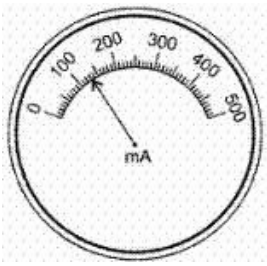
CBSE Test Paper-02

Chapter 12 Electricity and its Effects

1. The following instruments are available in a laboratory :Milliammeter A_1 of range 0-300 mA and least count 10 mAMilliammeter A_2 of range 0-200 mA and least count 20 mAVoltmeter V_1 of range 0-5 V and least count 0.2 VVoltmeter V_2 of range 0-3 V nd least count 0.3 V.
   Out of the following pairs of instruments, which pair would be the best choice for carrying out the experiment to determine the equivalent resistance of two resistors connected in series ? **(1)**

   a. Milliammeter A2 and voltmeter V2
   b. Milliammeter A1 and voltmeter V1
   c. Milliammeter A2 and voltmeter V1
   d. Milliammeter A1 and voltmeter V2

2. The given diagram shows the milliammeter reading connected in a circuit :



   The value of current flowing in the circuit is **(1)**

   a. 103 mA
   b. 160 mA
   c. 100.3 mA
   d. 130 mA

3. What is the resistivity of Nichrome? **(1)**

   a. $110 \times 10^{-8}\,\Omega m$
   b. $12.9 \times 10^{-8}\,\Omega m$
   c. $10^{10} - 10^{14}\,\Omega m$

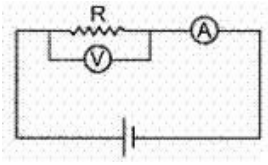
d. $1.60 \times 10^{-8}\,\Omega m$

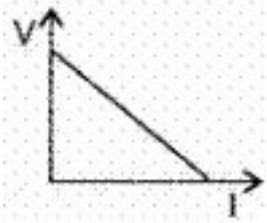
4. Which of the following charges is possible? **(1)**

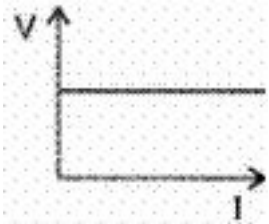
A. $1.6 \times 10^{-19}\,C$
B. $3.2 \times 10^{-19} C$
C. $6.4 \times 10^{-19} C$
D. $0.8 \times 10^{-19} C$

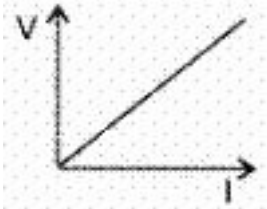
a. A, B and C
b. All of these
c. B and C
d. A and C

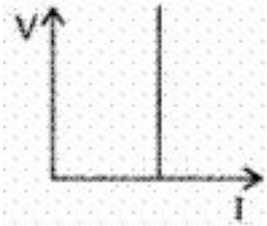
5. Using the adjoining circuit, current and potential difference are measured and plotted in a graph. The best suited graph is **(1)**



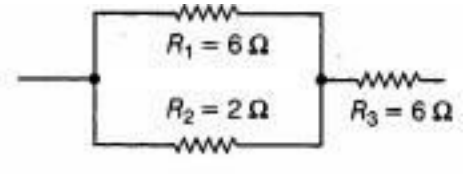
a. 

b. 

c. 

d. 

6. The given figure shows three resistors



Find the combined resistance. **(1)**

7. Define the term "volt". **(1)**

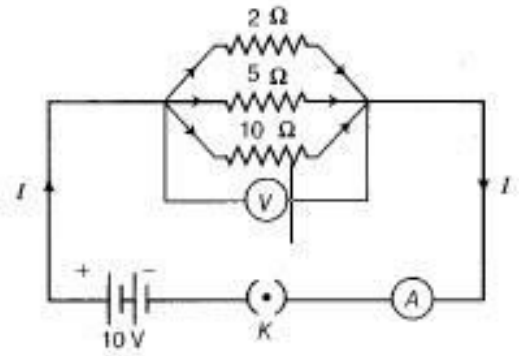
8. Nichrome is used to make the element of electric heater. Why? **(1)**

9. What constitutes the current ? **(1)**

10. An electric iron of resistance 20 Ω takes a current of 5A. Calculate the heat developed in 30s. **(3)**

11. How many bulbs of 8Ω should be joined in parallel to draw a current of 2A from a battery of 4 V? **(3)**

12. A circuit diagram is given as shown below:



Calculate

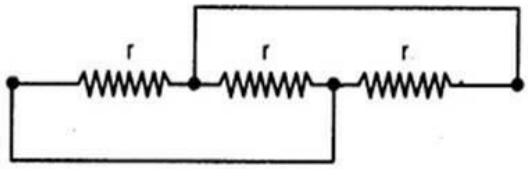
i. the total effective resistance of the circuit.
ii. the total current in the circuit.
iii. the current through each resistor. **(3)**

13. Radhika is a student of class X. Her mother was making tea in an old electric kettle having metal case. When she switched on the power supply to the electric kettle. She got a severe electric shock. Radhika put off the main switch quickly and found that the connecting cord was torn, where her mother touched the metal case of the kettle.

She also found that the red and black wires of connecting cord were firmly connected to the two lower terminals of the power plug but the green wire of cord was not connected to the upper terminal of the plug. Radhika replaced the torn connecting cord and also connected to the three wires of cord firmly to the power plug terminals. On the basis of the above passage, answer the following questions: **(3)**

i. Why did Radhika put off the main switch quickly?
ii. Which wire red, black or green, touched the metal case of electric kettle when Radhika's mother got electric shock?
iii. What values are displayed by Radhika in this incident?

14. Three equal resistors each equal to r and connected as shown in Fig. Calculate the equivalent resistance. **(5)**



15. What is meant by resistance of a conductor? Name and define its SI unit. List the factors on Which the resistance of a wire affected, if (i) its length is doubled, (ii) its radius is doubled? **(5)**

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Chapter 12 Electricity and its Effects

Answers

1. b. Milliammeter A_1 and voltmeter V_1

   Explanation: Milliammeter A_1 and voltmeter V_1 gives maximum measuring range with lowest least count. So, the combination of these two is best for two resistances connected in series.

2. d. 130 mA

   Explanation: Least count = $\frac{500\ mA}{50} = 10\ mA$

   No. of divisions = 13

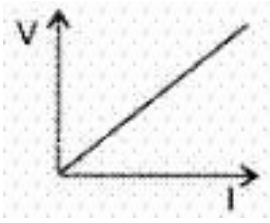
   ∴ Reading = 130 mA

3. a. $110 \times 10^{-8} \Omega m$

   Explanation: Resistivity of Nichrome at room temperature is (100—150) × 10^{-8} ohm metre.

4. a. A, B and C

   Explanation: Charges given in A, B and C are possible. $1.6 \times 10^{-19} C$ is the amount of charge on a proton or an electron. This is the minimum charge that any particle will have.

5. c. 

   Explanation: The graph of V (potential difference) versus I (electric current) is always a straight line.

   V = IR follows a straight line variation dependent on I.

6. Let the three resistors are R_1,R_2 and R_3. Here R_1 and R_2 are parallel to each other and R_3 is in series with them then equivalent resistance can be obtained by the given formula:

$\therefore \quad \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{6} + \frac{1}{2} = \frac{1+3}{6} = \frac{4}{6} = \frac{2}{3}$

$\Rightarrow \quad R = \frac{3}{2}\Omega$

Now, R and R_3 are in series.

$\therefore$ Combind resistance R_4=R+R_3

$=3/2+6=1.5+6=7.5\ Ohm$

7. The potential difference between two points A and B is said to be one volt if 1 joule of work is done to move 1 coulomb of charge from one point to another point in an electric field.

8. Nichrome is used to make the element of an electric heater because nicrome is an alloy which has high resistivity and high melting point. That's why nicrome is used to make the element of heater.

9. The flow of electric charges across a cross-section of a conductor constitutes an electric current. For example, a stream of electrons moving through a conducting wire constitutes an electric current.

10. R = 20 Ω; I = 5A; t = 30 s.

    $H = I^2Rt = (5)^2\ (20)\ (30)$

    H = 15,000 J

11. Given,

    current (i) = 2 A

    voltage (v) = 4 V

    Resistance of bulb is $R_1 = 8\Omega$

    resistance (R) = ?

    $R = \frac{V}{I} = \frac{4}{2} = 2\Omega$

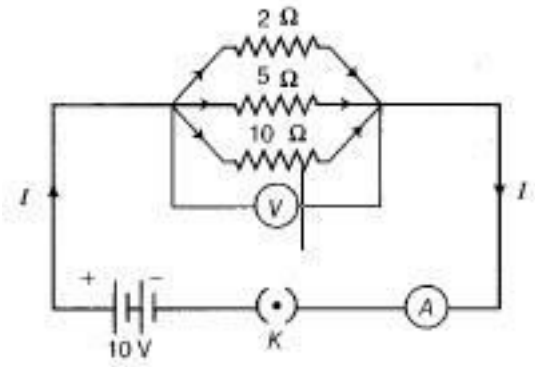
    so the total resistance = 2Ω

    let 'n' number of bulbs.

    $\frac{1}{R} = n\frac{1}{R_1}$

    $\frac{1}{2} = \frac{n}{8},$

    n = 4

12. 

i. Effective resistance is,

$$\frac{1}{R_{eff}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$
$$= \frac{1}{2} + \frac{1}{5} + \frac{1}{10} = \frac{5+2+1}{10} = \frac{8}{10}$$
$$\Rightarrow R_{eff} = \frac{10}{8} = 1.25\Omega$$

ii. Total current,

$$I = \frac{V}{R_{eff}}$$
$$= \frac{10}{1.25}$$
$$= 8A$$

iii. Current through each resistor,

$$I_1 = \frac{V}{R_1} = \frac{10}{2} = 5A,$$
$$I_2 = \frac{V}{R_2} = \frac{10}{5} = 2A$$

and

$$I_3 = \frac{V}{R_3} = \frac{10}{10} = 1A\ .$$

13. i. Radhika put off the main switch quickly to save her mother.

ii. Red wire which is at a high potential of $220V$ was touching the metal case of electric kettle.

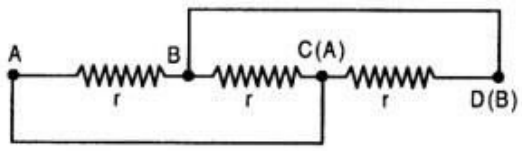
iii. The values displayed by Radhika are:

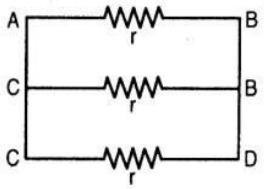
a. Concern for her mother.

b. Presence of mind.

c. Knowledge of household wiring and daily life activities.

14. Reducing the actual circuit to an equivalent circuit i.e. we find that the there resistors, each equal to r, are just placed parallel to each.





$\therefore$ Equivalent resistance R_p is given by

$$\frac{1}{R_p} = \frac{1}{r} + \frac{1}{r} + \frac{1}{r} = \frac{3}{r} \; or \; R_p = \frac{r}{3}$$

15. Property to oppose the flow of electric current is called resistance. Its SI unit is ohms. If 1V potential difference is there and 1A current is flowing then it is said that there is 1 ohm resistance.

i. $\therefore R = \frac{\rho l}{A}\left[\begin{array}{c} where, l = length\, of\, wire, \\ A\ area\, of\, cross - section\, of\, wire \end{array}\right]$

$R' = \frac{\rho l \times 2}{A}$

$\because R' = 2R$

i.e. resistance will be doubled, if length of the wire is doubled.

ii. $\therefore R = \frac{\rho l}{A} \Rightarrow R = \frac{\rho l}{\pi r^2} \left[\because A = \pi r^2\right]$

$R' = \frac{\rho l}{\pi (2r)^2} = \frac{\rho l}{\pi r^2} \times \frac{1}{4} = \frac{R}{4}$

Thus, resistance will decrease by four times, if radius of wire is doubled.