CHAPTER-3
CURRENT ELECTRICITY
ASSIGNMENT-2

1-Mark Questions

Q1. Is current density scalar or vector quantity?

Q2. Steady current is flowing in cylindrical conductor. Does electric field exist within the conductor?

Q3. When a straight wire of resistance R bent into U-shape, does its resistance change?

Q4. If the radius of copper wire is doubled, will its specific resistance increase, decrease or remain same?

Q5. What is the effect of heating of conductor on the drift velocity of free electrons?

Q6. A uniform wire resistance 50 ohms is into equal parts. These parts are now connected parallel. What the value equivalent resistance of combination?

Q7. What happens to the power dissipation if the value of electric current passing through conductor of constant resistance doubled?

Q8. Define the resistivity and write the SI unit.

Q9. A wire resistivity p stretched double length. What will be new resistivity?

Q10.What is the Significance of positive value of temperature coefficient of resistivity?

Q11. What is the significance of negative value of temperature coefficient of resistivity?

Q12. What happens to internal resistance of a cell after long use?

Q13. Write the relation between internal resistance, EMF, and terminal potential difference of a cell

Q14. Under what condition EMF of a cell is less than terminal potential difference**.**

Q15. How does the relaxation time of electron in the conductor change when temperature of the conductor decreases.

Q16. Resistors of high value are made up of carbon. Why?

Multiple Choice Questions (Each 1M)

Q17. In a current carrying conductor, the ratio of the electric field and the current density at a point is called

(a) Resistivity (b) Conductivity (c) Resistance (d) Mobility

Q18. Consider a current carrying wire (current I) in the shape of a circle. Note that as the current progresses along the wire, the direction of j (current density) changes in an exact manner, while the current I remain unaffected. The agent that is essentially responsible for is _____

(a) source of emf.

(b) electric field produced by charges accumulated on the surface of wire.

(c) the charges just behind the given segment of wire which push them just the right way by repulsion

(d) the charges ahead

Q19. Calculate the conductance and conductivity of a wire of resistance 0.01 Ω and area of cross section 10^{-4} m^2 and length 0.1 m.

(a) 10 S and 10^5 S m^{-1}

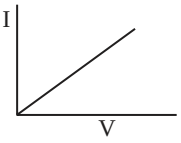
(b) 100 S and 10^4S m^{-1}

(c) 100 S and 10^6S m^{-1}

(d)100 S and 10^5 S m^{-1}

Q20. The *V-I* characteristics of four circuit elements are shown. Which of these is ohmic?

(a)



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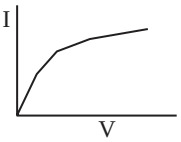

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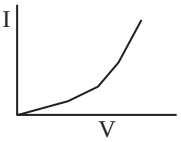

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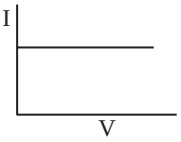
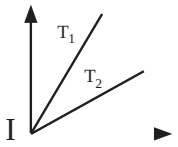


Q21. The current-voltage (*I-V*) graph for a given metallic wire at two different temperatures T_1 and T_2 are shown in figure. It follows from the graph that:



V

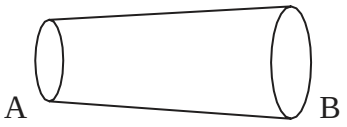
(a) $T_1 > T_2$

(b) $T_1 < T_2$

(c) $T_1 = T_2$

(d) T_1 is greater or less than T_2 depending on whether the resistance R of the wire is greater or less than the ratio V/I.

Q22. A wire has a non-uniform cross-section as shown in the figure. If a steady current is flowing through it, then the drift speed of the electrons:



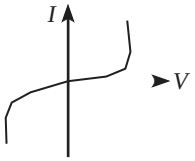
(a) is constant throughout the wire

(b) decreases from A to B

(c) increases from A to B

(d) varies randomly

Q23. The *I*-*V* characteristics shown in figure represents:



(a) ohmic conductors (b) non-ohmic conductors

(c) Insulators (d) superconductors

Q24.A metal wire is subjected to a constant potential difference. When the temperature of the metal wire increases, the drift velocity of the electron in it:

(a) increases, thermal velocity of electron increases

(b) decreases, thermal velocity of electron increases

(c) increases, thermal velocity of electron decreases

(d) decreases, thermal velocity of electron decreases

Q25.Current of 4.8 amperes is flowing through a conductor. The number of electrons crossing any cross-section per second will be:

(a) 3×10^{19} (b) 7.68×10^{21} (c) 7.68×10^{20} (d) 3×10^{20}

Q26.Ohm's law deals with the relation between:

(a) current and potential difference

(b) capacity and charge

(c) capacity and potential

(d) charge and potential difference

Q27. Ohm's law is valid when the temperature of the conductor is_____:

(a) constant (b) very high (c) very low (d) varying

Q28.Ohm's law is valid for:

(a)metallic conductors at low temperature

(b)metallic conductors at high temperature

(c)electrolytes when current passes through them

(d)diode when current flows

Q29.In gallium-arsenide material, Ohm's law does not hold good because:

(a)current remains constant for any value of voltage

(b)resistance is infinite

(c)negative resistance exists in the voltage-current variation

(d)current goes to infinite at very low voltages

Q30.When the length and area of cross-section both are doubled, then its resistance:

(a) will become half

(b)will be doubled

(c)will remain the same

(d)will become four times

Q31.For a metallic wire, the ratio V/I (V = the applied potential difference, I = current flowing):

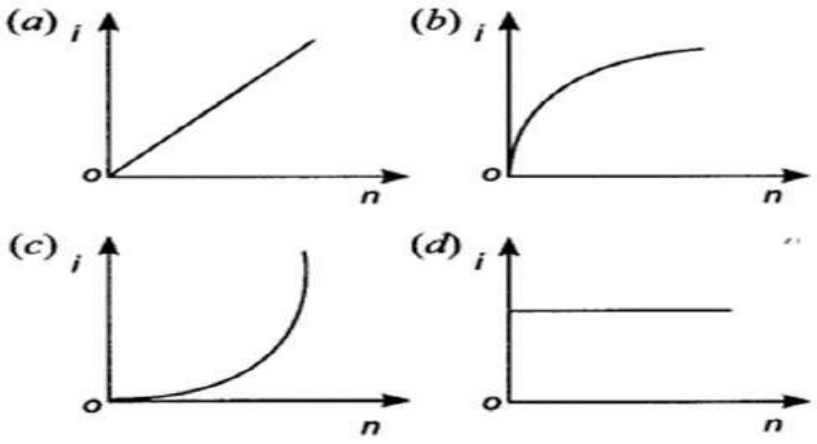
(a)is independent of temperature.

(b)increases as the temperature rises.

(c)decreases as the temperature rises.

(d)increases or decreases as temperature rises, depending upon the metal.

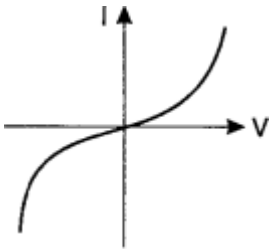
Q32. A battery consists of a variable number ′n′ of identical cells (having internal resistance ′r′ each) which are connected in series. The terminals of the battery are short-circuited and the current I is measured. Which of the graphs shows the correct relationship between I and n?



Q33.Drift velocity v_d varies with the intensity of electric field as per the relation

(a) v_d a E (b) v_d a $\frac{1}{E}$ (c) v_d = constant (d) v_d a E^2

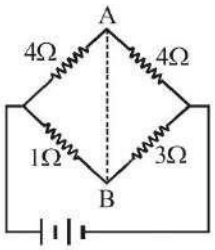
Q34. The I-V characteristics shown in figure represents



(a) ohmic conductors (b) non-ohmic conductors

(c) insulators (d) superconductors

Q35. In the circuit shown, if a conducting wire is connected between points A and B, the current



in this wire will

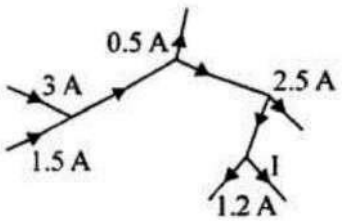
(a) flow in the direction which will be decided by the value of V

(b) be zero

(c) flow from B to A

(d) flow from A to B

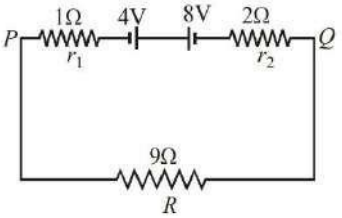
Q36.In following figure shows currents in a part of electrical circuit, then the value of I (in ampere) is given by :



(a) 0.3 A (b) 0.5 A

(c) 1.3 A (d) None of these

Q37. Two batteries of emf 4 V and 8V with internal resistance 1 ohm and 2 ohm are connected in a circuit with a resistance of 9 W as shown in figure.



The current and potential difference between the points P and Q are

a) 1 /3 A and 3 V (b) 1 /6 A and 4 V

(c) 1 /9 A and 9 V (d) 1 /12 A and 12 V

Q38. In a Wheatstone bridge all the four arms have equal resistance 2R. If the resistance of the galvanometer arm A B is also R, the equivalent resistance of the combination as seen by the battery is

(a) 2 R (b) R (c)2R (d) 4 R

Assertion-Reasoning Questions

Directions: These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

Q39.**Assertion**: There is no current in the metals in absence of electric field.

Reason: Motion of free electrons is randomly.

Q40. **Assertion**: A wire carrying an electric current has no electric field around it.

Reason: Rate of flow of electrons in One direction is equal to rate of flow of protons in opposite direction

Q41. **Assertion**: In a simple battery circuit, the point of the lowest potential is positive terminal of the battery.

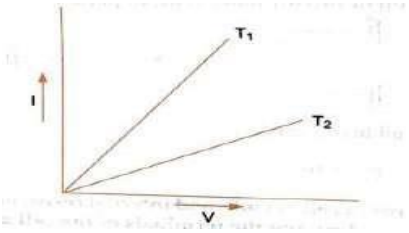
Reason: The current flows towards the point of the higher potential, as it does in such a circuit from the negative to the positive terminal

2 MARKS QUESTIONS

Q42. The metallic conductor is at temperature $\square_1$. The temperature of metallic conductor is increased to $\square_2$. How will the product of resistivity and conductivity change? Why?

Q43. Specific resistance copper, silver constantan are 1.18×10^{-6}, 1×10^{-6}, and 45×10^{6} ohm cm respectively. Which is the best electrical conductor and why?

Q44. Nichrome and copper wires of same length and same radius are connected in series. Current I is passed through them. Which wire gets heated up more? Justify your answer.



Q45. I - V graph for a metallic wire at two different temperatures, T1 and T2 is as shown in the figure. Which of the two temperatures is lower and why?

Q46. What conclusion can you draw from the following observations on a resistor made of an alloy manganin?

Current A	Voltage V	Current A	Voltage V
0.2	3.94	3.0	59.2
0.4	7.87	4.0	78.8
0.6	11.8	5.0	98.6
0.8	15.7	6.0	118.5
1.0	19.7	7.0	138.2
2.0	39.4	8.0	158.0

Q47. An electric bulb rated for 500W at 100V is used in circuit having a 200V supply. Calculate the resistance R that must be put in series with the bulb, so that the bulb delivers 500W.

Q48. Why is Wheatstone Bridge method considered unsuitable for measurement of very low resistances?

Q49. Why the Wheatstone method is considered Unsuitable for measurement of very high resistances?

Q50.A Battery of emf 3 volt and internal resistance r is connected in series with 55 ohms through an ammeter of resistance 1 ohm. The ammeter reads 50 mA. Draw the circuit diagram and calculate value of r.

Q51. Derive the conditions for obtaining maximum current through external resistance connected across a series combination of n identical cells.

Q52. Derive condition for obtaining maximum current through an external resistance connected to a parallel combination of n identical cells.

Q53. Two identical cells, whether joined in series or in parallel give the same current, when connected to an external resistance of 1 ohm. Find the internal resistance of each cell.

Q54. Two wire one of copper and other of manganin have same resistance and equal length. Which wire is thicker?

Q55. When does the terminal voltage of a cell become (i) greater than its emf (ii) less than its emf?

Q56.A car battery is of 12V. Eight dry cells of 1.5 V connected in series also give 12V, but such a combination is not used to start a car. Why?

Q57. The current flowing through a conductor is 2mA at 50V and 3mA at 60V. Is it an ohmic or non-ohmic conductor? Give reason.

3MARKS QUESTIONS

Q58. On what factors resistivity of the material depend? Write the corresponding equation. Why copper wires are used as connecting wires?

Q59. A heating element using nichrome connected to a 230 V supply draws an initial current of 3.2 A which settles after a few seconds to a steady value of 2.8 A. What is the steady temperature of the heating element if the room temperature is 27.0 °C? Temperature coefficient of resistance of nichrome averaged over the temperature range involved is 1.70×10^{-4} °C^{-1}?

Q60.Answer the following questions:

(a) A steady current flows in a metallic conductor of the non-uniform cross-section. Which of these quantities is constant along the conductor: current, current density, electric field, drift speed?

(b) Is Ohm's law universally applicable for all conducting elements? If not, give examples of

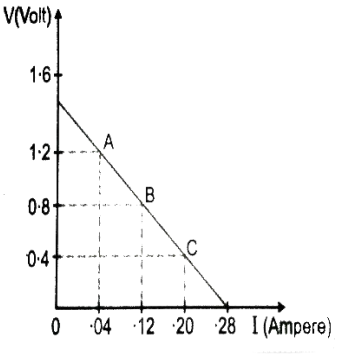
elements that do not obey Ohm's law.

(c) A low voltage supply from which one needs high currents must have very low internal resistance. Why?

Q61 **.** Two cells of different emfs and internal resistance are connected in parallel with one another find the expressions for equivalent EMF and equivalent internal resistance of the combination.

Q62.A battery of emf 12.0 V and internal resistance 0.5Ω is to be charged by a battery charger which supplies 110 V dc. How much resistance must be connected in series with the battery to limit the charging current to 5.0 A? What will be the potential difference across the terminals of the battery during charging?

Q63. Potential differences across the terminals of a cell were measured (in volt) against different currents (in ampere) flowing through the cell. A graph was drawn which was a straight-line ABC as shown in figure

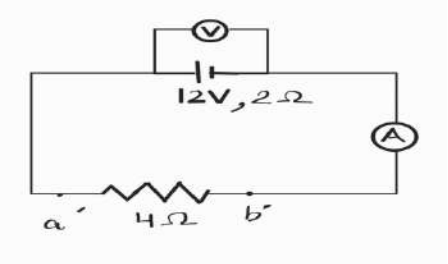


Determine from graph (i) emf of the cell (ii) maximum current obtained from the cell and (iii) internal resistance of the cell.

Q64. Four identical cells each of emf 2V, are joined in parallel providing supply of current to external circuit consisting of two 15Ω resistors joined in parallel. The terminal voltage of the cells ae read by an ideal voltmeter is 1.6V. Calculate the internal resistance of each cell.

Q65. Give three differences between e.m.f. and terminal potential difference of a cell.

Q66. In the figure, an ammeter A, and a resistor of resistance R = 4Ω have been connected to the terminals of the source to form a complete circuit. The emf of the source is 12V having an internal resistance of 2Ω. Calculate voltmeter and ammeter reading.



5 MARKS QUESTIONS

Q67. (a) On the basis of electron drift, derive an expression for resistivity of a conductor in terms of number density of free electrons and relaxation time. On what factors does resistance and resistivity of a conductor depend?

(b) Why alloys like constantan and manganin are used for making standard resistors?

Q68.(a) The electron drift arises due to the 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?

(b) If the electron drift speed is so small, and the electron's charge is small, how can we still obtain large amounts of current in a conductor?

(c) When electrons drift in a metal from lower to higher potential, does it mean that all the 'free' electrons of the metal are moving in the same direction?

(d) Are the paths of electrons straight lines between successive collisions (with the positive ionsof the metal) in the (i) absence of electric field, (ii) presence of electric field?

Q69. Define current density. Give its SI unit. Whether it is vector or scalar?

How does it vary when (i) potential difference across wire increases (ii) length of wire increases (i) temperature of wire increases (iv) Area of cross-section of wire increases justify your answer. Q70. State Kirchhoff's rules for electrical networks. Use them to explain the principle of Wheatstone bridge for determining an unknown resistance. How is it realized in actual practice inthe laboratory? Write the formula used.

Q71. Deduce the condition for balance in a Wheatstone bridge. Write any two important precautions you would observe while performing the experiment. When is Wheatstone bridge mostsensitive?