CBSE Test paper 04

Chapter 12 Electricity and its Effects

1. Which of the following statements is/are incorrect? **(1)**

   A. A neutron has a positive charge of $+1.6 \times 10^{-19} C$

   B. An ammeter is a low resistance device.

   C. Resistance of semiconductors decreases with temperature.

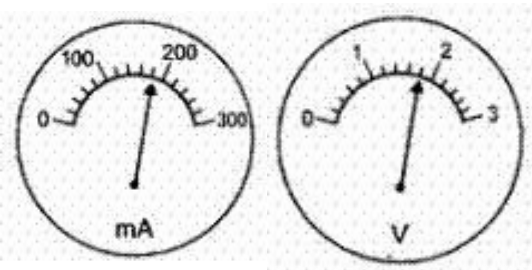
   D. One ampere is equal to 10^{-6} uA.

   a. A and C
   b. A and D
   c. A and B
   d. A, B and C

2. In an electric circuit, the direction of electric current is: **(1)**

   a. from the negative terminal to the negative terminal.
   b. from the positive terminal to the negative terminal.
   c. from the positive terminal to the positive terminal.
   d. from the negative terminal to the positive terminal.

3. The current flowing through a resistor connected in an electrical circuit and the potential difference developed across its ends are shown in the given diagrams : **(1)**



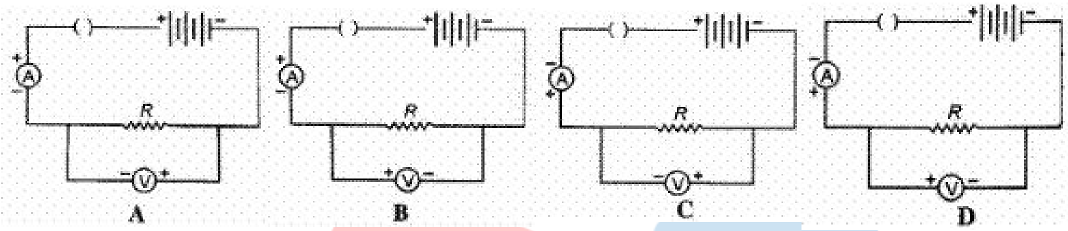
   The value of resistance of the resistor in ohms is

   a. 15
   b. 25
   c. 10
   d. 20

4. The use of a plane mirror in the meters is to **(1)**

   a. Give brightness to the reading
   b. Make the meter look good
   c. Get accurate value
   d. Avoid parallax error.

5. Out of the four given circuits for studying the dependence of the current on the potential difference across a resistor, the circuit that has been correctly drawn, is circuit **(1)**



   a. A
   b. C
   c. D
   d. B

6. Is electric potential a scalar or a vector quantity ? **(1)**

7. What is the direction of electronic current ? **(1)**

8. What causes the potential difference between the two terminals of a cell? **(1)**

9. A wire of resistivity ρ is pulled to double its length. What will be its new resistivity? **(1)**

10. Why does the cord of an electric heater does not glow while heating element does? **(3)**

11. What is Ohm's law? How can it be verified? **(3)**

12. Compare the power used in the 2Ω resistor in each of the following circuits: **(3)**

    i. a 6 V battery in series with 1Ω and 2Ω resistors,and

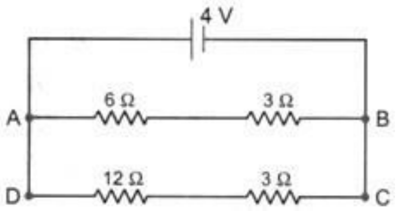
ii. a 4 V battery in parallel with 12 Ω and 2Ω resistors.

13. A potential difference of 220 V is applied across a resistance of 440 Ω in an electric ion. **(3)**

i. Find the current.

ii. Heat energy produced is 30s.

14. For the circuit shown in the given diagram: **(5)**



What is the value of

i. current through 6Ω resistor?

ii. potential difference across 12Ω resistor?

15. What is the resultant resistance when number of resistors are connected in parallel? **(5)**

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Answers

1. b. A and D

   Explanation: B and C are correct. An ammeter is a low resistance device. A semiconductor material has an electrical conductivity value falling between that of a conductor, such as copper, and an insulator, such as glass. As the temperature increases, their resistance decreases.
   A and D are incorrect. A neutron is a sub-atomic particle that has no charge. One μA is equal to 10^{-6} A. An ampere is a bigger unit. Micro-ampere (μA) is a smaller unit.

2. b. from the positive terminal to the negative terminal.

   Explanation: In an electric circuit, the direction of electric current is from the positive terminal of the battery to the negative terminal of the battery. This is as per convention. Electrons were not known at the time when the phenomenon of electricity was first discovered. Electric current was considered to be the flow of positive charges and the direction of flow of positive charges was taken to be the direction of electric current.

3. a. 10

   Explanation: $R = \frac{V}{I} = \frac{1.8V}{180\ mA} = \frac{1.8\times 10^3}{180} = \frac{1800}{180} = 10\Omega$

4. d. Avoid parallax error.

   Explanation: The use of a plane mirror in the meters is to avoid parallax error with our eye. Meters like ammeters and voltmeters use a mirror to avoid parallax error. The reading is taken from a position such that the image of the pointer is directly under the pointer.

5. d. B

   Explanation: Ammeter should be connected in series and the voltmeter in parallel along with resistor in parallel with correct polarities.

6. Electric potential is a scalar quantity.

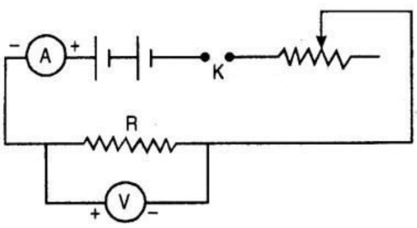
7. Electrons flow from negative to positive i.e. in the direction opposite to that of conventional current.

8. Excess of electrons at the negative terminal and lack of electrons at the positive terminal (due to chemical reactions) causes potential difference between the two terminals of a cell.

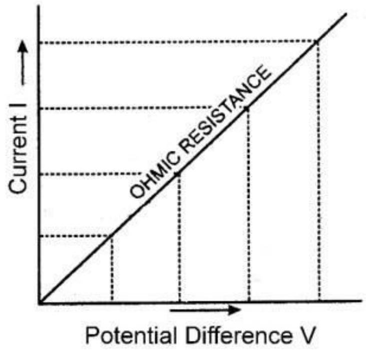
9. When a wire of resistivity rho is pulled to double it's length then new resistivity of conducting wire will not change as resistivity depends on the nature of material not on the length of conductor.

10. Heating effect = I^2Rt
    where I is the current flowing and R is the resistance and t is the time. Current is same in cord and in heating element. Resistance R of the cord is negligible since it is made of copper (which has very less resistivity) while heating element is made in nichrome whose resistivity is 6,000 times more than copper. Nichrome gets heated up much more than copper.

11. Ohm's law states that the current passing through a conductor is directly proportional to the potential difference across its ends provided the temperature and other physical conditions remains unchanged.
    or I µ V or V µ I or V = RI
    where R is a constant called resistance. Resistance is the property of a body to oppose the flow of current. R the resistance depends upon the nature of the conductor, its temperature and its dimensions (length, area)
    $R = \frac{V}{I}$ or $I = \frac{V}{R}$ i.e. $I \alpha V$ and $I \alpha \frac{1}{R}$



Experimental Verification of Ohm's Law: To verify Ohm's law, take a resistor R, connect voltmeter across it. Connect an ammeter, battery, key and rheostat to it as shown in Fig. Put in the key K. Read the value of potential difference across resistor R with the help of voltmeter and the current flowing through resistor with the help of ammeter. Note the readings. Vary the current in the circuit by sliding rheostat and go on noting reading in voltmeter and ammeter. Plot a graph between V and I on graph paper. It will come out to be straight line as shown in fig.



12. i. When a 2Ω resistor is joined to a 6 V battery in series with 1Ω and 2Ω resistors. Total resistance (R_s) = 2 + 1 + 2 = 5Ω.

ii. ∴ Current (I_1) = 6V/5Ω = 1.2 A

iii. ∴ Power used in 2 Ωresistor,$P_1 = I_1^2 R = (1.2)^2 \times 2 = 2.88$ W

iv. When 2Ω resistor is joined to a 4 V battery in parallel with 12Ω resistor and 2Ω resistors, the current flowing in 2Ω is independent of the other resistors.

v. ∴ Current flowing through 2Ω resistor,I_2= 4 V/ 2Ω = 2 A

vi. Power used in 2Ω resistor,$P_2 = I_2^2 R = (2)^2 \times 2 = 8$ W

vii. ∴ The required ratio, P_1/P_2 = 2.88/8 = 0.36 : 1

13. Here V = 220 volts; R = 440Ω

Now $I = \frac{V}{R} = \frac{220}{440} = 0.5$ A

Heat energy produced in 30s = $\frac{V^2}{R}T = \frac{(220)^2 \times 30}{440}$ = 3.300J

14. Let the current through the circuit be I which is divided into I_1 and I_2 in the arms AB and CD respectively, then we have

$I = I_1 + I_2$

In the arm AB, the total resistance is

R_1= 6Ω + 3Ω = 9Ω

and the total resistance in the arm CD is

R_2 = 12Ω + 3Ω = 15Ω

i. Then current in the 6Q resistor i.e.,

$I_1 = \frac{V}{R_1}$

$= \frac{4}{9}$ = 0.44 A

ii. Now the current through CD is

$I_2 = \frac{V}{R_2} = \frac{4}{15}$ = 0.27 A

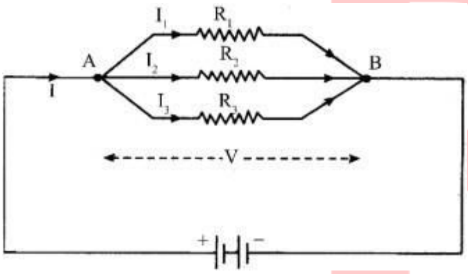
The potential difference across 12Ω, resistor is

$V_1 = I_2 \times 12\Omega$

$V_1 = 0.27 \times 12$

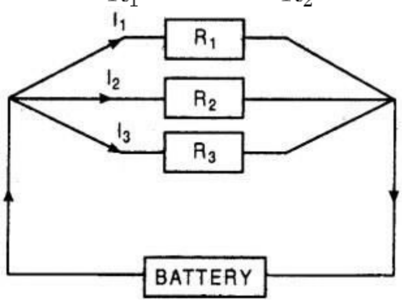
= 3.23 V

15. A circuit in which two or more resistors are connected across common points so as to provide separate paths is called parallel circuit.
In this case, the same potential difference will be maintained between the two ends of every resistor and the current will divide itself in various branches.



Let the resistors R_1, R_2 and R_3 be joined in parallel to the points A and B. Let the current I reaching A divide itself into three parts I_1, I_2 and I_3 along R_1, R_2 and R_3 respectively. Let V be the potential difference between the points A and B. The current flowing in the individual resistors are then given by :

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



Let R_p be the resistance of the combination, then $I = \frac{V}{R_p}$ But $I = I_1 + I_2 + I_3$

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

The result holds true for any number of resistors.