Exercise-9(A)   Page: 193

1. **Name one d.c. source and one a.c. source.**
   Solution:
   d.c source – cell
   a.c. source – mains

2. **Distinguish between d.c. and a.c.**
   Solution:
   The differences between d.c. and a.c are as follows:

D.C	A.C
Direct current(d.c) is a current of constant magnitude flowing in one direction	Alternating current (a.c.) is the current which reverses its magnitude and direction with time
It has zero frequency	It generates a frequency
Produced from battery or cell	Produced mainly by generators
It does not travel safely over a long distance and loses much energy compared to a.c.	It travels safely over a long distance without losing much energy

3. **What is an electric cell?**
   Solution:
   It is an electric device that converts chemical energy into electrical energy when it sends current in a circuit.

4. **What transformation of energy takes place when current is drawn from a cell?**
   Solution:
   When current is drawn from a cell, chemical energy is converted into electrical energy.

5. **Name the constituents of a cell.**
   Solution:
   A cell constitutes of the following:
   - Two electrodes
   - An electrolyte in a vessel

6. **State the two kinds of cell. Give one example of each.**
   Solution:
   The two kinds of cells are as follows:
   - Primary cell – example: simple voltaic cell
   - Secondary cells or accumulators – example: Li-H battery

7. **What is a primary cell? Name two such cells.**
   Solution:
   A primary cell provides current as a result of irreversible chemical reaction. They are the 'use and throw' type of cells and cannot be recharged as the cells are discarded after use when the entire chemical energy contained in it is converted into electrical energy.

Two primary cells are – Simple voltaic cell, Leclanche cell

8. **What is a secondary cell? Name one such cell.**
   Solution:
   Secondary cells or accumulators, providing current as a result of a chemical reaction. The chemical reaction is reversible in these cells and hence can be recharged after using. One such cell is a Lead accumulator.

9. **State three differences between primary and secondary cells.**
   Solution:
   The three differences between a primary and a secondary cell is as follows:

Primary cell	Secondary cell
In a primary cell, chemical reactions are irreversible	In a secondary cell, chemical reactions are reversible
When current is drawn from a primary cell, chemical energy is converted into electrical energy	When current passes in a secondary cell, electrical energy is converted into chemical energy, when current is drawn from it, chemical energy is converted into electrical energy
Primary cell cannot be recharged	Secondary cell can be recharged

10. **What do you understand by the term current? State and define its S.I. unit.**
    Solution:
    Current is the rate of flow of charge across a cross-section normal to the direction of flow of current.
    The S.I. unit of current is coulomb per second which is called ampere and denoted by A. Current is a scalar quantity.
    If 1 ampere current flows through a conductor, it means that 6.25×10^{18} electrons pass in one second across that cross section of conductor.

11. **How much is the charge of an electron?**
    Solution:
    The charge of an electron is -1.6×10^{-19} coulomb.

12. **n electrons flow through a cross section of a conductor in time t. If charge on an electron is e, write an expression for the current in the conductor.**
    Solution:
    The expression for current (I) in a conductor is as follows:
 $$I = \frac{ne}{t}$$
    Where: n is the electron flow, t is the time taken for electron flow, e is the charge on an electron e

13. **Name the instrument used to control current in an electric circuit.**
    Solution:
    The instrument used to control current in an electric circuit is a Rheostat.

14. **In the electric circuit shown in the figure, label the parts A, B, C, D, E, and F. State the function of each part. Show in the diagram the direction of flow of current.**
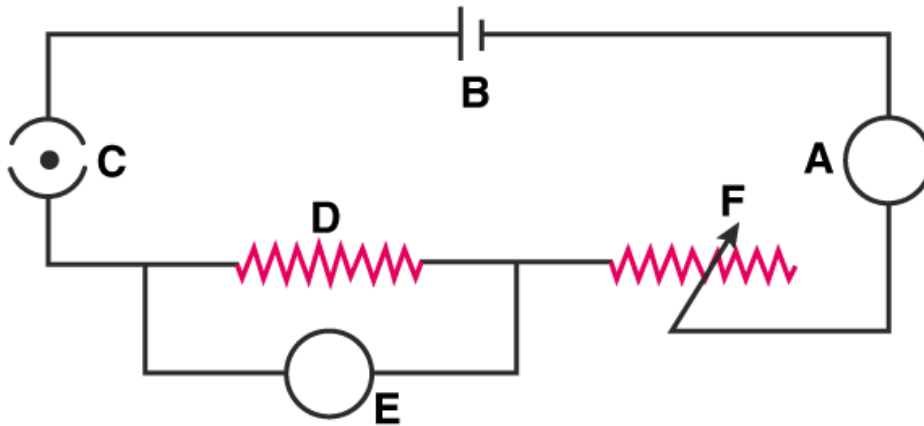
Solution:
The diagram shows the direction of flow of current and the labeling - A, B, C, D, E, and F
The function of each part is as follows:
A – A is the Ammeter, which measure the flow of current in the circuit
B – Cell: acts as a source of direct current for the circuit
C – key: Key puts the current, on and off in the circuit
D – Load: load is an appliance connected in a circuit which can be a combination of different electrical components or a resistance (bulb).
E - Voltmeter: It measures the potential difference between two points of a circuit.
F – Rheostat: it controls the flow of current in a circuit
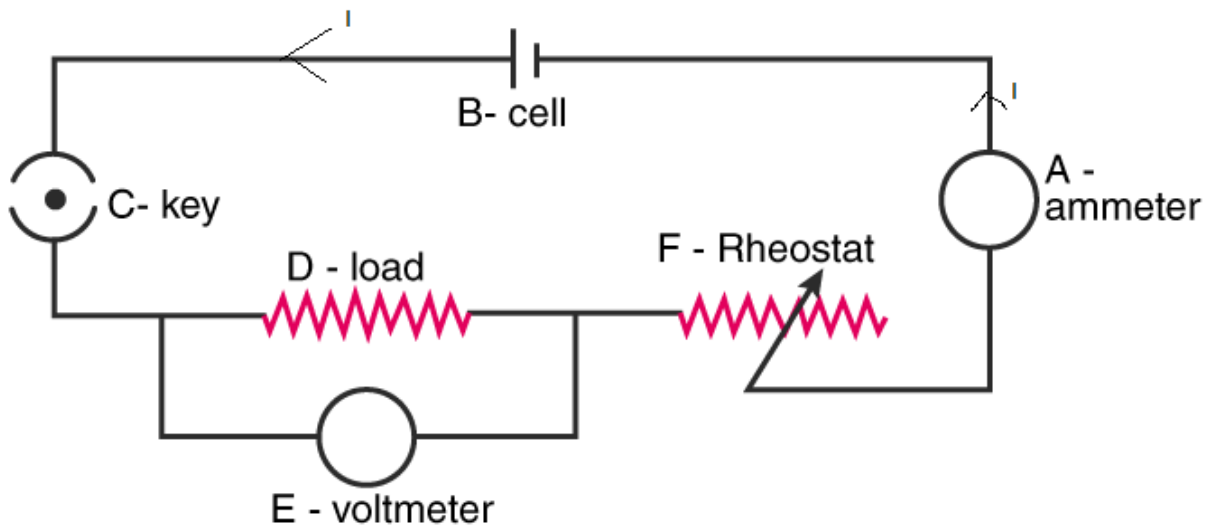
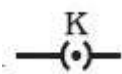**15.** **What is the function of a key (or switch) in an electric circuit?**
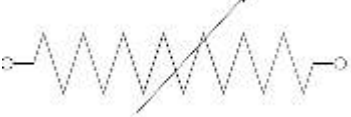Solution:
The function of a key or a switch is to put on or off current in a circuit.

**16.** **Write symbols and state functions of each of the following components in an electric circuit:**

(i)   **Key,**
(ii)   **Cell,**
(iii)   **Rheostat,**
(iv)   **Ammeter, and**
(v)   **Voltmeter.**

Solution:
The table below states the symbols and functions of the components:

Components	Symbol	Function
Key		Switches current on or off in the circuit
Cell		Acts as a source of direct current for the circuit
Rheostat		it controls the flow of current in a circuit
Ammeter		Measures the flow of current in the circuit
Voltmeter		Measures the potential difference between two points of a circuit

17. **(a) Complete the circuit given in figure by inserting between the terminals A and C, an ammeter. (b) In the diagram mark the polarity at the terminals of ammeter and indicate clearly the direction of flow of current in the circuit, when the circuit is complete. (c) Name and state the purpose of Rh in the circuit.**
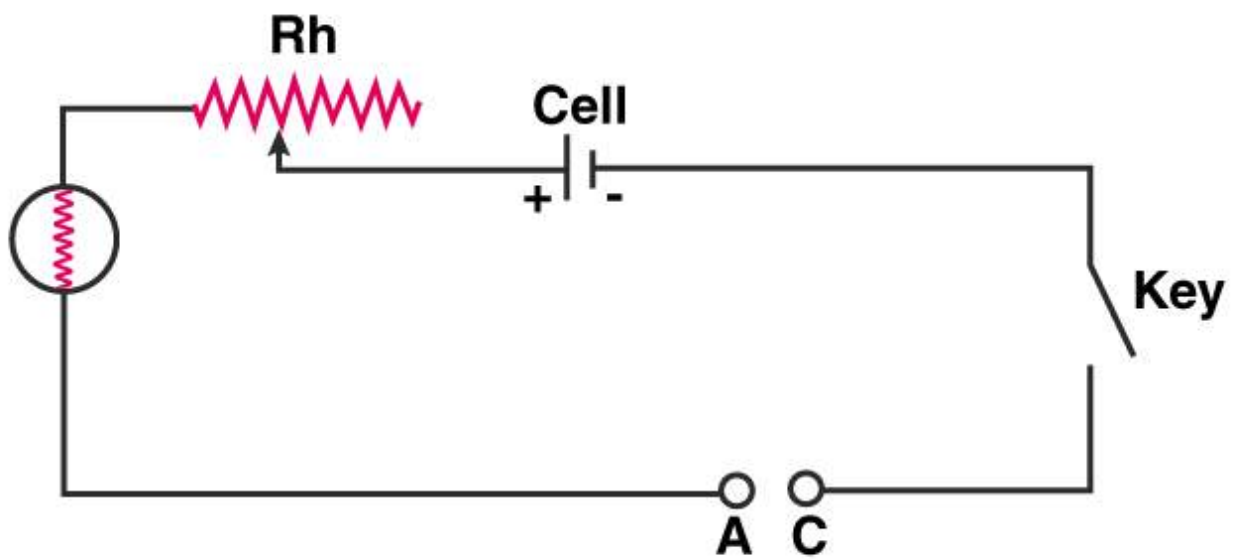
Solution:
(a) The circuit is as follows:
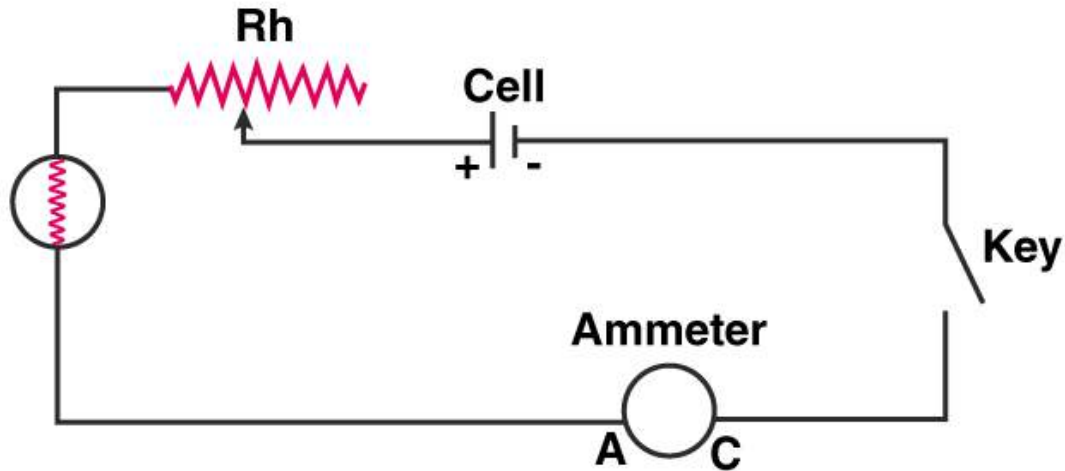
(b) The circuit is as follows:
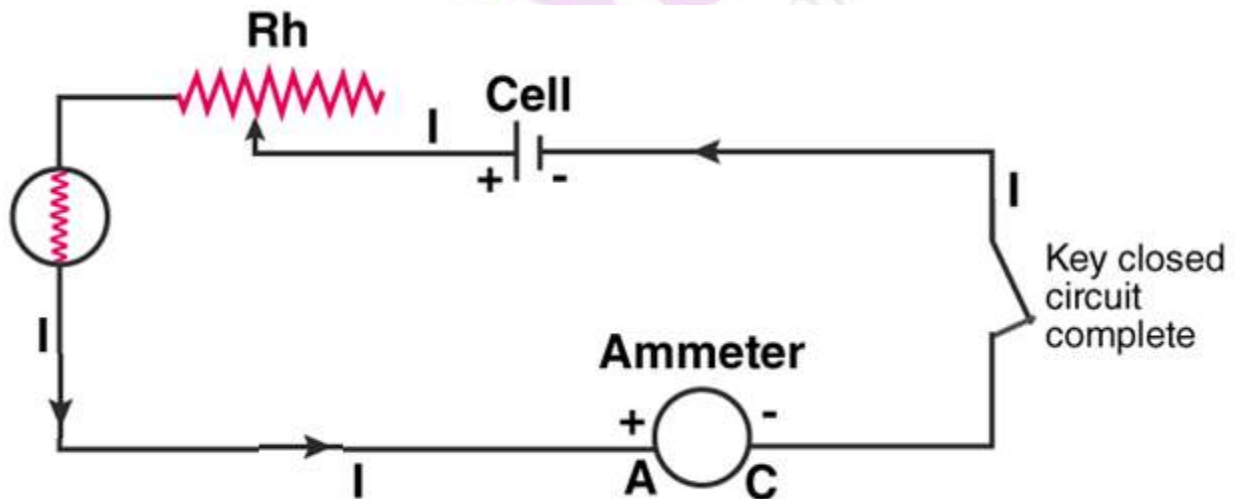
(c) Rh is the rheostat. Rheostat controls the flow of current in a circuit.

18. What are conductors and insulators of electricity? Give two examples of each.
Solution:
Conductors – they are the substances which allow the current to flow through them easily. They have a large number of free electrons and they offer a very small resistance to the current flow. Two examples of conductors of electricity are impure water and mercury. Some others are copper, aluminum etc.
Insulators – they are the substances which do not allow current to flow through them. They have no

electrons and offer a very high resistance to the current flow. Example – Cotton, rubber.

19. Select conductors of electricity from the following:
Copper wire, silk thread, pure water, acidulated water, human body, glass, mercury.
Solution:
The conductors of electricity are as follows:
- Copper wire
- Acidulated water
- Human body
- Mercury

20. State two differences between a conductor and an insulator of electricity.
Solution:
The two differences between a conductor and an insulator of electricity are as follows:
1. Insulators do not conduct electricity but conductors allow the current to flow through them
2. Insulators have no free electrons and offer a very high resistance to current flow but conductors have a large number of free electrons and offer a very small resistance to current flow.

21. Distinguish between a closed circuit and an open circuit, with the use of suitable labelled diagram.
Solution:
The differences are as follows:

Closed circuit	Open circuit
A circuit is closed when each part of it is made of a conductor(allowing current to pass through it) and on plugging in the key or if it is complete, current flows in the circuit	An open circuit does not allow current to flow through it, which could occur if: any of its component is not made of a conductor or the key is not plugged in or the circuit is broken.
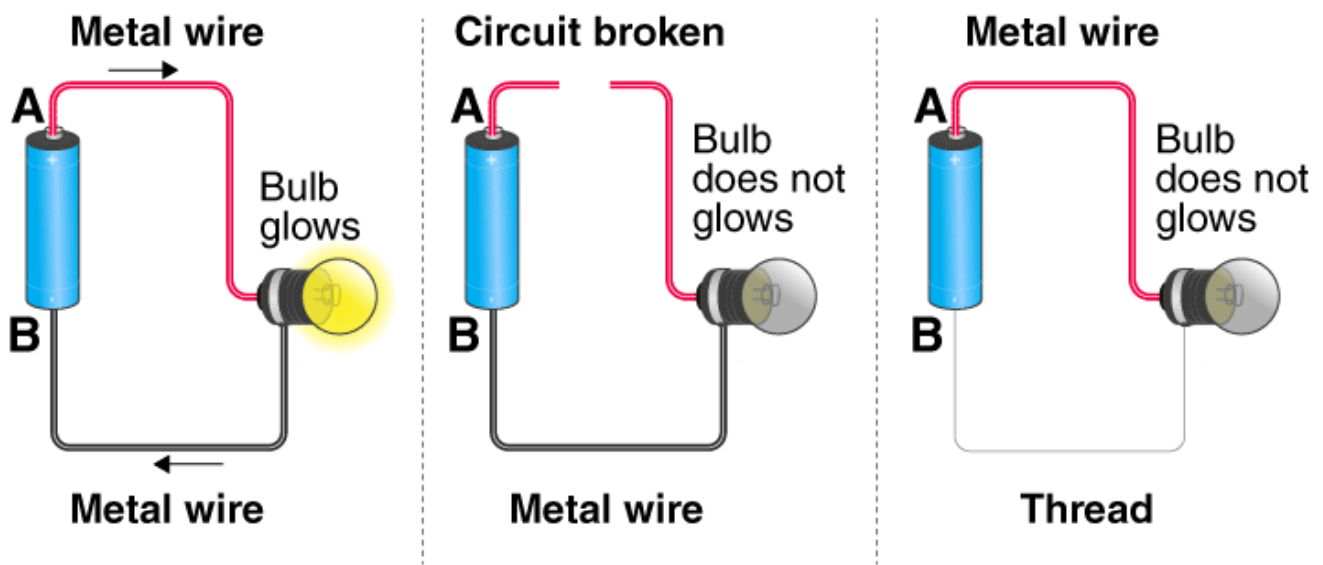
22. Write the condition required for a circuit to be a closed circuit.
Solution:
For the circuit to be closed, every part of the circuit should be a conductor.

Multiple choice type:

1. **A cell is used to:**
   (a) Measure current in a circuit
   (b) Provide current in a circuit
   (c) Limit current in a circuit
   (d) Prevent current in a circuit
   Solution:
   (b) Provide current in a circuit
   A cell converts chemical energy into electrical energy when it sends current in a circuit.

2. **The unit of current is:**
   (a) Ampere
   (b) Volt
   (c) Ohm
   (d) Coulomb
   Solution:
   (a) ampere
   Current is the flow of electrons. S.I. unit of current is coulomb per second which is called ampere.

3. **The insulator of electricity is:**
   (a) Copper
   (b) Acidulated water
   (c) Human body
   (d) Silk
   Solution:
   (d) Silk
   Copper, acidulated water, human body conduct electricity, silk does not conduct electricity.

Numericals:

1. **A charge 0.5C passes through a cross section of a conductor in 5s. Find the current.**
   Solution:
   Given: charge = 0.5 C, time = 5s, current=?
   We know that;
   Current = charge/time
   = 0.5 / 5
   = 0.1 A

2. A current of 1.5A flows through a conductor for 2.0s. What amount of charge passes through the conductor?

Solution:

Given: current = 1.5A, time= 2s, charge = ?

We know that:

Current = charge/time

⇨ Charge = current x time

⇨ = 1.5 x 2

⇨ = 3 C

3. When starter motor of a car is switched on for 0.8s, a charge 24 C passes through the coil of the motor. Calculate the current in the coil.

Solution:

Given: Time = 0.8s, charge = 24C, current=?

We know that:

Current = charge/time

= 24/0.8

= 30A

Exercise-9(B)   Page: 198

1. **Figure below shows two conductors A and B. Their charges and potentials are given in the diagram. State the direction of (i) flow of electrons, and (ii) flow of current, when both the conductors are joined by a metal wire.**

Q = -10 coulomb   Q = 5 coulomb
V = 5 volt   V = 10 volt

Solution:
(a) The direction of flow of electrons is from A to B
(b) The direction of flow of current when both the conductors are joined by a metal wire is from B to A.

2. **How is the direction of flow of current between two charged conductors determined by their potentials?**
Solution:
The direction of current can be determined as current flows from high potential to low potential.

3. **Explain the concept of electric potential difference in terms of work done in transferring the charge.**
Solution:
The electric potential difference between two conductors is equivalent to the work done in transmitting a unit positive charge from one to another conductor.

4. **Define the term potential difference.**
Solution:
Potential difference between two conductors is equal to the work done in transferring a unit positive charge from one conductor to the other conductor. It is a scalar quantity.
If 'W' work is done in transferring a test charge q from one conductor to the other, the potential difference between them is given by:
$$V_1 - V_2 = \frac{W}{q}$$

5. **State and define the S.I. unit of potential difference.**
Solution:
The S.I. unit of potential difference is joule per coulomb which is named as volt (V).
It can defined as follows:
We know that, potential difference (V) is given by:
$$V = \frac{W}{q}$$
Unit of potential difference $= \frac{\text{unit of work}}{\text{unit of charge}}$

$$1 \text{ V} = \frac{1 \text{ joule}}{1 \text{ coulomb}}$$
$$1V = \frac{1 \text{ J}}{1 \text{ C}}$$

Hence, potential difference between two points is said to be 1 volt if work done in transferring 1 coulomb of charge from one point to the other point is 1 joule.

6. **'The potential difference between two conductors is 1 volt'. Explain the meaning of this statement.**
   Solution:
   If the potential difference between two conductors is 1 volt it means that 1 joule of work should be done to transfer 1 coulomb of charge from one conductor to the other.

7. **What do you understand by the term resistance?**
   Solution:
   Resistance(R) is the obstruction offered to the flow of current by a conductor. It is a scalar quantity.
   Resistance can be given by:
   $$\text{Resistance} = \frac{\text{Potential difference}}{\text{Current}}$$

8. **Explain why does a metal wire when connected to a cell offer resistance to the flow of current.**
   Solution:
   A metal wire has free electrons which moves in a random manner in the absence of any cell connected across it.
   When the ends of the wire are connected to a cell, the electrons begin to move from the negative to the positive terminal of the cell through the wire, during which they collide with the fixed positive ions and other free electrons of the wire due to which the speed decreases and direction of motion changes.
   They again accelerate after each collision towards the positive terminal and suffer collisions with other positive ions and free electrons again and the process continues.
   Hence, the electrons do not move in bulk with increasing speeds from one end to the other but drift towards the positive terminal. This depicts how the wire offers resistance to current through it.

9. **State and define the S.I. unit of resistance.**
   Solution:
   S.I. unit of resistance is volt per ampere which is named as ohm (Ω).
   $$1 \text{ ohm} = \frac{1 \text{ } volt}{1 \text{ ampere}} = \frac{1 \text{ V}}{1 \text{ A}}$$

   The resistance of a conductor is said to be 1 ohm if a current of 1 ampere flows through it when the potential difference across its ends is 1 volt.

10. **State Ohm's law.**
    Solution:
    Ohm's law states that if a current I flows through a wire when potential difference across the ends of the wire is V, the resistance offered by the wire to the flow of current is the ratio of potential difference across it to the current flowing in it.

11. **How are the potential difference (V), current (I) and resistance (R) related?**
    Solution:
    The relation is as follows:
    $\quad$ V = IR
    Where V is the potential difference, I is the current, R is the resistance.

12. **'The resistance of wire is 1 ohm'. Explain the meaning of this statement.**
    Solution:
    If the resistance of a wire is 1 ohm it means that if current of 1ampere flows through a component across which a potential difference of 1 volt is existent, then the resistance of that component is one ohm.

13. **How is the current flowing in a conductor changed if the resistance of conductor is doubled keeping the potential difference across it the same?**
    Solution:
    The current flowing in a conductor is halved if the resistance of the conductor is doubled keeping the potential difference across it the same.

14. **State three factors on which the resistance of a wire depends. Explain how does the resistance depend on the factors stated by you.**
    Solution:
    The three factors are as follows:
    - Temperature of the wire – resistance of the wire is directly proportional to the temperature of the wire
    - Length of the wire – resistance is directly proportional to the length of the wire
    - Area of cross section of wire – resistance is inversely proportional to the area of cross section of the wire

15. **How is the resistance of a wire affected if its (a) length is doubled, (b) radius is doubled?**
    Solution:
    (a) The resistance of a wire becomes more or twice if the length of the wire is doubled.
    (b) The resistance of a wire becomes less or one-fourth if the radius of the wire is doubled

16. **State whether the resistance of filament of a bulb will decrease, remain unchanged or increase when it glows.**
    Solution:
    When a bulb glows, the resistance of the filament increases.

17. **Name the physical quantities of which the units are:**
    (i)   **Volt**

(ii) **Coulomb**
(iii) **Ohm**
(iv) **Ampere**
Solution:
Listed below are the physical quantities:
(i)   Volt – Potential difference
(ii)   Coulomb - Charge
(iii)   Ohm - Resistance
(iv)   Ampere – Current

Multiple choice type:

1. **Current in a circuit flows:**
   (a) In direction from high potential to low potential
   (b) In direction from low potential to high potential
   (c) In direction of flow of electrons
   (d) In any direction
   Solution:
   (a) In direction from high potential to low potential
       Electric current is said to flow from a body at higher potential to a body at lower potential, in
       a direction opposite to the direction of flow of electrons.

2. **The unit of potential difference is:**
   (a) Ampere
   (b) Volt
   (c) Ohm
   (d) Coulomb
   Solution:
   (b) Volt
       Potential difference is measured in joule per coulomb which is named as volt (V).

3. **On increasing the resistance in a circuit, the current in it:**
   (a) Decreases
   (b) Increases
   (c) Remains unchanged
   (d) Nothing can be said
   Solution:
   (a) Decreases
       Current (I) is inversely proportional to the resistance (R).

Numericals:

1. **In transferring 1.5 C charge through a wire, 9 J of work is needed. Find the potential
   difference across the wire.**
   Solution:
       Given: charge = 1.5 C, work = 9 J, potential difference V = ?

We know that:

V = work/charge => w/q

⇨ 9/1.5 = 6V

2. **A cell of potential difference 12V is connected to a bulb. The resistance of filament of bulb when it glows, is 24Ω. Find the current drawn from the cell.**

Solution:

Given: V = 12V, R = 24Ω, I =?

We know that:

V = IR

I = V/R

= 12/24

= 0.5A

3. **A bulb draws current 1.5A at 6.0V. Find the resistance of filament of bulb while glowing.**

Solution:

Given: I = 1.5A, Potential difference = 6V, R=?

We know that:

V = IR

R = V/I

= 6/1.5

= 4Ω

4. **A current 0.2A flows in a wire of resistance 15Ω. Find the potential difference across the ends of the wire.**

Solution:

Given: I = 0.2A, Potential difference =?, R=15Ω

We know that:

V = IR

= 0.2 x 15

= 3V

Exercise-9(C)   Page: 199

1. **What is meant by efficient use of energy?**
    Solution:
    It means to reduce the cost and amount of energy used to provide us the various products and services.

2. **State two ways to save the energy.**
    Solution:
    The two ways to save energy are as follows:
    *   It is possible to maintain a comfortable temperature inside by properly insulating a home, which reduces the cost of heating devices in winter and cooling devices in summer
    *   Replacing traditional incandescent bulbs with fluorescent and LED lights or natural skylight can reduce the amount of energy required to attain the same level of illumination.

3. **How does proper insulation of home save energy?**
    Solution:
    It is possible to maintain a comfortable temperature inside by properly insulating a home. It will reduce the cost of heating devices in winter and cooling devices in summer.

4. **Which of the following device is most efficient for lighting purpose:**
    LED, CFL, Fluorescent tube light, Electric bulb.
    Solution:
    For lighting purpose, LED or light emitting diode is the most efficient.

5. **Give an example to explain that the use of modern eco-friendly technologies is more efficient and less polluting.**
    Solution:
    Modern eco-friendly technologies are most efficient and less polluting. Modern energy efficient appliances such as refrigerators, ovens, freezers, dishwashers etc. make use of significantly less energy than the older appliances. They are star rated in accordance to their efficient use of electricity. The more the star rating, higher is the efficiency.

6. **Describe three ways for the efficient use of energy.**
    Solution:
    Listed below are three ways for the efficient use of energy:
    *   Use of LED lights or fluorescent lights or natural skylight instead of traditional incandescent light bulbs will reduce the amount of energy required to attain the same level of illumination
    *   Usage of compact fluorescent lights (CFL) saves 67% energy which may last 6-10 times longer than the incandescent lights
    *   By reducing the weight of vehicles, fuel efficiency in vehicles can be increased with the use of advanced tyres and computer controlled engines.

7. **What social initiatives must be taken for the sensitive use of energy?**
   Solution:
   Listed below are the social initiatives that must be taken:
   - Community involvement will be effective in reducing the misuse of electricity
   - Non-government organizations (NGO's) can be used to create social awareness of the sensitive use of resources.
   - Public awareness can be improved through mass-media and children's participation in campaigns and eco-club activities.

Multiple choice type:

1. **The most non-polluting and efficient lighting device is:**
   (a) CFL
   (b) LED
   (c) Fluorescent light
   (d) Electric bulb
   Solution:
   (a) LED
   Light emitting diode or LED bulbs drastically reduces the consumption of energy.

2. **IEA is the short form of:**
   (a) Indian Energy Association
   (b) Indian Eco Academy
   (c) International Energy Agency
   (d) International Eco Academy
   Solution:
   (c) International Energy Agency
      As per the agency, the improved energy efficiency in buildings, industries and transportation could reduce the world's energy need in 2050 by one-third and thus it can help to control global emission of greenhouse gases.