MULTIPLE CHOICE QUESTIONS

1. What is the order of magnitude of the resistance of a dry human body?
   a. 10 Ω **b. 10^4 Ω** c. 10 MΩ d. 10 μΩ

2. A silver wire has a resistance of 2.1 Ω at 27.5 °C, and a resistance of 2.7 Ω at 100 °C. What is the temperature coefficient of resistivity of silver?
   a. 0.0059 **b. 0.0039** c. 0.0129 d. 0.0159

3. The rate of flow of electric charge through any cross-section of a conductor is known as _____.
   a. Electric flux b. Electric potential **c. Electric current** d. Electric field

4. Mobility is denoted by _____.
   a. $V_d E$ b. $\frac{E}{V_d}$ **c.** $\frac{V_d}{E}$ d. none

5. Which of the following has non-ohmic resistance?
   a. Lamp filament b. Copper wire c. Carbon resistor **d. Diode**

6. Unit of conductance is _____.
   a. Dyne **b. Siemen** c. Ohm d. Volts

7. Current density is a _____.
   a. scalar quantity. **b. vector quantity.**
   c. dimensionless quantity. d. none of these options

8. The resistivity of certain metals or alloys drops to zero when they are cooled below a certain temperature, this phenomenon is known as _____.
   a. Conductivity b. Partial conductivity
   c. Superconductivity d. Non-conductivity

9. The opposition offered by the electrolyte of the cell to the flow of current through itself is known as _____.
   a. External resistance **b. Internal resistance**
   c. Non-resistance d. None of these options

10. Kirchhoff s second law is based on the law of conservation of
   (a) charge (b) mass **(c) energy** (d) momentum

11. When there is an electric current through a conducting wire along its length, then an electric field must exist:
   (a) outside the wire but normal to it. **(b) inside the wire but parallel to it.**
   (c) inside the wire but normal to it. (d) outside the wire but around it.

11. The terminal potential difference of a cell when short circuited is
   (a) zero (b) E (c) E/2 (d) E/3

12. In 10 minutes, 3000 Coulombs of free electrons enter one end of a conductor and 3000 Coulomb of then leave the conductor at its other end. The current in the conductor is:

(a) 5 A (b) 10 A (c) 0 A (d) 30 A

13. The temperature coefficient of resistance of a wire is 0.00125° C^{-1}. At 27°C, its resistance is 1Ω. The temperature of the wire at which its resistance becomes 2Ω is:

(a) 1400 K **(b) 854°C** (c) 1127 K (d) 1154 K.

14. The heating element of an electric heater should be made of a material that should have:

(a) low specific resistance and low melting point.

(b) high specific resistance and high melting point.

(c) high specific resistance and low melting point.

(d) low specific resistance and high melting point

15. The SI units of the current density is

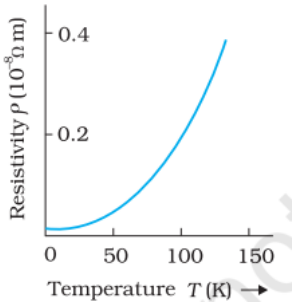
(a) A (b) Am^2 (c) A/m **(d) A/m^2**

16. The SI unit of mobility is

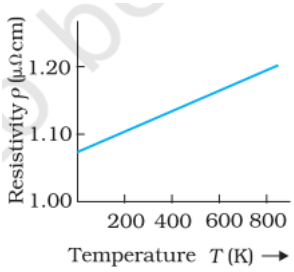
(a) m^2 /Vs (b) m /Vs (c) m^2 /V (d) m^2

17. the following graph represent temperature v/s resistivity curve, choose the correct option

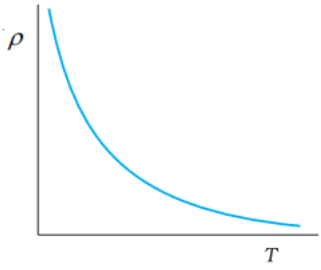
(i)



(ii)



(iii)



(a)(i) is nichrome (ii) is copper (iii) is semi conductor

(b) (i) is copper (ii) is semi conductor (iii) is nichrome

(c) (i) is semi conductor (ii) is nichrome (iii) is copper

(d) (i) is copper (ii) is nichrome (iii) is semi conductor

18. Manganin and constantan are widely used in wire bound standard resistors because

(a) their resistance values would change very little with temperatures

(b) they have very high resistivity

(c) they are abundantly available

(d) they are cheaper

19. which of the following option is correct in case of charge carriers

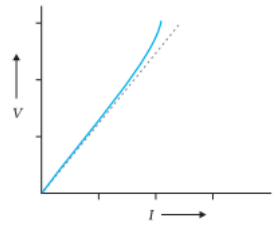
(a) In metals, the mobile charge carriers are electrons

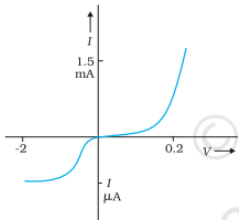
(b) In an ionised gas, mobile charge carriers are electrons and positive charged ion.

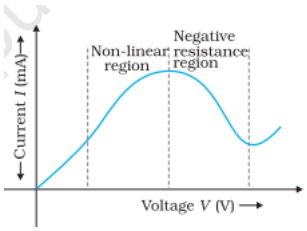
(c) in an electrolyte, mobile charge carriers are both positive and negative ions.

(d) all the above are correct.

20. The following graph represent V – I characteristic of different curve, choose the correct option

(i) 

(ii) 

(iii) 

(a) **(i) represent good conductor, (ii) represent diode (iii) represent GaAs gas**
(b) (i) represent diode, (ii) represent good conductor (iii) represent GaAs gas
(c) (i) represent diode, (ii) represent GaAs gas (iii) represent good conductor
(d) (i) represent GaAs gas, (ii) represent diode (iii) represent good conductor

21. Resistivity depends
(a) inversely on the number n of free electrons per unit volume
(b) directly on the average time t between collisions
(c) directly on the number n of free electrons per unit volume
(d) all the above are correct

22. SI unit of electromotive force is
(a) volt (b) newton (c) ampere (d) watt

2 MARKS QUESTIONS:

1. State and explain Ohm's law.
2. Give any two limitations of Ohm's law
3. Define mobility. Give its SI unit.
4. What is Ohmic device? Give one example.
5. State Kirchhoff's law of electric networks.(write its significance)
6. Represent graphically variation of resistivity with absolute temperature for copper and nichrome wire or silicon wire.
7. Define drift velocity. Write its expression in terms of electric field.
8. Write the expression for drift velocity in terms of current and explain the terms.

3 MARKS QUESTIONS

1. Derive the expression for drift velocity of electrons.
2. Derive the relation $\boldsymbol{J = \sigma E}$ with terms have usual meaning.
3. Arrive at the expression for electric current in terms of drift velocity. Or Derive where the symbols have their usual meaning.
4. Write the factors on which the resistance of a conductor depend.
5. Derive $\sigma = \frac{ne^2\tau}{m}$

5 MARKS DERIVATIONS

1. Two cells of emf E_1 and E_2 and internal resistance r_1 and r_2 are connected in parallel such that they send current in same direction. Derive an expression for equivalent resistance and equivalent emf of the combination.
2. Two cells of emf E_1 and E_2 and internal resistance r_1 and r_2 are connected in series such that they send current in same direction. Derive an expression for equivalent resistance and equivalent emf of the combination.
3. Deduce the condition for balance of Wheatstone's bridge using Kirchhoff's rules

5 MARKS PROBLEMS

1. Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area 1.0×10^{-7} m^2 carrying a current of 1.5 A. Assume that each copper atom contributes roughly one conduction electron. The density of copper is 9.0×10^3 kg/m^3 , and its atomic mass is 63.5 u
2. The number density of free electrons in copper is estimated to be $8.5X10^{28}m^{-3}$. A copper wire of length 3.0 m and area of cross – section 2.0 mm^2 is carrying a current of 3.0 A. calculate the drift velocity of electrons. How long does an electron take drift from one end of the wire to its other end?
3. A wire having length 2.0 m, diameter 1.0 mm and resistivity $1.963x10^{-8}$ Ω m is connected in series with a battery of emf 3V and internal resistance 1 Ω . Calculate the resistance of the wire and current in the circuit.
4. Two cells of emf 2V and 4V and internal resistance 1Ω and 2Ω respectively are connected in parallel so as to send the current in the same direction through an external resistance of 10Ω . Find the potential difference across 10Ω resistor.
5. Two cells identical cells either in series or in parallel combinations, give the same current of 0.5 A through external resistance of 4Ω. Find emf and internal resistance of each cell.
6. a. three resistor 3, 4, 12 are connected in parallel. What is the effective resistance of combination? b. if the combination is connected to battery of emf 6V and internal resistance of 0.5, find the current drawn from the battery and terminal potential difference potential difference across battery.
7. 100 mg mass of nichrome metal is drawn into a wire of area of cross-section 0.05 mm^2. Calculate the resistance of this wire. Given density of nichrome 8.4 x 103 kg^{-3} and resistivity of the material as $1.2x\ 10^{-6}$ Ωm.
8. Three resistor 4Ω, 6Ω, and 8Ω are combined in parallel. What is the total resistance of the combination? If the combination is connected to a battery of emf 25V and negligible internal resistance. Determine the current through each resistor and total current drawn from the battery.
9. When two resistors are connected in series with a cell of emf 2V and negligible internal resistance, a current of 2/5 A flows in a circuit. When the resistors are connected in parallel the main current is 5/3 A. Calculate the resistances.
10. Two resistors are connected in series with 5V battery of negligible internal resistance. A current of 2A flows through each resistor. If they are connected in parallel with the same battery a current of 25/3 A flows through combination. Calculate the value of each resistance.