Ans: Current:

1 Ka = 10^3 A

1 MA = 10^6 A

1 mA = 10^{-3} A

1 uA = 10^{-6} A

Resistance

1K Ω = 10^3 Ω

1M Ω = 10^6 Ω

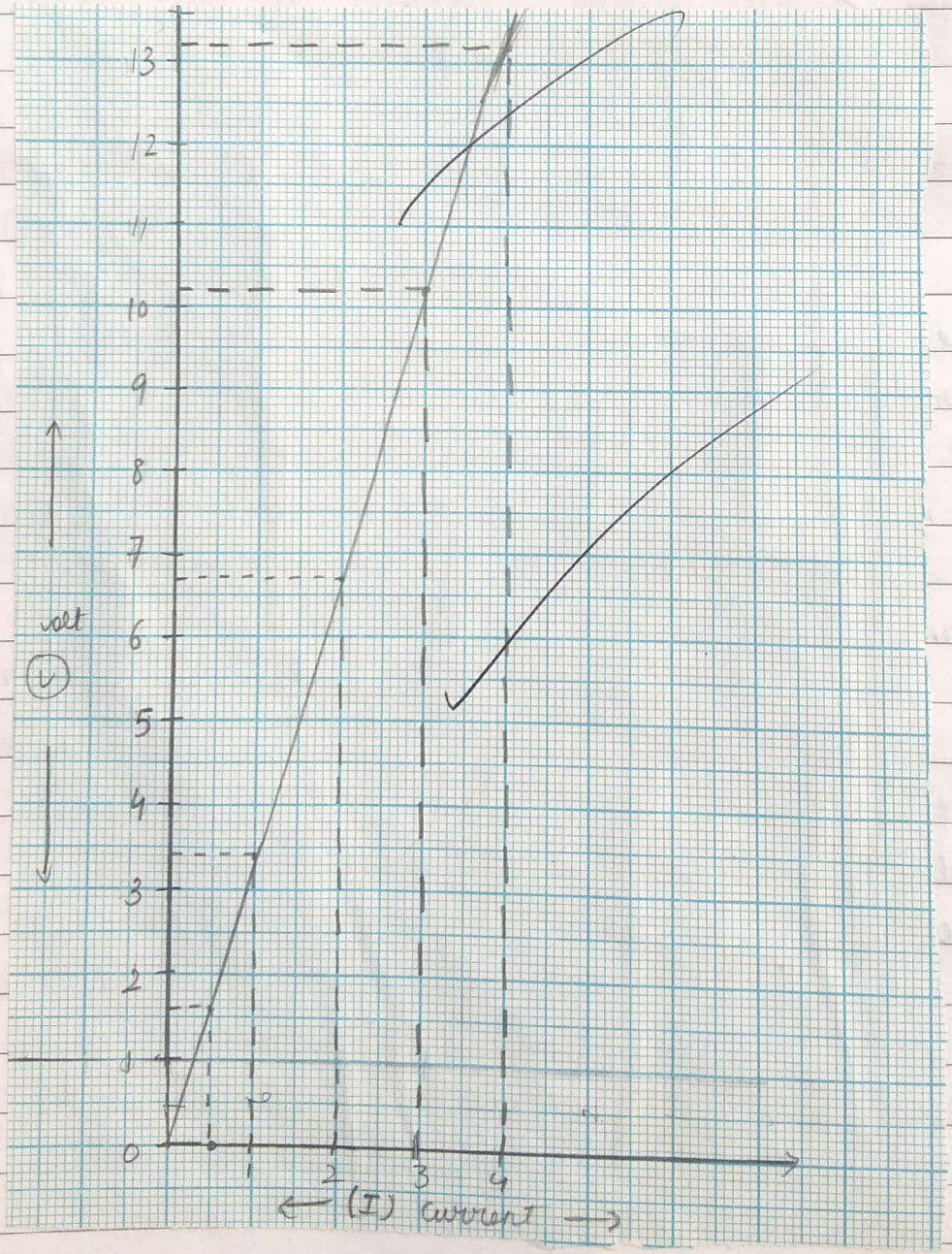
1 m Ω = 10^3 Ω

1 u Ω = 10^{-6} Ω

Ques 3: The value of current (I) flowing in given resistor for a corresponding value potential difference the across the resistor given below:

I (A)	V (Volt)
0·5	1·6
1·0	3·4
2·0	6·7
3·0	10·2
4·0	13·2

* Plot the graph b/w v and I calculate the resistance.

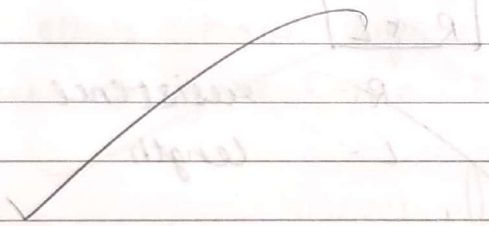


#> Formula to Calculate the resistance from Graph

$$R = \frac{\Delta V}{\Delta I} = \frac{V_2 - V_1}{I_2 - I_1} \quad \left[\text{Slope } \frac{A}{B} = \frac{BC}{AC} \right]$$

$$R = \frac{13.2 - 6.2}{4.2}$$

$$R = \frac{6.5}{2 \times 10^{-2}} = 43.22\ \Omega$$



Factor affecting Resistence of Conductor.

The electric resistence of conductor depends upon following factors.

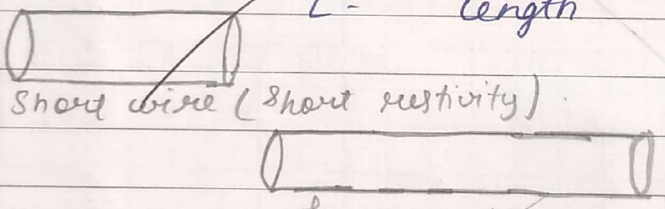
→ Length of conductor
→ Temp. of conductor
→ Nature of Material of conductor.
→ Area of cross section of Conductor.

Effect of Length on Resist

Resistence of conductor is directly proportional to its length

$$R \propto L$$

* Symbol naming - R - resistence
L - length

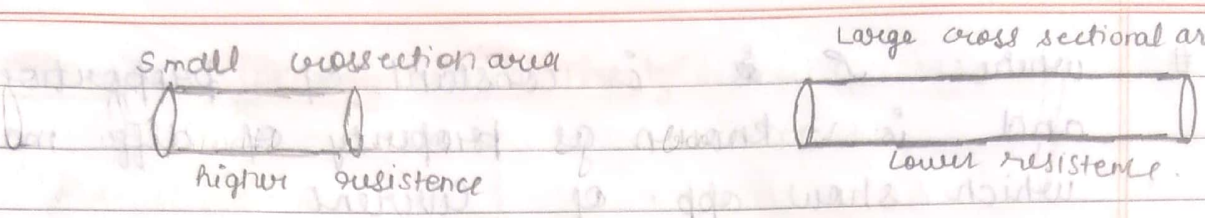


- If the length of conductor is doubled, its resistence also get doubled.
- If the length of conductor is halved, its resistence also gets halved.

Effect of Cross-section of resistence ON A conductor.

The resistence of conductor is inversely proportional to area of cross section.

$$R \propto \frac{1}{A}$$



A thick wire has lesser resistence than thin wire.

Effect of temperature on the resistence of a Conductor. The resistence of all pure metals increases with increase in temp. and decreases on lowering the temp.

☆ Effect of nature of material on the resistence of a Conductor :- Some material have low resistence, whereas other have higher resistence.
Ex. Silver is good than Iron.

Resistivity:
= As from the ohm's Law we study R and dependency of R on diff. cases.

$$R = \rho \frac{l}{A}$$

from the factor (1).
⇒ dependency of Length.

$$R \propto l \quad \text{— (1)}$$

from 2nd factor

$$R \propto \frac{1}{A} \quad \text{— (2)}$$

Combine (1) and (2)
we get $R \propto \frac{l}{A}$

$$R = \rho \frac{l}{A}$$

where ρ is constant of proportional and is known as property of diff. material which show opp. of current.

Resistivity.

Definiation: It is a measure of resisting power of a specified material to the flow of an electric current.

Unit of Resistivity.

* Formula - $\rho = \frac{RA}{L}$

S.I. Unit - "Ohm meter"

Dimension $[M^1 L^3 T^{-3} A^{-2}]$

Unit of resistivity $(\rho) = \frac{\text{Ohm} \times (\text{metre})^2}{\text{metre}}$

$= \frac{\Omega \times m^2}{m}$

$= \Omega m.$

Factor affecting Resistivity

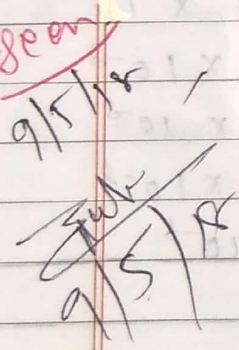
1. $\rho \neq L \neq A$.
   It does not depend upon Length and area of material
2. Nature of Material
3. Temp. of Material.

Electrical resistivity of some substaces at 20°C

Category	Material	Resistivity (Ω m)
Conductors	Metals.	
	Silver	1.60×10^{-8}
	Copper	1.62×10^{-8}
	Aluminium	2.63×10^{-8}
	Tungstem	5.20×10^{-8}
	Nickel	6.84×10^{-8}
	Iron	10.0×10^{-8}
	Chromium	12.9×10^{-8}
	Mercury	94.0×10^{-8}
	Magnese	1.0×10^{-6}
	Alloys Nichrome.	
Semiconductor	Germanium	0.6
	Silicon	2300.
Insulators	Glass	$10^{10} - 10^{14}$
	Hard glass	$10^{13} - 10^{-16}$
	Ebonite	$10^{15} - 10^{17}$
	Diamond	$10^{12} - 10^{13}$
	Paper (dry).	10^{12}

Difference between Resistence and Resistivity

Parameter	Resistence	Resistivity
Defination	The property of material due to which it opposes the flow of current through it is called resistence	Rustivity of materid is resistence offerd by 1m L of wire of material having an area of cross section of $1m^2$.
Formula	The resistence of conductor depends on its length and thickness	The resistivity of material does not depend on its length or thickness, and is the characteristic of given materid
Formula dependency	$R = \frac{V}{I}$ (Potential Diff / Current)	$\rho = \frac{R \times A}{L}$ (Resistence * Cross Section Area / Legth of material)
S.I unit	ohm (Ω)	ohm-metre (Ω-m)



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Conductor - those substance which have very low electrical resistivity are called Conductores Ex- Silver the best Conductor amongst metals.

Resistors: Those substances which have comparatively higher electrical resistivity are called resistors

Insulators: Those substance which have infinitely high resistivity are called Insulators.

Ques / Sol What will be the resistence of metal wire of length 2m and area of crossection $1.25 \times 10^{-6} m^2$, if the resistivity of metal is $1.6 \times 10^{-8} \Omega m$?

Sol $\rho = \frac{R \times A}{l}$

Given Quantity

Here, Resistivity (R) = ?

Area of crossection (A) = $1.25 \times 10^{-6} \Omega m$

Length (l) = 2m.

Resistivity of metal (ρ) = $1.6 \times 10^{-8} \Omega m$

$\Rightarrow$ Putting the value

$$1.6 \times 10^{-8} \Omega m = \frac{R \times 1.25 \times 10^{-6} m^2}{2m}$$

$$R = \frac{2m \times 1.6 \times 10^{-8} \Omega m}{1.25 \times 10^{-6} m^2}$$

$$R = \frac{2 \times 1.6 \times 10^{-8+6} \Omega}{1.25}$$

$$R = \frac{2 \times 1.6 \times 10^{-2} \Omega}{1.25}$$

$$R = 2.56 \times 10^{-2} \Omega$$

$\Rightarrow$ The resistence of metal wire is $2.56 \times 10^{-2} \Omega$

Ques 2 The electrical resistivites of iron and mercury are $10.0 \times 10^{-8}\ \Omega m$ and $94.0 \times 10^{-8}\ \Omega m$ respectively which is better conductor.

sol. Iron is a better conducter than mercury because it has a lower resistivity than mercury we know lower the resistivity, better is conducter.

Ques 3 What are coils of electric toasters and electric ions made of an alloy rather than a pure metal?

Ans. The coils of electric toasters and electric ions are made of an alloy rather than a pure metal is
a. the resistivity of an alloy is higher than that of its constituent pure metals
b. Alloy do not oxdise (burn) readily at high temperature.

Seen
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Combination of Grouping of Resistors.

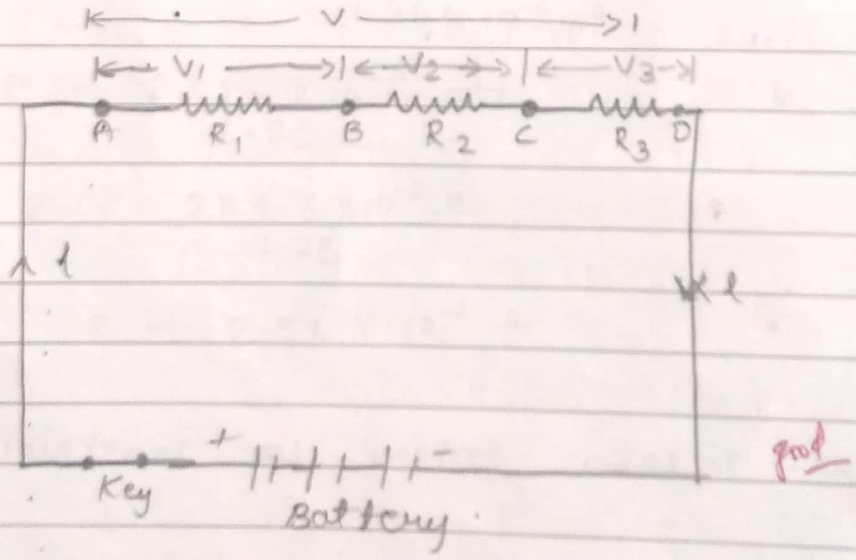
The resistors may be connected in two ways.

(a) Series combination of resistors.

Two or more resistors are said to be connected in series if they are connected end to end consecutively in electric circuit

the Current I Passes through each resistor is same.

each resistor has different potential diff across its ends. But the sum of Potential diff. across all resistance is equal to voltage of the battery.



Symbol Naming.

V = Potential difference

R = Resistence.

I = Current

Equilant resistorsll of three resistors connected in series.

Consider three resistors of R_1, R_2 and R_3 connected in series. Let I be flowing current through each resistor and V be the Potential diff across the series combination. If V_1, V_2 and V_3 Potential diff across resistors R_1, R_2, R_3.

$V = V_1 + V_2 + V_3$ ——①

By ohm Law $V_1 = IR_1$, $V_2 = IR_2$, $V_3 = IR_3$

⇒ Current flowing through all resistors is same.

∴ Eq (1) becomes

$$V = IR_1 + IR_2 + IR_3$$

or $$V = I(R_1 + R_2 + R_3) \quad \text{——②}$$

If R_3 be effective or equivalent resistence of series.

$$V = IR_3$$

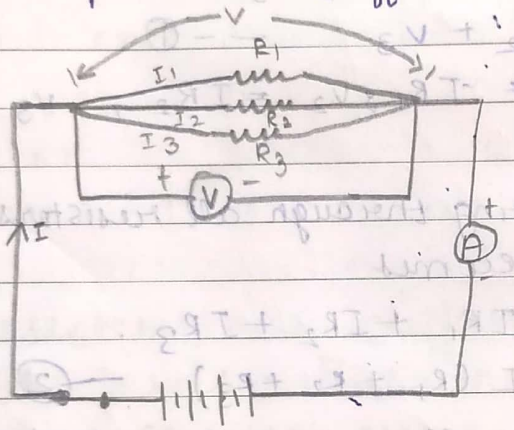
From eq (2) and (3) we get,

$$IR_3 = I(R_1 + R_2 + R_3)$$

$$\boxed{R_3 = R_1 + R_2 + R_3.}$$

Parallel combination of resistors.

Two or more resistors are said to be connected in parallel if one end of a resistor is connected to one end of other resistor and the second end of the first resistor is connected to second end of other resistor, such that potential diff. across resistor is same.



* All the resistors have the same potential across them
* diff. amount of I flows through each resistor. But sum of I flowing through all resistances is equal to total current flowing in circuit.

Consider three resistors of resistance - R_1, R_2, R_3 connected in Parallel.

⇒ Let v be Potential diff across each resistor. The current I drawn from cell divides into 3 Parts (I_1, I_2, I_3) at junction Point A. Let I_1, I_2, I_3 flow through resistors R_1, R_2, R_3

$$\boxed{I = I_1 + I_2 + I_3}$$

Since potential diff b/w 2 end A & B is V, By ohm's Law.

Current in R_1 is $I_1 = \frac{V}{R_1}$

" in R_2 is $I_2 = \frac{V}{R_2}$

" in R_3 is $I_3 = \frac{V}{R_3}$

Now, $I = I_1 + I_2 + I_3$

$$I = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3} \quad \text{— (1)}$$

In equivalent resistance of combination b/w Points A and B is R_p then,

$$I = \frac{V}{R_p} \quad \text{— (2)}$$

From eq (1) and (2) we get,

$$\frac{V}{R_p} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\frac{V}{R_p} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

$$\boxed{\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}.}$$

Seen 16/5/18

Assignment

Ques 1:- Resistores of 5Ω, 10Ω, 15Ω and 20Ω are connected in series. Calculate the total resistence of the circuit.

Sol :- Given Quantity

Resistence R_1 = 5Ω, 10Ω, 15Ω, 20Ω

R_2 = 10Ω

R_3 = 15Ω

R_4 = 20Ω

Find :- Total resistence (R_T) = ____ ?

As we known.

$R_T = R_1 + R_2 + R_3 + R_4$

$R_T = 5\Omega + 10\Omega + 15\Omega + 20\Omega$

$R_T = 50\Omega$ Ans

Ques 2- Three resistors of 2Ω, 3Ω, and 15Ω are connected in parallel. Calcute the total resistence of the circuit.

Sol Given Quantity =

Resistence (R) = 2Ω, 3Ω, 15Ω

Find :- Total Resistence (R) = ____ ?

As we know:

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_p} = \frac{1}{2\Omega} + \frac{1}{3\Omega} + \frac{1}{15\Omega}$$

$$= \frac{15 + 10 + 2}{30} = \frac{27}{3} = 1.17\Omega \text{ Ans}$$

? ?

Quest 1 State the law of Combination of resistors in series.
Ans. Page no 27 on N/B.

Ques 2 Why is the series arrangement not used for domestic circuits.
Ans Page no 27.

Ques 3 Air Conditioners, water heaters, etc. do not work properly in series circuit. Give reasons.
Ans

Ques 4.
Sol t.

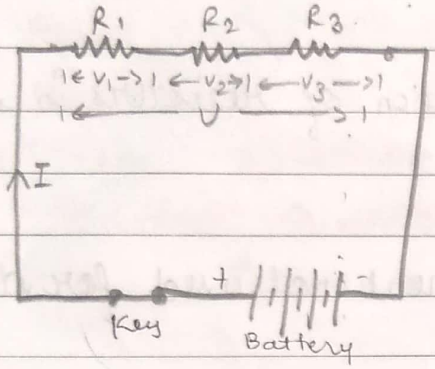
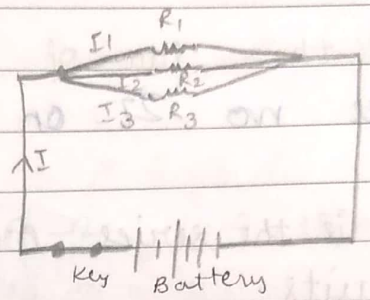
? ?

Ques 5 State the law of combination of resistors in Parallel
Sol 5. On Page no. 28 in N/B.

Ques 6. what are the characteristics of the combination resistors in Parallel ?
Sol : 1. All other appliances keep working normally
2. Each electrical appliance has its independent switch, so it can be operated independently.
3. Each electrical appliance gets same voltage (220V)

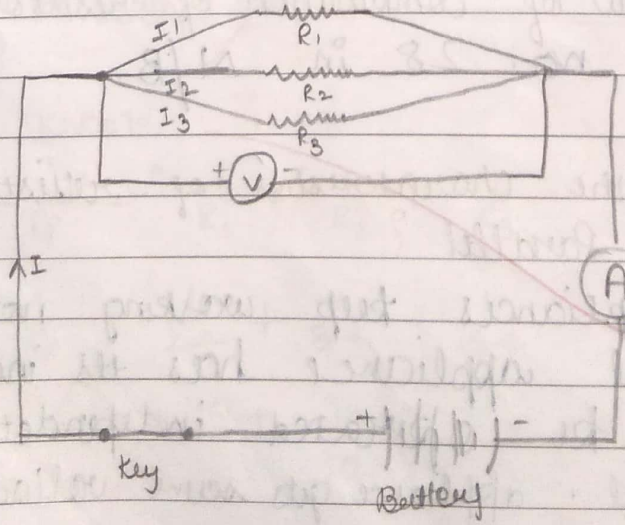
Ques 7 Distinguish b/w the resistors connected in series and Parallel.

Ans

Resistors in Series	Parallel
	
# Symbol Naming. V = Potential diff I = ~~Const~~ Electric Current R = Resistence.	Symbol Naming. V = Potential diff I = Current R = resistence.
# Formula $V = V_1 + V_2 + V_3$ $I = \text{constant}\ (I_1 = I_2 = I_3 = I)$ $R_S = R_1 + R_2 + R_3$	Formula $V = \text{Constant}\ (V_1 = V_2 = V_3 = V)$ $I = I_1 + I_2 + I_3$ $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

Ques 9.

Sol 9.



Ques 10

Sol 10 Given Quantity :

Resistence (R) = 8Ω, 10Ω, 5Ω

Find: Resistence (R_S) ——— ?

As we know.

$$R_S = R_1 + R_2 + R_3$$

$$R_S = 8\Omega + 10\Omega + 5\Omega$$

$$R_S = 23\Omega \quad \text{Ans}$$

Ques 11

Sol 11 Given Quantity :

Four resistor = 5Ω, 10Ω, 15Ω & 20Ω

find Total Resistence (R_P) ——— ?

As we Know.

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

$$\frac{1}{R_P} = \frac{1}{5\Omega} + \frac{1}{10\Omega} + \frac{1}{15\Omega} + \frac{1}{20\Omega}$$

$$\frac{1}{R_P} = \frac{12 + 6 + 4 + 3}{30} = \frac{25}{60} = \frac{5}{12} = \frac{1}{2}$$

$$R_P = 2.4\Omega \quad \text{Ans}$$

Tutorial
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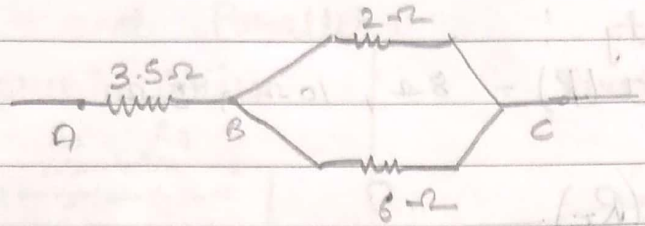
Ques 13 Calculate the total resistence of circuit:-

Sol 13.



Sol Case I - Given Quantity

$R_1 = 2\Omega$, $R_2 = 6\Omega$

To find R_p

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \Rightarrow \frac{1}{R_p} = \frac{1}{2} + \frac{1}{6}$$

$$\frac{1}{R_p} = \frac{3+1}{6} = \frac{4}{6}$$

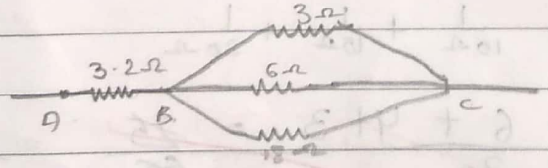
$$R_p = \frac{3}{2}$$

Case II: Given Quarity $R_1 = 3.5\Omega, \frac{7}{2}$, $R_2 = \frac{3}{2}$

$$R_S = R_1 + R_2$$

$$= \frac{7}{2} + \frac{3}{2} = \frac{10}{2} = 5\Omega \text{ Ans}$$

B



Sol Case I - Given Quantity = $R_1 = 3\Omega$ $R_2 = 6\Omega$, $R_3 = 18\Omega$

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \Rightarrow \frac{1}{R_p} = \frac{1}{3} + \frac{1}{6} + \frac{1}{18}$$

$$\frac{1}{R_p} = \frac{6+3+1}{18} = \frac{9}{5}$$

Case II $R_S = R_1 + R_2$

$= \frac{16}{5} + \frac{9}{5} = \frac{25}{5} = 5\,\Omega$ Ans

Ques 14 Four resistor are connected in series such that their total resistence is 50 Ω. Three resistor of 5 Ω, 10 Ω, 15 Ω - find the fourth.

Sol Given Quantity. $R_S = 50\,\Omega$,

$R_1 = 5\,\Omega$, $R_2 = 10\,\Omega$, $R_3 = 15\,\Omega$

$R_4 = ?$

$R_S = R_1 + R_2 + R_3 + R_4$

$50 = 5 + 10 + 15 + R_4$

$50 = 30 R_4$

$50 - 30 = R_4$

$20 = R_4$

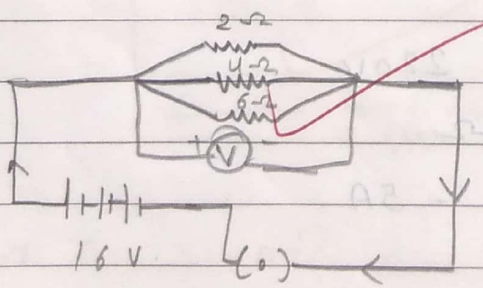
Ques 15. Given Quantity $V = 5$, $R = 10$.

Sol $V = IR$

$I = \frac{V}{R} = \frac{5}{10} = 0.4A$

Ques 16:

(i)



(a) Total resistence of circuit in each resistor

Sol $V = IR$, $I = \frac{V}{R}$.

(i) $I_1 = \frac{V}{R} = \frac{16}{2} = \boxed{8A}$

ii $I = \frac{V}{R} = \frac{16}{4} = \boxed{4A}$

iii $I = \frac{V}{R} = \frac{16}{8} = \boxed{2A}$

(b) Total current $= 8A + 4 + 2 = \boxed{14A}$

(c) Given Quantity:

$R_1 = 2\Omega$, $R_2 = 4\Omega$, $R_3 = 8\Omega$

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$

$\frac{1}{R_p} = \frac{4 + 2 + 1}{8} = \frac{7}{8}$

$R_p = \frac{8}{7} = 1.14\Omega$.

Ques 17

Sol: (a) Separately = volt = 220V

$R = 44\Omega$

$I = \frac{V}{R} = \frac{220}{44} = 5A$

(b) Series, volt = 220V.

$R = 44 + 44 = 88\Omega$

$I = \frac{V}{R} = \frac{220}{88} = \frac{5}{2} = 2.5A$

(C) Parallel = volt = 220V.

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{R_p} = \frac{1}{44} + \frac{1}{44} + \frac{1}{44}$$

$$R_p = 22.$$

$$I = \frac{V}{R} = \frac{220}{22} = 10A.$$

Ques18

Sol: Given Quantity = $R_1 = 6\Omega$, $R_2 = 8\Omega$, $R_3 = 12\Omega$, $R_4 = 24\Omega$.

Highest Resistence.

$$R_S = R_1 + R_2 + R_3 + R_4$$

$$R_S = 6 + 8 + 12 + 24$$

$$R_S = 50\Omega.$$

Lowest Resistence.

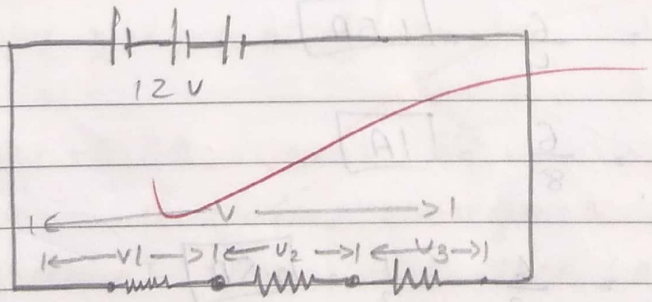
$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{6} + \frac{1}{8} + \frac{1}{12} + \frac{1}{24}.$$

$$\frac{1}{R_p} = \frac{4+3+2+1}{24} = \frac{10}{24}$$

$$R_p = \frac{24}{10} = \boxed{2.4\Omega}$$ Ans

Ques19

Sol:



Sol(a) Find I ____A?

$$R_S = 6 + 10 + 8 = 24\Omega$$

$$V = 12V$$

$$I = \frac{V}{R} = \frac{12}{24} = \boxed{0.5A}$$

b (i) $V_1 = I_1 R_1$

$= 0.5 \times 6 = \boxed{3V}$

ii $V_2 = I_2 \times R_2$

$= 0.5 \times 8$

$= \boxed{4V}$

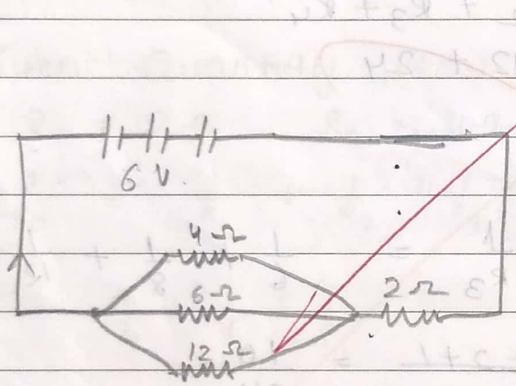
iii $V_3 = I_3 \times R_3$

$= 0.5 \times 10$

$= \boxed{5V.}$

Qus 20

Sol :



Sol : (b) $R_1 = 4\Omega$, $R_2 = 6\Omega$, 12Ω

$V = 6.V$

$I_1 = \frac{V_1}{R_1} = \frac{6}{4} = \boxed{1.5A}$

$I_2 = \frac{V_2}{R_2} = \frac{6}{8} = \boxed{1A}$

$I_3 = \frac{V_3}{R_3} = \frac{6}{12} = \frac{1}{2} = \boxed{0.5A}$

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Heating effect of electric current

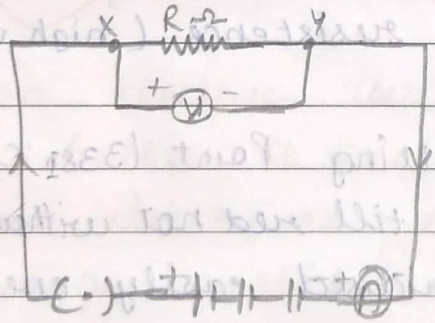
Due to energy conservation, electrical energy is converted into heat energy which give heat and light. This is called heating effect of electric current.

or

A current flow through a conductor, the free electrons lose energy which is converted into heat.

Heat Produced in conductor by electric current

Consider a conductor XY of resistence R Ω let a Potential diff. (in V) be applied across the ends of XY.



$$Q = I \times t \quad \text{---} \quad (1)$$

when an electric charge Q moves against V, the amount of work done (W)

$$W = Q \times V \quad \text{---} \quad (2)$$

Ohm's Law

$$R = \frac{V}{I}$$

$$V = IR \quad \text{---} \quad (3)$$

Substiting value of eq (1) and 3 in eq (2)

$W = Q \times T$

$W = I \times t \times I \times t$

$W = I^2 \times t \times R$

Work done = energy

$W = E = I^2 \times R \times t$

H is also form of energy

$$\boxed{H = I^2 R t}$$

It is known as Joule's law of heating

Electric Bulb:

A electric bulb consist of a filament made tungsten wire, Tungesten is used because it has a large value of resistivity and a high Melting Point.

→ Because:

1. It has a very high resistence (high value of resistivity.
2. It has a high Melting Point (3380°C), so it can be heated till red hot without melting
3. It does not get oxidised easily even at temp. (2500°
4. Its thermal expansion is not very large. So on heating, it does not get loose and cau any insulation Problem.

Bulb is filled with Argon or Nitrogen to prevent oxidation and evaporation of the filament and hence prolong the life of the filament of an electric bulb.

Electric Fuse :-

is a safety device constituting of piece of thin wire of a material (generally an alloy of tin and copper) having a low melting point and high resistence which melts and breaks the circuit of current exceeds a safe value, hence preventing the electrical appliances in circuit from getting damaged.

⇒ Rating of fuse :-

The maximum current which can flow through a fuse without melting it, is called its fuse rating.

⇒ Quiz

Ques1: when an electric current is passed through a electric bulb is, it becomes warm when touched.

Ans because electrical energy converted into heat energy, which make it warm.

Ques2 What is meant by heating effect of current?

Ans when electrical energy converted into heat and light to Produce it heat and light

Ques3: what is cause of heating effect of electric current?

Ans As Current flows through a conductor the fuse electron loose energy which is converted into heat.

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Heating effect of electric current :-

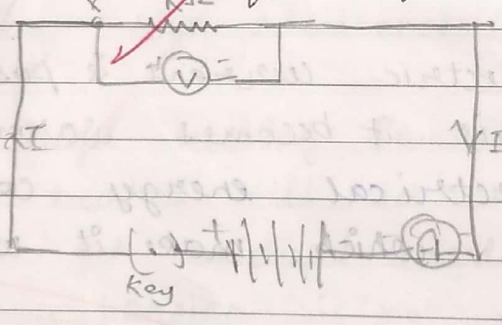
Due to the energy conservation the electric energy converted into the heat energy is is called Heating effect.

OR:

As current flow through a conductor, the free electrons lose energy which is converted into heat

Electric bulb

Cause of heating effect of electric current



Heat produced in a conductor by electric current

Consider a conductor XY of resistance R ohms. Let a potential diff. (in volts) be applied across the ends of XY.

$$Q = I \times t \quad \text{---(1)}$$

When an electric charge Q move against V, the amount of work done (W)

$$W = Q \times V \quad \text{---(2)}$$

$W = Q \times t$

$W = I \times t \times I \times R$

$W = I^2 \times t \times R$

Work done = energy.

$W = E = E^2 \times R \times t$

H is also form of energy

$H = I^2 R t$

It is known as Joule's Law of Heating.

Electric Bulb.

An electric bulb consist of a filament made of tungsten wire, Tungestion is used because it has a large value of resistivity and a high melting point.

→ Build is filled with Argon or Nitrogen to prevent oxidation and evaporation of the filament and hence prolong the life of the filament of an electric bulb

Electric fuse:

is a safety device constituting of a piece of thin wire of a Material having a low melting point and high resistence which melts and breaks the circuit of the current exceeds a safe values, hence preventing the electrical applinces in circuit from getting damaged.

Electric Power

Electric power is defined as the rate of doing electric work per unit time. Electric Power (P) =

$$= \frac{\text{Electrical work done}}{\text{Time}}$$

$$P = \frac{E}{t}$$

$$P = \frac{I^2 R t}{T} = P = \frac{V \times I \times T}{T}$$

$$P = V \times I$$

Form of I and R

we know = $V = IR$

and $P = V \times I$ — (i)

put value of V in eq (i)

$$P = IR \times I$$

$$P = I^2 R$$

Form of V and R

$$P = V \times I \quad -(i)$$

Ohms Law = $I = \frac{V}{R}$

Put the value of I in eq (i)

$$P = \frac{V \times V}{R}$$

$$P = \frac{V^2}{R}$$

Unit of Electric power.

$P = V \times I$

then,

$1P = 1V \times 1A$

$1P = 1$ watt (1w)

1 watt = when 1 Ampere current flows through an electrical circuit when a potential diff. of 1 volt is applied.

1 Kilowatt = 1KV = 1000w

1 Mega watt (1Mw) = 10^6 w

1 Micro watt 1Mw = 10^{-6} w

1 Mili watt = 10^{-3} w

1 giga watt 1gw = 10^9 w

1 nano watt 1nw = 10^{-9} w.

In Series:

$R_T = R_1 + R_2$

$R_T = 10\Omega + 10\Omega$

$R_T = 20\Omega$

In Parallel

$\frac{1}{R_P} = \frac{1}{R_T} + \frac{1}{R_3}$

$\frac{1}{R_P} = \frac{1}{20} + \frac{1}{10}$

$= \frac{1+2}{20}$

$\frac{1}{R_P} \times \frac{3}{20}$

$3R_P = 20$

$R_P = \frac{20}{3}$

Incomplete Ans

(C) Short type - II Question.

Ques(i) Calculate the Resistence of 5m length wire of cross-section $0.01 mm^2$ and Resistivity 50×10^{-8} ohmmeter.

Sol Given Quantity.

Length (l) = 5m

Area of cross-section (A) = $0.01 mm^2$

Resistivity (ρ) = $50 \times 10^{-8} \Omega m$.

find Resistence ____ Ω?

As we know.

$$R = \rho \frac{l}{A}$$

Symbol Naming.

R = Resistence.

ρ = Resistivity.

L = Length.

A = Area

Putting the values in above formula.

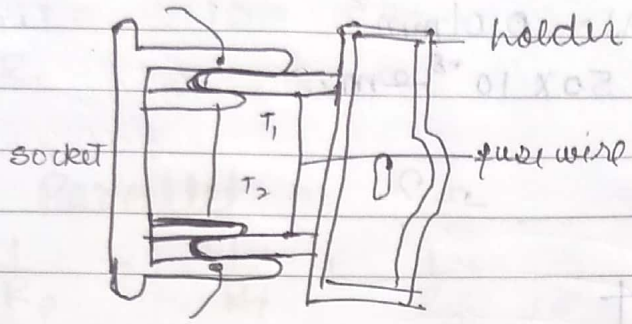
$$R = \frac{50 \times 10^{-8} \Omega m \times 5m \times 10}{0.01 m^2 \times 10 \times 10.}$$

$$R = 25 \times 10^{-2} \Omega$$

Resistence of wire is $.25 \times 10^{-8} \Omega$.

Quesii) What is a fuse and How does it work?

Ans Fuse -



An electric fuse is a safety device consisting of a piece of thin wire of material having low melting point and high resistence, which melts and breaks the circuit if the current exceeds a safe value, hence preventing the electrical appliances in the circuit from getting damaged.

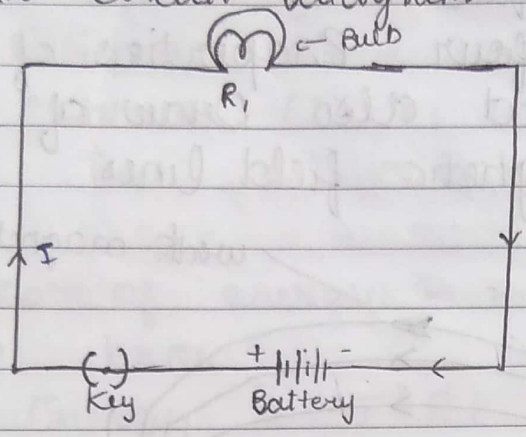
Working of fuse

1. Only when the fuse holder is inserted in fuse socket, the circuit of our domestic wiring is complete So, under normal circumstances, the fuse wire is intact and electric current is available through wiring

2. when a short circuit occurs. touching ~~fuse~~ of live wire and neutral wire takes place or overloading occurs due to flow of extremely large current in circuit due to excessive use of electrical appliances at same time, the current in Circuit exceeds the specified value to the which fuse wire gets heated up.

Ques iii) Draw the circuit diagram to verify ohm's law?

Sol



Symbol Naming

+|||+ - Battery

-(.)- Key.

—R— = Bulb

I = Current

Acc. to ohm's Law the electric current flowing through a conductor is directly Proportional to the Potential diff. across its ends, provided the temp. and other physical conditions of condactor remain same.

$V \propto I$

$V = IR$

$\frac{V}{I} = R$ constant

$R = \frac{V}{I}$

$V = I \times R$

V = Potential diff.

I = Electric Current

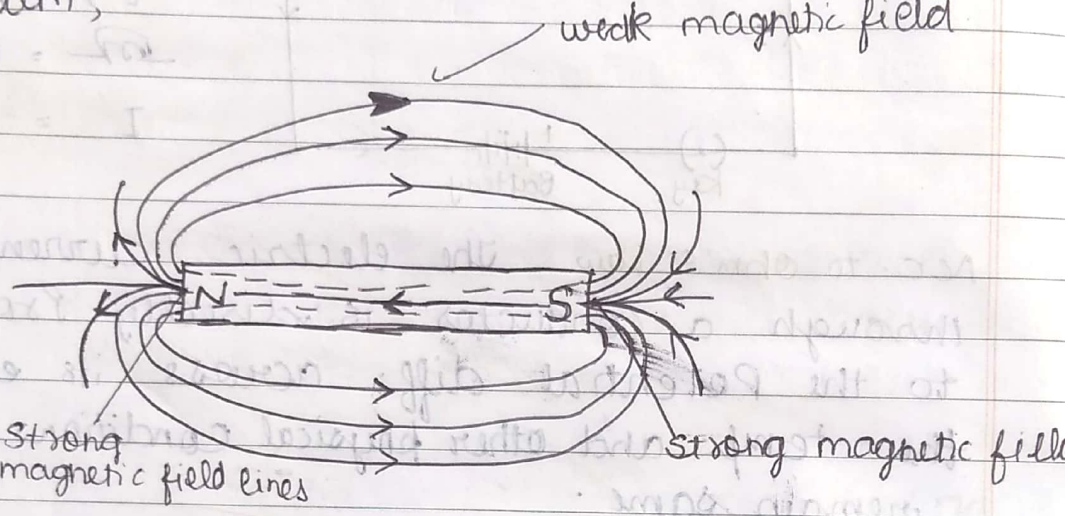
R = Resistence

$$I = \frac{V}{R}$$

(D) Long answer question.

Ques(i) write any four Properties of magnetic field lines and also Draw of diagram to show magnetic field lines.

Sol Diagram,



Properties of Magnetic field lines

1. Each Magnetic field line formes a closed curve
2. The relative Strength of Magnetic field show by degree of closeness of field lines.
3. No two magnetic field line cannot intersect each other.
4. The Magnetic field line emerges from north p and ~~meg~~ merge of south pole.
5. Although Magnetic field line are not real, they represent a Magnetic field which real.

Ques(ii)

(ii) Given Quantity.

Resistence (R) = 20Ω

Current (I) = 10A

Time (t) = 30hr.

Find.

cost of energy = ___ ₹

As we know.

Energy = I^2Rt

= 10A X 10A X 2Ω X 3hr.

= 6KwH

A unit charge = ₹4.

6KwH Charge is = 6X4

= ~~₹24~~ ₹24

One day cost of Heat oven is = ₹24

30 days cost of " = 24 X 30

= ₹720.

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✡ Working of DC Motor.

1. Let us assume the coil ABCD is initally in horizontall position. when switch is pressed current enters the coil through carbon Brushes B_1 and split ring C_1. The flow of current direction BADC and it leaves through C_2 & B_2.

2. The direction of current is AB is from B to A and Magnetic field North to South Appling Fleming's Left hand rule to side AB, force is downward perpendicular to plane of paper.

3. The direction of Current in Side ~~AB~~ CD of coil is from D to C and direction of magnetic field is same again from N to S. By Appling Fleming's Left rule to sid CD the force direction is upward perpendicular to plane of paper.

4. These two equal, opposite and Parallel forces acting on two side of coil AB and CD form on torque. Due to this, side of AB coil pushed down and side CD is coil is pushed up. This makes coil move in anticlockwise direction.

5. During rotation when coil reaches vertical position, the brushes B_1 and B_2 lose contact with split ring C_1 & C_2 and current in coil is cut off. the coil continue its motion due to inertia of motion. It rotates untill it covers a rotation of 180°

6. In 180° position, the sides AB and CD are interchanged. As result, split ring C_1 is now contact with B_2 and split ring C_2. Therefore, the current continuous to flow in the direction CDAB

23/7 Seen 23/7/18

7. According Fleming's left hand rule the coil AB is now experience a force in upward direction and Perpendicular to Plane of paper whereas coil AB experience a force in upward direction and the coil CD experience force in downward direction.

7. The coil while rotating reaching vertical position. In this position, once again, the brushes and split rings lose contact with each other and current in coil cut off. The coil continue flow Due to inertia of motion till it complete an angle of 360° one revolution.

8. This process is repeated again and again the coil continues to rotate as long as current is Passing through it. A wheel can be mounted the axle attached to rotating coil along axis