SHIKSHA CLASSES

Sub. : Science | **Answer Paper** | **Marks : 30**

Std. : Xth - CBSE | **12. Electricity.** | **Time : 1 Hour.**

SECTION (A) **(Each - 1 Mark)**

Q.1 : When a current I flows through a resistance R for time 't' the electrical energy spent is given by

Ans. : b) I^2Rt

OR

If the current flowing through a fixed resistor is halved, the heat produced in it will become :

Ans. : a) One-fourth

Q.2 : A wire of resistance R_1, is cut into five equal pieces. These five pieces of wire are then connected in parallel. If the resultant resistance of this combination be R_2, then the ratio R_1 / R_2 is:

Ans. : d) 25

OR

Two electric bulbs have resistances in the ratio 1:2. If they are joined in series. the energy consumed in them is in the ratio.

Ans. : b) 1:2

Q.3 : Assertion (A) : The current flowing through each resistor is the same when connected in series.

Reason (R) : The voltage drop across each resistor remains the same when connected in parallel.

Ans. : b) Both A and R are true but R is not the correct explanation of the assertion.

Q.4: Assertion (A) : Alloys are commonly used in electrical heating devices like electric iron and heater.

Reason (R): Resistivity of an alloy is generally higher than that of its constituent metals but the alloys have low melting points then their constituent metals.

Ans. : c) A is true, but R is false.

Q.5: Assertion (A) : The metals and alloys are good conductors of electricity.

Reason (R) : Bronze is an alloy of copper and tin and it is not a good conductor of electricity.

Ans. : (a) Both A and R are true and R is the correct explanation of the assertion A.

Q. 6: You are given four ammeters A. B, C and D having least counts mentioned below:

I. Ammeter A with least count 0.25 A

II. Ammeter B with least count 0.5 A

III. Ammeter C with least count 0.05 A

IV. Ammeter D with least count 0.1 A

Which of the ammeters would you prefer for doing an experiment to determine the equivalent resistance or two resistances most accurately, when connected in parallel?

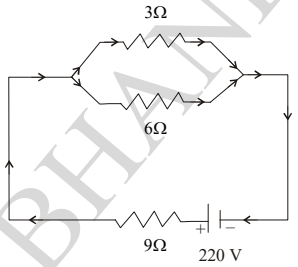
Ans. : c) Ammeter C

OR

Two appliances of rating 200 watt-250 volts and 100 watt-250 volts are joined in series to a 250 volts supply. Total power consumed in the circuit is

Ans. : b) 67 watt

Q.7 : Observe the following figure and answer any two question from 5(i) to 5(iii). (2 Mark)



i) In the given figure, the resistors

Ans. : d) 3 Ω and 6 Ω are in parallel and the combination is in series with 9 Ω

ii) The equivalent resistance of the figure is.

Ans. : a) 11 Ω

iii) Find the value of current flowing through the circuit.

Ans. : a) 20 A

Q.8: An electrical appliance has a resistance of 25 Ω When this electrical appliance is connected to a 230 V supply line, the current passing through it will be:

Ans. : c) 9.2 A

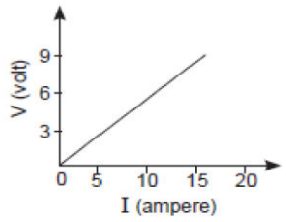
Q.9 : How is the resistivity of alloys compared with those of pure metals from which they may have been formed?

Ans. : The resistivity of an alloy is generally higher than that of its constituent metals.

Q.10: Electrical resistivity of a given metallic wire depends upon

Ans. : (d) Nature of the material

Q.11: The resistance whose V – I graph is given below is



Ans. : (b) 3/5 Ω

Q.12: What is the S.I. unit of resistivity?

Ans. : The S.I. unit of resistivity is Ohm-meter.

Q.13: Two wires of same length and area made of two materials of resistivity ?1 and ?2 are connected in series to a source of potential V. The equivalent resistivity for the same area is

(a) $\rho_1 + \rho_2$ (b) $\frac{\rho_1\rho_2}{\rho_1+\rho_2}$

(c) $\frac{(\rho_1+\rho_2)}{\rho_1\rho_2}$ (d) $\left(\frac{|\rho_1+\rho_2|}{2}\right)$

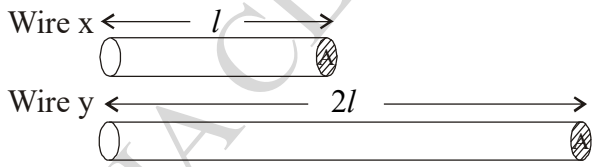
Ans. : a) $\rho_1 + \rho_2$

Q.14: If R1 and R2 be the resistance of the filament of 40 W and 60 W respectively operating 220 V, then

Ans. : (b) R2 < R1

SECTION (B) **(Each - 2 Mark)**

Q.15: Out of two wires x and y shown below, which one has greater resistance? Justify your answer.



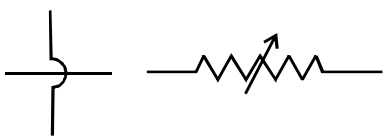
Ans. : Wire y has greater resistance as it has more length than wire x'. It is because resistance of wire is directly proportional to the length of the wire.

Q.16 : State ohm's law.

Ans. : The potential difference V across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it, provided its temperature remains the same. This is called ohm's law.

OR

: a) What do the following circuit symbols represent?



i) ii)

b) The potential difference between the terminals of an electric heater is 60V when it draws a current of 4A from the source find the resistance of heater when in use.

Ans. : a) i) Wires crossing without touching each other

ii) Rheostat/Variable resistor

b) **Given :** $V = 60V$

$I = 4A$

$R = ?$

From ohm's law

$V = IR$

$60 = 4 \times R$

$$R = \frac{60}{4} = 15\Omega .$$

SECTION (C) **(Each - 3 Mark)**

Q.17 : a) Define the term 'Coulomb'

b) State the relationship between the electric current, the charge moving through a conductor and the time of flow. Calculate the charge passing through an electric bulb in 20 minutes if that value of current is 200 mA.

Ans. : a) One Coulomb is the charge contained in 6.25×10^{18} electrons or coluomb is equal to the amount of charge from a current of one ampere flowing for one second. It is the S.I. unit of electric charge.

b) i) $I = \frac{Q}{t}$ where I = electric current

Q = Charge moving through a conductor

t = time of flow.

ii) Current $I = 200\ mA = 200 \times 10^{-3} A$

Time, t = 20 minutes = 20×60

= 1200 Seconds.

Charge, Q ?

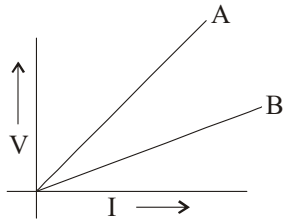
$$I = \frac{Q}{t}$$

$Q = I \times t = 200 \times 10^{-3} \times 1200$

$$= \frac{200 \times 1200}{1000} = 240C .$$

OR

: V-I graph for two wires A and B are shown in the figure. If both wires are of same length and same thickness, which of the two is made of a material of high resistivity? Give justification for your answer.



Ans. : Greater the slope of V-I graph greater will be the resistance of given metallic wire. In the given graph, wire A has greater slope than B. Hence wire A has greater resistance.

For the wires of same, length and same thickness, resistance depends on the nature of material of wire.

i.e.

$$R_1 = \rho_1 \frac{\ell}{A} \text{ and } R_2 = \rho_2 \frac{\ell}{A}$$

$$\frac{R_1}{R_2} = \frac{\rho_1}{\rho_2} \text{ or } R \alpha \rho$$

Hence wire A is made of a material of high resistivity.

Q.18 : a) Write an expression for the amount of heat produced in a wire of resistance of R and carrying a current of I for time t.

b) An electric heater of resistance 10 Ω draws 15A from the service main for 2 hours calculate:

i) The heat developed in the heater and

ii) The power of the heater.

Ans. : a) $H = I^2Rt$

b) i) Resistance of the heater, $R = 10\Omega$

current drawn, $I = 15A$

Time, $t = 2hrs = 2 \times 60 \times 60$

$H = I^2Rt$

$= 15 \times 15 \times 10 \times 2 \times 60 \times 60$

$= 162000J$

$\therefore H = 162 \times 10^3 J$

ii) Power of the heater

$P = I^2 \times R = 15 \times 15 \times 10$

$= 2250W$

$= 2.25KW.$

SECTION (D) **(5 Mark)**

Q.19 : Derive the expression to find the equivalent resistance when the resistors are connected in parallel combination.

Ans. : It is observed that the total current I, is equal to the sum of the separate currents through each branch of the combination.

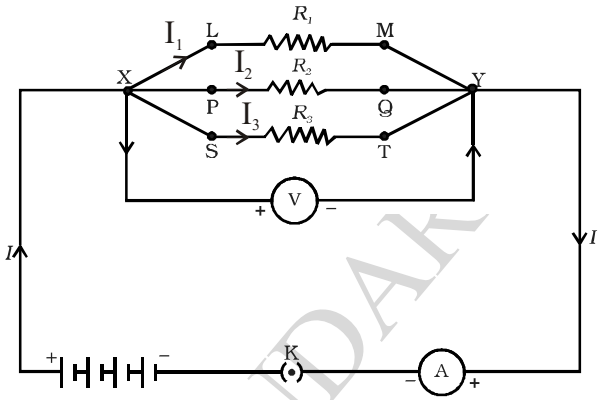
$I = I_1 + I_2 + I_3$ ---(i)

Let R_p be the equivalent resistance of the parallel combination of resistors. By applying Ohm's law to the parallel combination of resistors

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

On applying Ohm's law

$$I_1 = \frac{V}{R_1};\ I_2 = \frac{V}{R_2};\ \text{and } I_3 = \frac{V}{R_3}$$



From eqn. (i)

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

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

It is conclude that the reciprocal of the equivalent resistance of a group of resistances joined in parallel is equal to the sum of the reciprocals of the individual resistances.

OR

: Three 250 watt heaters are connected in parallel to a 100 volt supply. Calculate :

i) the total current taken from the supply.

ii) the resistance of each heater.

iii) the energy supplied in kwh to the three heaters in 5 hours.

Ans. : Given, power of one heater (P) = 250 watt; potential (v) = 100 volt, time(t) = 5 hours

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

$$\therefore R = \frac{V^2}{P} = \frac{100 \times 100}{250} = 40\Omega$$

The three 250 watt heaters are connected in parallel then total current,

$$I = I_1 + I_2 + I_3$$

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

$$= \frac{100}{40} + \frac{100}{40} + \frac{100}{40}$$

$$= 2.5 + 2.5 + 2.5$$

$$= 7.5\ A$$

Then three heaters in connection

The energy supplied to heaters

Total power consumption = 250+250 + 250 = 750W

$\therefore$ Energy supplied in Kwh in 5 hours $= \frac{\text{watt} \times \text{hour}}{1000} = \frac{750 \times 5}{1000} = 3.75$ Kwh energy used in the circuit.

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