CURRENT

Q.1 The standard resistance coil are made of manganin. Why?

A.1 When current flows through a wire its temperature will increase. For alloys like manganin the temperature coefficient of resistance is very small. Thus, even if the temperature of the coil increases its resistance will remain constant.

Q.2 Does the value of temperature coefficient of resistance always positive?

A.2 No, positive temperature coefficient of resistance implies that the resistance increases with increase in temperature. But for semiconductors and insulators the resistance decreases with increase in temperature and their temperature coefficient of resistance is negative.

Q.3 What is the difference between static electricity and current electricity.

A.3 Static electricity deals with the study of electric charges at rest whereas current electricity is the branch of physics which deals with charge particle in motion.

Q.4 Is Ohm's law, universally applicable to all current carrying elements?

A.4 No, no ohm's law can be applicable only for substances for which V-I curve is a straight line or whose resistance remains constant with potential difference. For non- ohmic conductors like diodes ohm's law s not applicable.

Q.5 Currents of the order of 0.1A through human body are fatal what causes death: heating due to current o something else?

A.5 When current flows through the body it has electromagnetic wave associated with it. This can interfere with the wave connecting brain with body parts and can affect the functioning of heart. Cardiac arrest is the cause of death in most cases.

Q.6 The connecting wires are made of copper. Why?

A.6 The specific resistance of copper is small, thus when current flows through the copper wire heat generated will be less and energy losses will be reduced

Q.7 If electron drift speed is small, and the charge on electron is also very small, how can we obtain large amount of current in the conductor?

A.7 Large currents can be obtained due to large number density of charge carriers inside the conductors, which is of the order of 10^{29} m^{-3}.

Q.8 A steady current flows through the cylindrical conductor is there any electric field inside the conductor?

A.8 Current flows inside the conductor when potential difference is applied across the two ends of the conductor. Thus, if V is the potential difference applied and l is the length of the conductor then electric field inside the conductor is $E = V/l$

Q.9 There is an impression among people that person touching a high power line gets stuck with it. Is that true? Explain.

A.9 No, a person will not get stuck to the wire. But when current flows through the wire it affects the nervous system and snaps the connection between brain and body parts. It is the brain, which is not giving an order to the hand to move it.

Q.10 Explain, why bending of wire does not affect the resistance?

A.10 Free electrons in the wire has small value of drift velocity and thus very low inertia. Due to it, they are unable to move around bends easily.

Q.11 A wire is carrying current. Is it charged?

A.11 No, flow of current only means that electron are moving in direction opposite to the electric field intensity. But, number of electrons in the wire are always equal to the number of protons in the wire Thus wire as a whole is neutral.

Q.12 The electron drift speed is estimates to be few mm/s for current flow. How is then current established almost instantly when the circuit is closed?

A.12 When we close the circuit, potential difference and thus electric field is established instantly in the wire with the speed of em waves. Thus, information for flow of current through the wire is transmitted through the wire with a speed of 3×10^8 m/s.

Q.13 Of metals and alloys, which have greater value of temperature coefficient of resistance?

A.13 The value of a is more for metals, as there is greater variation in resistance f metals with temperature as compared to alloys.

Q.14 What happens to the drift velocity of electrons and resistance R, if the length of conductor is doubled [keeping potential difference unchanged]?

A.14 Drift velocity is inversely proportional to the length for constant value of V potential difference. Thus, if the length of the conductor is doubled drift velocity will be halved.
The resistance of conductor is directly proportional to the length of the conductor. Thus, if length is doubled resistance will also be doubled.

Q.15 A large number of free electrons are present in metals, why there is no current in absence of potential difference?

A.15 In absence of potential difference, the electrons are moving randomly and keeps on colliding with each other. Thus, even if the thermal speed of the electrons is of the order of 10^6 m/s there drift velocity is zero due to Brownian motion of electrons.

Q.16 When electrons drift in a metal from lower to higher potential, does that mean that all the free electrons of the metal are moving in the same direction?

A.16 No, electrons will have resultant drift velocity in the direction from lower to higher potential. But they still suffer collisions inside metal and with each collision the direction of motion of electron changes.

Q.17 The electron drift speed arises due to force experienced by electrons in the electric field inside the conductor. But force should cause acceleration. Why then do the electrons acquire a steady average drift speed?

A.17 The free electron in metal under the effect of electric field intensity accelerates due to electric field intensity. It experience deceleration due to the collisions. The resultant affect of these two is that electrons acquire steady drift speed, which is almost, half the maximum drift speed acquired by the free electron before collision.

Q.18 A steady current flows through wire of non uniform cross-section. Explain which of these quantities is constant along the conductor: current, current density, electric field and drift speed?

A.18 Only current is constant along the length as other quantities are inversely proportional to the cross-sectional area which is variable.

Q.19 What are thermistors? Where are thermistors used?

A.19 Thermistors is a heat sensitive device whose resistance changes with the change in temperature. Thermistors are used in the protection of windings of generators etc against the variation of current.

Q.20 Can potential difference of a cell be greater than its emf?

A.20 No, potential difference is less than emf of the cell when the cell is being discharged. But, during charging, action of the cell potential difference s greater than the emf f the cell.

Q.21 If the resistance of our body is so large [of the order of 10 kiloW], why does one experience shock when one accidentally touches the line wire, say a 240-volt supply?

A.21 Even if the resistance is high the magnitude of current flow will be of the order of 0.024A which can interfere with the nerve process and affects the beating of heart.

Q.22 It is easier to start a car engine on a warm day than on a chilly day, why?

A.22 On chilly day the temperature of a surroundings which is low results in increase in internal resistance of the battery and decreases the current supply from the battery.

Q.23 Lights of car are dimmed when the starter is operated, why?

A.23 When the motor of a car is operated, it draws large current from the battery. Due to this potential drop across bulb decreases and light becomes dim.

Q.24 On what factors does the emf of a cell depends?

A.24 Emf of a cell depends upon [a] nature of electrolyte and its concentration [b] nature of electrodes [c] temperature of the electrolyte.

Q.25 If the temperature of good conductor decreases, how does the relaxation time of electrons in the conductor change?

A.25 If the temperature of conductor decreases its resistance will decrease and relaxation time increases.

Q.26 Is it possible that there is no potential between the plates of the cell? If yes, under what conditions?

A.26 Yes, it is possible for terminal potential difference across the cell to be zero, if the plates of the cell are short-circuited.

Q.27 What does the no deflection position in the galvanometer of potentiometer experiment tells us about the flow of current?

A.27 When null point is obtained on the wire, then potential difference between one end of wire and null point is equal to the emf of the cell to be measured. Thus current through galvanometer circuit is zero.

Q.28 When is Wheatstone bridge most sensitive?

A.28 Wheatstone bridge is most sensitive when four resistances in the Wheatstone bridge are of the same order or null point is obtained in the middle of meter bridge wire.

Q.29 On what factors, does the potential gradient of the potentiometer wire depend?

A.29 The potential difference per unit length of the wire depends on [a] current through the wire [b] specific resistance of the wire. [c] area of cross-section of the wire.

Q.30 Why the current should not be passed through the potentiometer wire for long time?

A.30 For potentiometer to work properly, pd per unit length should be constant. But if the current is passed through for a long time then the wire gets heated up and its specific resistance and resistance per unit length [i.e. r = r/A] becomes variable.

Q.31 Copper wire is not used for making potentiometer wires. Why?

A.31 Copper should not be used for making potentiometer wire because temperature coefficient of resistance for copper is large and when current flows through wire, its specific resistance and resistance per unit length begins to vary due to heat generation.

Q.32 What do you understand by sensitiveness of potentiometer and how can you increase the sensitiveness of the potentiometer?

A.32 Sensitivity of potentiometer is the minimum value of potential difference which it can measure or p.d. across unit length of wire. It can be increased by [a] increasing the length of the wire [b] decreasing the current flow through the potentiometer wire.

Q.33 Can you interchange the positions of the battery in the auxiliary circuit and cell whose emf is to b determined in potentiometer circuit diagram?

A.33 No, battery and cell can' be interchanged because the emf of the battery should always be greater than the emf of the cell is to be measured. If the positions of two are interchanged there will be no null point on the wire.

Q.34 Why do we prefer to use potentiometer for measurement of emf rather than the voltmeter?

A.34 Potentiometer is preferred for measuring the emf of the cell because it uses null deflection method for measurement, thus it draws no current from the cell whose emf is to be measured.

Q.35 The emf of the driver cell should always be greater than emf of the cell to be measured. Why?

A.35 If emf of the driver cell is less than the emf of the cell to be measured because in that case fall of potential across the length of potentiometer will be less than emf of the cell to be measured

Q.36 Are Kirchoff's law applicable to both a.c. and d.c?

A.36 Yes, Kirchoff's two laws are basically law of conservation of charge and law of conservation of energy. Thus, they are equally applicable to both ac as well as dc.

Q.37 Why the jockey should not be pressed against the potentiometer wire?

A.37 Jockey should not be pressed against the potentiometer wire because pressing the jockey will change the cross-sectional area of the wire and thus resistance per unit length becomes variable.

Q.38 Can meter bridge be used for measuring very low resistances?

A.38 Meter bridge can't be used for measuring low resistances because in that case we can't neglect the resistance of connecting wires and copper strips.

Q.39 Why the connection between resistors in Wheatstone bridge or Meter Bridge are made of thick copper wires?

A.39 Connections are made of thick copper wires so that the resistance of copper wires is negligible as compared to other resistances used in the circuit.

Q.40 Why balance point should be near the middle point of the meter bridge wire?

A.40 Meter bridge is based on the principle of Wheatstone bridge. When null point is obtained in the middle the ratio arms resistances is of the same order and sensitivity of potentiometer is maximum.

Q.41 What happens if cell and galvanometer in Wheatstone bridge are interchanged?

A.41 there will be no change in the balance point condition of Wheatstone bridge even if galvanometer and cell are interchanged.

Q.42 In Wheatstone bridge method why do we break the galvanometer circuit first and then the battery circuit?

A.42 This is done to save the galvanometer from large current, which can flow due to large induced emf in the ciruit at the time of breaking the circuit.