

Basic Electricity

40 Important Questions and Answers

1. Basic Electricity

Q1. What is electricity?

Ans: Electricity is a form of energy caused by the flow of electric charges (electrons) through a conductor.

Q2. What is an atom?

Ans: An atom is the smallest particle of an element. It has a nucleus (protons and neutrons) with electrons revolving around it in orbits.

Q3. What is the charge of an electron, proton and neutron?

Ans: Electron: negative. Proton: positive. Neutron: neutral (no charge).

Q4. What are free electrons?

Ans: Electrons in the outermost shell (valence shell) that are loosely bound to the atom and can move freely from one atom to another.

Q5. What is static electricity?

Ans: Electric charge at rest on the surface of a body, produced by friction, e.g. rubbing a glass rod with silk.

Q6. What is current electricity?

Ans: The continuous flow of electrons through a conductor in a closed path.

Q7. What are the main sources of electricity?

Ans: Chemical (cells, batteries), heat (thermocouple), light (solar cell), friction, magnetism (generator/dynamo) and pressure (piezoelectric).

2. Fundamentals of Electricity

Q8. What is electric current? State its unit.

Ans: The rate of flow of electric charge. Unit: ampere (A). $I = Q / t$.

Q9. What is voltage (potential difference)? State its unit.

Ans: The electrical pressure or force that pushes electrons through a circuit. Unit: volt (V).

Q10. What is resistance? State its unit.

Ans: The opposition offered by a material to the flow of current. Unit: ohm.

Q11. State Ohm's law.

Ans: At constant temperature, the current through a conductor is directly proportional to the voltage across it: $V = I \times R$.

Q12. Define electric power and its unit.

Ans: The rate at which electrical energy is used or delivered. $P = V \times I$. Unit: watt (W).

Q13. Define electrical energy and its commercial unit.

Ans: Energy = Power x Time. The commercial unit is the kilowatt-hour (kWh), also called one 'unit' of electricity.

Q14. What is the difference between AC and DC?

Ans: DC flows in one direction only with constant polarity (battery). AC periodically reverses its direction and polarity (supply mains). In India, AC frequency is 50 Hz.

3. Flux and Soldering Technique

Q15. What is soldering?

Ans: Joining two metal parts using a molten filler metal (solder) that has a lower melting point than the metals being joined, without melting the parts themselves.

Q16. What is solder? Give its composition.

Ans: An alloy of tin and lead used for joining metals. Common electrical solder is 60% tin and 40% lead (60/40).

Q17. What is flux?

Ans: A chemical substance applied to the joint that cleans away oxide, prevents re-oxidation during heating and helps the solder flow and stick.

Q18. Name the types of soldering flux.

Ans: Rosin (resin) flux, acid flux and paste (organic) flux. Rosin flux is used for electrical and electronic work.

Q19. Why is acid flux not used for electrical work?

Ans: Acid flux is corrosive. Its residue keeps eating the wire and joint over time and can cause failure.

Q20. What is a cold (dry) solder joint?

Ans: A dull, grainy, weak joint made when the solder did not melt and flow properly, usually due to low heat or movement while cooling. It gives poor electrical contact.

Q21. List the main steps of good soldering.

Ans: 1) Clean the surfaces. 2) Apply flux. 3) Heat the joint with a hot, tinned iron. 4) Feed solder to the joint, not the iron. 5) Let it cool without moving. 6) Clean off excess flux.

4. Property of Resistance

Q22. What are the factors on which the resistance of a conductor depends?

Ans: Length, cross-sectional area, nature of the material (resistivity) and temperature.

Q23. Write the formula for resistance in terms of resistivity.

Ans: $R = \rho \times L / A$, where ρ is the resistivity, L the length and A the area of cross-section.

Q24. What is resistivity (specific resistance)? Give its unit.

Ans: The resistance of a conductor of unit length and unit cross-sectional area. Unit: ohm-metre.

Q25. What is the effect of length and area on resistance?

Ans: Resistance is directly proportional to length and inversely proportional to cross-sectional area.

Q26. What is the temperature coefficient of resistance?

Ans: The change in resistance per ohm of original resistance per degree Celsius rise in temperature.

Q27. How does temperature affect the resistance of metals and of semiconductors?

Ans: For metals, resistance increases as temperature rises (positive coefficient). For semiconductors, carbon and insulators, resistance decreases as temperature rises (negative coefficient).

Q28. What is conductance? State its unit.

Ans: The reciprocal of resistance ($G = 1/R$), a measure of how easily current flows. Unit: siemens (S).

5. Conductor, Insulator and Semiconductor

Q29. What is a conductor? Give examples.

Ans: A material with many free electrons that allows current to pass easily. Examples: silver, copper, aluminium, gold.

Q30. What is an insulator? Give examples.

Ans: A material with almost no free electrons that does not allow current to flow. Examples: rubber, PVC, glass, porcelain, mica, dry wood.

Q31. What is a semiconductor? Give examples.

Ans: A material whose conductivity lies between a conductor and an insulator. Examples: silicon and germanium.

Q32. Why is copper widely used as a conductor?

Ans: It has very low resistivity, good ductility and strength, is easy to solder and is available at reasonable cost.

Q33. What is doping? Name the two types of doped semiconductors.

Ans: Adding a small amount of impurity to pure (intrinsic) semiconductor to increase its conductivity. Types: N-type (pentavalent impurity) and P-type (trivalent impurity).

Q34. Which is the best conductor of electricity, and which is the most commonly used?

Ans: Silver is the best conductor, but copper is the most commonly used because silver is too costly.

6. Types of Wires and Cables

Q35. What is the difference between a wire and a cable?

Ans: A wire is a single conductor, bare or insulated. A cable consists of two or more insulated conductors (cores) enclosed in a common protective sheath.

Q36. What are the main types of wires by construction?

Ans: Solid (single-strand) wire and stranded wire (many thin strands twisted together, more flexible).

Q37. What are the main parts of a cable?

Ans: Conductor (core), insulation, filler/bedding, armouring (if any) and the outer sheath.

Q38. Name the common insulating materials used on wires and cables.

Ans: PVC, rubber, XLPE (cross-linked polyethylene), paper, varnished cambric and Teflon.

Q39. Name some common types of cables.

Ans: PVC insulated cable, VIR (vulcanised indiarubber) cable, TRS/CTS cable, flexible cord, armoured cable, coaxial cable, and lead-sheathed cable.

Q40. What does SWG stand for and what does it indicate?

Ans: Standard Wire Gauge. It is a numbering system for wire diameter: the higher the SWG number, the thinner the wire.