

Electricity

Basic Concepts of Electricity (Questions 1-5)

1. What is electric current? Define the SI unit of electric current and explain how current flows in a conductor.
2. State Ohm's law and express it mathematically. Draw a circuit diagram to verify Ohm's law experimentally.
3. What is electric potential and potential difference? How is potential difference measured? What is the SI unit of potential difference?
4. Define resistance. What factors affect the resistance of a conductor? Write the formula relating resistance to these factors.
5. What is the difference between conductors, insulators, and semiconductors? Give two examples of each.

Ohm's Law and Resistance (Questions 6-10)

6. A wire of resistance 5Ω is connected to a battery of 3V. Calculate the current flowing through the wire. What will be the current if the voltage is doubled?
7. Explain why the resistance of a conductor increases with increase in temperature while that of a semiconductor decreases.
8. Two resistors of 4Ω and 6Ω are connected in series. Find the equivalent resistance. If a current of 2A flows through the combination, find the voltage across each resistor.
9. Three resistors of 2Ω , 3Ω , and 6Ω are connected in parallel. Calculate the equivalent resistance of the combination.
10. Derive the formula for equivalent resistance when resistors are connected: (a) in series (b) in parallel.

Combination of Resistors (Questions 11-15)

11. Two resistors of 100Ω and 200Ω are connected in series and then in parallel. Calculate the equivalent resistance in both cases. In which case is the equivalent resistance maximum?
12. You have three resistors of 6Ω each. How will you combine them to get: (a) 9Ω (b) 4Ω (c) 18Ω ?
13. A current of 1A flows through a series combination of two resistors of 2Ω and 3Ω connected to a battery. Find: (a) equivalent resistance (b) battery voltage (c) voltage across each resistor.

14. Three resistors of 1Ω , 2Ω , and 3Ω are connected in parallel to a 6V battery. Calculate: (a) equivalent resistance (b) total current (c) current through each resistor.
15. Why are household appliances connected in parallel and not in series? Explain with suitable reasons.

Electric Power and Energy (Questions 16-20)

16. Define electric power. Derive three expressions for electric power in terms of V, I, and R.
17. An electric bulb is rated at 60W, 220V. Calculate: (a) its resistance (b) current drawn by it (c) energy consumed in 5 hours.
18. Which consumes more energy: a 100W bulb used for 6 hours or a 60W bulb used for 10 hours? Calculate and compare.
19. What is meant by the electrical energy consumed by an appliance? How is it calculated? What is the commercial unit of electrical energy?
20. An electric heater of 1000W is used for 2 hours daily for 30 days. If the cost of electricity is ₹4 per unit, calculate the electricity bill for the month.

Additional Application-Based Questions:

Numerical Problems:

- A 9V battery is connected to a resistor, and a current of 0.3A flows. What is the resistance? If the same battery is connected to a 45Ω resistor, what current will flow?
- Two bulbs of 40W and 60W are connected in series to a 220V supply. Which bulb will glow brighter and why?
- A toaster operating at 120V draws 8A of current. What is its resistance and power consumption?
- Calculate the cost of operating a 1.5kW heater for 10 hours if electricity costs ₹3.50 per kWh.

Conceptual Questions:

- Why does a fuse wire melt when excess current flows through it? What material is used for making fuse wires?
- Explain why birds sitting on electric wires do not get electric shock.
- Why are copper and aluminum wires preferred for electrical transmission lines?
- What happens to the brightness of bulbs when more bulbs are added in series? In parallel?

Practical Applications:

- How does a rheostat control current in a circuit? Draw its symbol and explain its working.
- Why are electric bulbs filled with inert gases like argon instead of air?
- Explain the working of an electric fuse. Why is it connected in the live wire?
- How does the thickness of a wire affect its resistance? Why are transmission lines made thick?

Real-life Problems:

- Your electricity bill shows consumption of 150 units. If each unit costs ₹5, what is your bill amount? How many kWh of energy does this represent?
- A house has 5 bulbs of 60W each, 2 fans of 100W each, and 1 refrigerator of 300W. If all operate for 6 hours daily, calculate the daily energy consumption.
- Why do we get a shock when we touch electrical appliances with wet hands?
- Explain why short circuits are dangerous and how they can be prevented.

Comparative Questions:

- Compare the advantages and disadvantages of series and parallel combinations of electrical components.
- How does AC differ from DC? Which type of current do we use in our homes?
- Compare the resistance of a thick wire and a thin wire of the same material and length.
- Why is electrical energy preferred over other forms of energy for domestic use?