

CHAPTER 12

Electricity

ONE MARK QUESTIONS

1. If the charge on an electron be $1.6 \times 10^{-19}\text{C}$, find the approximate number of electrons in 1 C.

Ans : [CBSE 2016]

$1.6 \times 10^{-19}\text{C}$ charge is of = 1 electron and

$$1\text{ C charge is of} = \frac{1}{1.6 \times 10^{-19}} \text{ electron}$$

$$\text{No. of electrons} = 6.25 \times 10^{18}$$

2. List any two factors on which resistance of a conductor depends.

Ans : [CBSE 2016]

Resistance of a conductor:

- a. is directly proportional to its length

$$R \propto \rho \quad \dots(1)$$

- b. is inversely proportional to its area of cross section.

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

Combining (1) and (2), we get

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

3. What is the SI unit of electric potential?

Ans : [Delhi 2016]

Volt is the SI unit of electric potential.

4. When is potential difference between two points said to be 1 volt?

Ans : [Delhi 2016]

Potential difference between two point is said to be 1 Volt if the amount of work done in bringing 1 C charge between them is 1 J.

5. State Ohm's law.

Ans : [Delhi 2016]

If the physical conditions of a conductor remain same then current through a conductor is directly proportional to the potential difference b/w the two ends of the conductor.

$$I \propto V \Rightarrow V = IR$$

6. Mention one reason why tungsten is used for making filament of electric lamp.

Ans : [CBSE 2015]

Tungsten is used for making filament because of its high melting point and low resistivity.

7. (a) Name the instrument/device used to measure

electric current in a circuit.

- (b) How is an ammeter connected in a circuit to measure current flowing through it?

Ans : [CBSE 2015]

- a. Ammeter is used to measure electric current.

- b. Ammeter is connected in series in an electric circuit.

8. In an electric circuit, state the relationship between the direction of conventional current and the direction of flow of electrons.

Ans : [CBSE 2015]

Electrons flows from negative terminal to positive terminal where as current flows from +ve terminal to -ve terminal in external circuit i.e. Conventional current and electrons flow are opposite to each other.

9. How does the resistivity of alloys compare with those of pure metals from which they may have been formed?

Ans : [All India 2014]

The resistivity of pure metals is lesser than resistivity of alloys with which these alloys are made.

10. Write SI unit of resistivity.

Ans : [CBSE 2014]

Ohm-m

11. State a difference between the wire used in the element of an electric heater and in a fuse wire.

Ans : [CBSE 2014]

The wire used in element of electric heater has high resistance and high melting point where as a fuse wire has a low resistance and low melting point.

12. Power of a lamp is 60 W. Find the energy in joules consumed by it in 1 s.

Ans : [CBSE 2014]

in electrical heating device.

99. (a) Name an instrument that measures electric current in a circuit. Define unit of electric current.
 (b) What are the following symbols mean in an electric circuit?



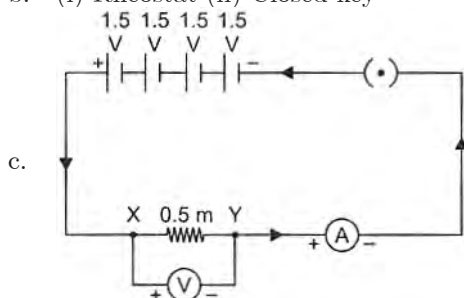
- (c) Draw a closed circuit diagram consisting of 0.5 m long nichrome wire XY, an ammeter, a voltmeter, four cells of 1.5 V and a plug key.

Ans : [CBSE 2015]

- a. Ammeter.

If IC charge flows in an electric circuit is 1 s then the current is said to be 1 A.

- b. (i) Rheostat (ii) Closed key



100. What is meant by resistance of a conductor? Name and define its SI unit. List the factors on which the resistance of a conductor depends. How is the resistance of a wire affected if:

- a. its length is doubled,
 b. its radius is doubled?

Ans : [CBSE 2015]

Property of any conductor by virtue of which it opposes the flow of current in the conductor is called its resistance.

SI unit of resistance is Ohm. If by applying a potential difference of 1 volt the current in the conductor is 1 A. Then the resistance of the conductor is said to be 1 ohm.

Factor affecting resistances:

- a. If length is double then resistance also becomes doubled.
 b. If radius is doubled then area $A = \pi(2r)^2$ becomes 4 times, then the resistance becomes $1/4$.

101. What do you mean by heating effect of electric current? Explain the production of heat in a resistor by flow of electric current through it. Name two devices based on heating effect of current.

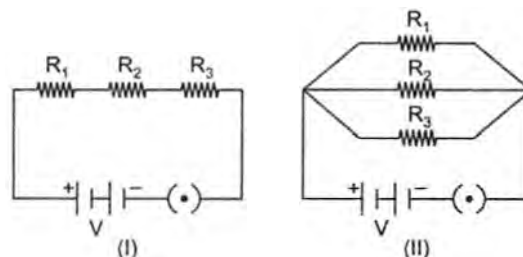
Ans : [All India 2015]

When current is passed through a conductor, heat is produced. Production of heat in a conductor on passing the current is called heating effect of current. When a current is passed in a conductor by applying a potential difference, electrons get accelerated and collide with the atoms of the conductor. During the collision there is a loss of kinetic energy. This loss in K.E. appears in the form of heat energy in the conductor 1. Electric heater, 2. Bulb.

102. (a) Name an instrument that measures potential difference between two points in a circuit. Define the unit of potential difference in terms of SI unit

of charge and work. Draw the circuit symbols for (i) variable resistor, (ii) a plug key which is closed one.

- (b) Two electric circuits I and II are shown below “



- (i) Which of the two circuits has more resistance?
 (ii) Through which circuit more current passes?
 (iii) In which circuit, the potential difference across each resistor is equal?
 (iv) If $R_1 > R_2 > R_3$ in which circuit more heat will be produced in R_1 as compared to other two resistors?

Ans : [CBSE 2014]

- a. Voltmeter

The amount of work done in bringing a unit positive charge from one point to another in an electric field is said to be potential difference

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

- (i)  Variable resistance
 (ii)  Closed key.

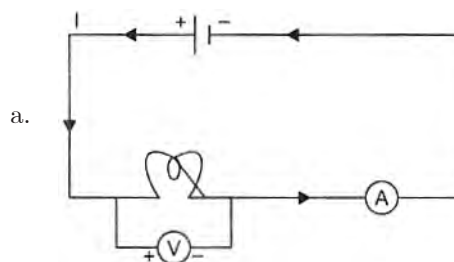
- b. In series combination resistance is more than parallel combination.

- (i) Lesser the resistance more the current in circuit i.e., in parallel (II) current is max.
 (iii) In parallel combination (II)
 (iv) More heat in (I) across R_1 .

103. When a high resistance voltmeter is connected directly across an electric bulb, its reading is 2 V. An electric cell is sending the current of 0.4 ampere (measured by an ammeter) in the electric circuit.

- a. Draw the circuit.
 b. Find the resistance of the electric bulb,
 c. State the law that is applied for making these calculation. If a graph is plotted between V and I, show the nature of the graph obtained.

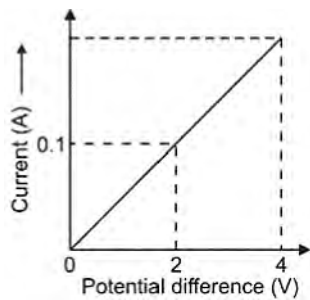
Ans : [Delhi 2014]



- b. $V = 2$ Volt, $I = 0.4$ A

$$R = \frac{V}{I} = \frac{2}{0.4} \text{ ohm or } R = 5 \text{ ohm}$$

- c. **Ohm's law:** If the physical conditions of a conductor is kept constant then current in the circuit is directly proportional to the potential difference



- b. Resistance of the circuit to carry a current of 5A on 220V.

$$R = \frac{220}{5} = 44 \Omega$$

Let n resistors of 176Ω are connected whose equivalent resistance is 44Ω .

$$\frac{176}{n} = 44 \text{ or } n = \frac{176}{44}$$

$$n = 4$$

- a. The rate of electrical energy is consumed in a circuit is called electric power

$$P = \frac{W}{t} = \frac{I^2 R t}{t}$$

$$P = I^2 R \text{ But } I = \frac{V}{R}$$

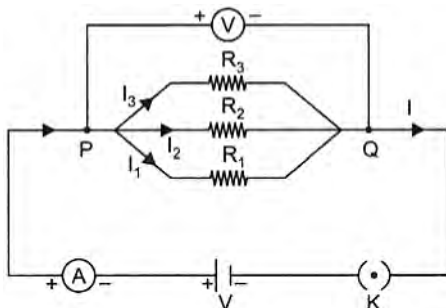
$$P = \frac{V^2}{R^2} R \text{ or } P = \frac{V^2}{R}$$

111. (a) Three resistors R_1 , R_2 and R_3 are connected in parallel and the combination is connected to battery, ammeter, voltmeter and key. Draw suitable circuit diagram. Obtain an expression for the effective resistance of the combination of resistors in parallel.
- (b) Why are electric bulbs filled with chemically inactive nitrogen gas?
- (c) What is meant by the statement that the rating of a fuse in a circuit is 5 A?

Ans : [CBSE 2012]

- a. Let equivalent (effective) resistance is R

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



$$\text{Similarly, } I_1 = \frac{V}{R_1}$$

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

But

$$I = I_1 + I_2 + I_3$$

or

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

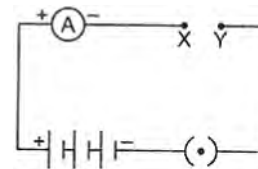
$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

- b. To prevent oxidising the filament due to high temperature.
- c. The current in the fuse wire must not exceed 5 A otherwise it will melt.

112. (a) In the circuit shown connect a nichrome wire of length "L" between points X and Y and note the ammeter reading.

- (i) When this experiment is repeated by inserting another nichrome wire of the same thickness but twice the length (2L), what changes are observed in the ammeter reading?
- (ii) State the changes that are observed in the ammeter reading if we double the area of cross-section without changing the length in the above experiment. Justify your answer in both the cases.

- (b) "Potential difference between points A and B in an electric field is 1V". Explain the statement.



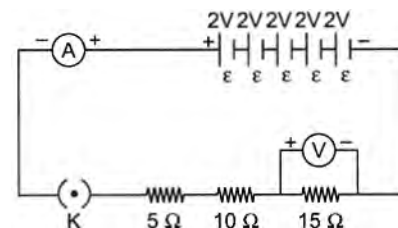
Ans : [CBSE 2012]

- a. (i) The resistance of two times long wire also becomes two times so current decreases in the circuit.
- (ii) If area of the nichrome wire is doubled then its resistance decreases and hence current increases in the circuit.
- b. Potential difference b/w A and B is 1 volt means that 1 J of work is to be done in moving a unit positive charge (+ 1C) from point A to B.

113. Draw a circuit diagram for a circuit consisting of a battery of five cells of 2 volts each, a 5Ω resistor, a 10Ω resistor and a 15Ω resistor, an ammeter and a plug key; all connected in series. Also, connect a voltmeter to record the potential difference across the 15Ω resistor and calculate:

- a. the electric current passing through the above circuit and
- b. potential difference across 5Ω resistor when the key is closed.

Ans : [CBSE 2012]



- a. Net effective resistance of the circuit.

$$R = (5 + 10 + 15) \Omega = 30 \Omega$$

Current in the circuit

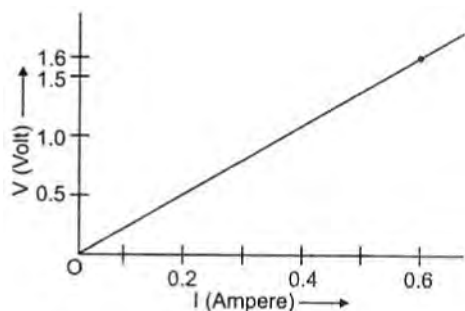
$$I = \frac{n\varepsilon}{R} = \frac{5 \times 2}{30} \text{ A} = \frac{1}{3} \text{ A}$$

$$I = 0.33 \text{ A}$$

119. (a) Name an instrument that measures electric current in a circuit. Define the unit of electric current.
 (b) What do the following symbols mean in circuit diagrams?



- (c) An electric circuit consisting of a 0.5 m long nichrome wire XY, an ammeter, a voltmeter, four cells of 1.5 V each and a plug key was set up.
 (i) Draw a diagram of this electric circuit to study the relation between the potential difference maintained between the points X and Y and the electric current flowing through XY.
 (ii) Following graph was plotted between V and I values:



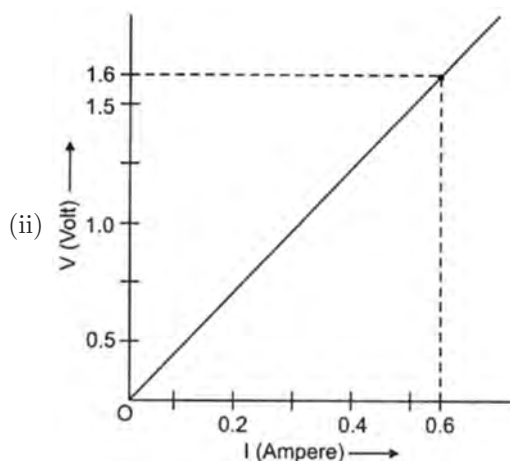
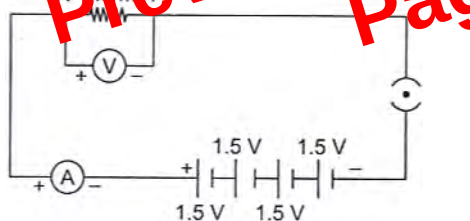
What would be the values of V/I ratios when the potential difference is 0.8 V, 1.2 V and 1.6 V respectively? What conclusion do you draw from these values?

Ans :

[Delhi 2008]

- a. **Ammeter:** Ampere is the unit of current. If one coulomb charge flows in a circuit in 1 s then the current in the circuit will be 1 Ampere (A).
 b. (i) Variable resistor (ii) Plug key

- c. (i)



The graph b/w V and I is a straight line.

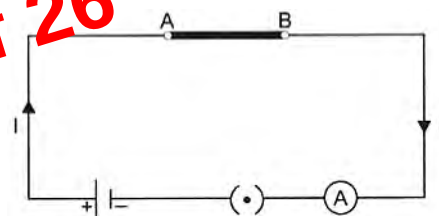
$$R = \frac{V}{I} = \frac{1.6 - 0}{0.6 - 0} = \frac{1.6}{0.6} = 2.67 \Omega$$

120. (a) (i) What is meant by saying that the potential difference between two points is 1 volt?
 (ii) How much energy is given to 5 coulomb of charge passing through a 12 V battery?
 (b) Describe an activity with necessary electric circuit drawn to study the factors on which the resistance of a conducting wire depends.

Ans :

[CBSE 2008]

- a. (i) Potential difference b/w the two points is 1 volt mean if we bring a unit positive charge (+1C) from one point to other point then amount of work done is 1 J, $W = VQ$.
 (ii) Given: $Q = 5 \text{ C}$, $V = 12 \text{ V}$, $W = 12 \times 5 = 60 \text{ J}$
 b. Activity to study the factors of affecting resistance of the conductor—Take a cell, an ammeter, manganin wires of different length and different area of cross-section and key. Connect an ammeter, a manganin wire of (say) 10 cm long to a cell through a plug key.
 (i). Now closed the key and note the current in the circuit with the help of ammeter.
 (ii). Now replace the manganin wire with another manganin wire of twice the area of cross-section and again measure the current in the circuit with the help of ammeter.
 (iii). Now repeat the activity by taking a copper wire of same length same area of cross-section, and note down the current in each case. You will find that current in the circuit in each case is different which shows that resistance depends upon (1) nature of material (2) length of the conductor and (3) area of cross-section.



121. (a) What do the following symbols represent in a circuit? Write the name and one function of each.



- (b) Draw a schematic diagram of a circuit consisting of a battery of 12 V, three resistors of 5Ω , 10Ω and 20Ω connected in parallel, an ammeter to measure the total current through the circuit, a voltmeter to measure the potential difference across the combination of resistors.
 (c) State any one advantage of connecting electrical devices in parallel with the mains instead of connecting them in series in a household circuit.

Ans :

[CBSE 2008]

- a. (i) Variable resistor used to change the current in circuit.
 (ii) Wires crossing each other which are not connected together. It is used when large number of connections are to be made with the help of wires out joining them.