# UNIT-2 CURRENT ELECTRICITY

## VERY SHORT ANSWER QUESTIONS (I Mark)

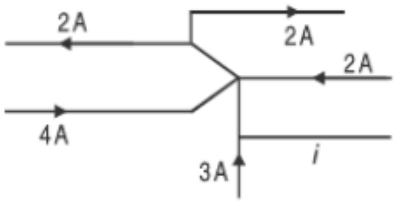
1. How does the relaxation time of electron in the conductor change when temperature of the conductor decreases.

2. Sketch a graph showing variation of resistivity with temperature of (i) Copper (ii) Carbon.

3. The emf of the driver cell (Auxillary battery) in the potentiometer experiment should be greater than emf of the cell to be determined. Why?

4. You are required to select a carbon resistor of resistance 47kΩ ± 10% from a large collection. What should be the sequence of color bands used to code it?

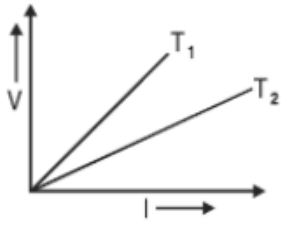
5. The fig. here shows a part of a circuit. What are the magnitude and direction of the current $i$ in the lower right-hand wire? (8 Amp)



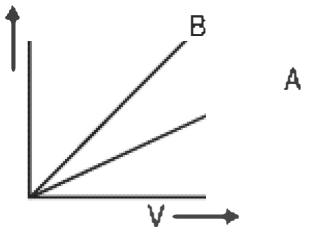

6. Two wire one of copper and other of manganin have same resistance and equal length. Which wire is thicker?

7. You are given three constantan wires P, Q and R of length and area of cross-section $(L, A)$, $\left(2L, \frac{A}{2}\right)$ and $\left(\frac{L}{2}, 2A\right)$ respectively Which has highest resistance?

8. V – I graph for a metallic wire at two different temperatures $T_1$ and $T_2$ is as shown in the figure. Which of the two temperatures is higher and why?



9. Out of V – I graph for parallel and series combination of two metallic resistors, which one represents parallel combination of resistors? Justify your answer.

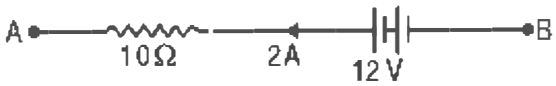



10. Why is the potentiometer preferred to a voltmeter for measuring emf of a cell?

11. How can a given 4 wires potentiometer be made more sensitive?

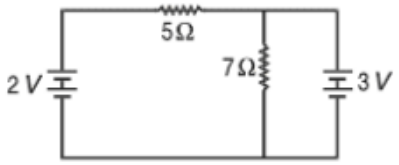
12. Why is copper not used for making potentiometer wires?

13. In the figure, what is the potential difference between A and B?

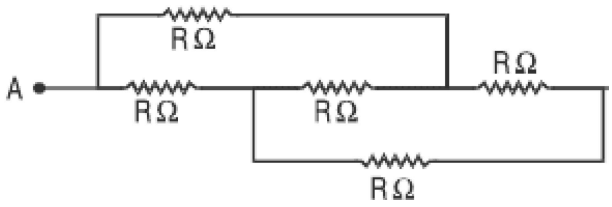



14. A copper wire of resistance R is uniformally stretched till its length is increased to n times its original length. What will be its new resistance?

15. Two resistances 5Ω and 7Ω are joined as shown to two batteries of emf 2V and 3V. If the 3V battery is short circuited. What will be the current through 5Ω?




16. Calculate the equivalent resistance between points A and B in the figure given below.



17. What is the largest voltage that can be safely put across a resistor marked 196Ω, 1W?

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

19. 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?

20. Two electric lamps A and B marked (220V, 100W) and (220V, 60W) respectively. Which of the two lamps has higher resistance?

21. Constantan is used for making the standard resistance. Why?

22. A 16Ω thick wire is stretched so that its length becomes two times. Assuming there is no change in density on stretching. Calculate the resistance of new wire.

23. State the Condition under which the terminal potential difference across a battery and its emf are equal.

24. State the Condition for maximum current to be drawn from the Cell.

25. Name the physical quantity measured by potential gradient.

## SHORT ANSWER QUESTIONS (2 Marks)

1. Define mobility of electron in a conductor. How does electron mobility change when (i) temperature of conductor is decreased (ii) Applied potential difference is doubled at constant temperature?

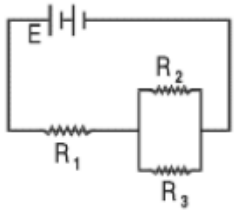
2. On what factor does potential gradient of a potentiometer wire depend?

3. What are superconductors? Give one of their applications.

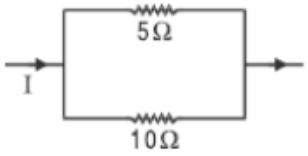
4. Two manganin wires whose lengths are in the ratio 1 : 2 and whose resistances are in the ratio 1 : 2 are connected in series with a battery. What will be the ratio of drift velocities of free electrons in the two wires?

5. The current through a wire depends on time as $i = i_0 + at$ where $i_0 = 4A$ and $a = 2As^{-1}$. Find the charge crossing a section of wire in 10 seconds.

6. Three identical resistors $R_1$, $R_2$ and $R_3$ are connected to a battery as shown in the figure. What will be the ratio of voltages across $R_1$ and $R_2$. Support your answer with calculations. (2:1)




7. In the arrangement of resistors shown, what fraction of current I will pass through 5Ω resistor? $\left(\frac{2}{3}\right)$




8. A 100W and a 200 W domestic bulbs joined in series are connected to the mains. Which bulb will glow more brightly? Justify. (100W)

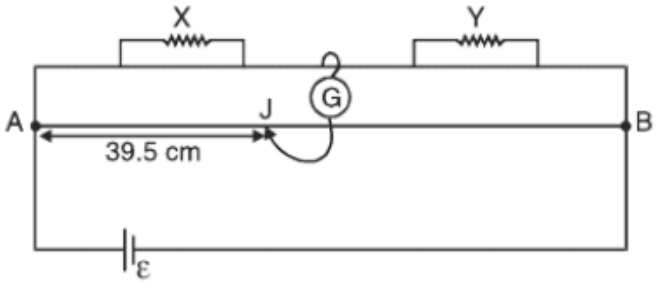
9. A 100W and a 200 W domestic bulbs joined in parallel are connected to the mains. Which bulb will glow more brightly? Justify. (200W)

10. A battery has an emf of 12V and an internal resistance of 2Ω. Calculate the potential difference between the terminal of cell if (a) current is drawn from the battery (b) battery is charged by an external source.

11. A uniform wire of resistance R ohm is bent into a circular loop as shown in the figure. Compute effective resistance between diametrically opposite points A and B. [**Ans.** R/4]


12. In a potentiometer arrangement, a cell of emf 1.25V gives a balance point at 35 cm length of the wire. If the cell is replaced by another cell, then the balance point shifts to 63 cm. What is the emf of the second cell? [**Ans.** 2.25V]

13. In a meter bridge, the balance point is found to be 39.5 cm from end A. The known resistance Y is 12.5Ω. Determine unknown resistance X. [**Ans.** 8.16Ω]




14. A meterbridge is in balance condition. Now if galvanometer and cell are interchanged, the galvanometer shows no deflection. Give reason.

    [**Ans.** Galvanometer will show no deflection. Proportionality of the arms are retained as the galvanometer and cell are interchanged.]

15. If the emf of the driving cell be decreased. What will be effect on the position of zero deflection in a potentiometer.

16. Why should the area of cross section of the meter bridge wire be uniform? Explain.

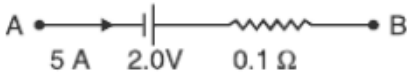
17. Given any two limitations of Ohm's law.

18. Which one of the two, an ammeter or a milliammeter has a higher resistance and why?

19. Name two factors on which the resistivity of a given material depends? A carbon resistor has a value of 62kΩ with a tolerance of 5%. Give the colour code for the resistor.

20. If the electron drift speed is so small (~$10^{-3}$ m/s) and the electron's charge is very small, how can we still obtain a large amount of current in a conductor

21. A battery of emf 2.0 volts and internal Resistance 0.1Ω is being charged with a current of 5.0A. Whatis the potential difference between the terminals of the battery?




22. Why should the jockey be not rubbed against potentiometer wire?

23. What is meant by the sensitivity of a potentiometer of any given length?

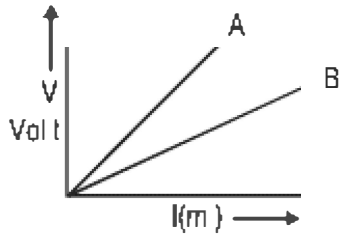
## SHORT ANSWER QUESTIONS (3 Marks)

1. Define specific resistance. Write its SI unit. Derive an expression for resistivity of a wire in terms of its material's parameters, number density of free electrons and relaxation time.

2. A potential difference V is applied across a conductor of length L and diameter D. How are the electric field E and the resistance R of the conductor affected when (i) V is halved (ii) L is halved (iii) D is doubled. Justify your answer.

*3. Define drift velocity. A conductor of length L is connected to a dc source of emf E. If the length of conductor is tripled by stretching it, keeping E constant, explain how do the following factors would vary in the conductor? (i) Drift speed of electrons (ii) Resistance and (iii) Resistivity.

4. Define potential gradient. How can potential gradient of a potentiometer be determined experimentally. In the graph shown here, a plot of potential drop versus length of the potentiometer is made for two potentiometers. Which is more sensitive –A or B?

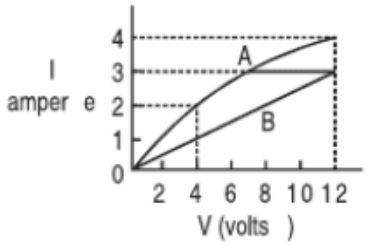



*5. Define conductivity of a substance. Give its SI units. How does it vary with temperature for (i) Copper (ii) Silicon?

*6. State the principle of potentiometer. Drawa circuit diagram used to compare the emf of two primary cells. Write the formula used.

7. The graph shows how the current I varies with applied potential difference V across a 12 V filament lamp (A) and across one metre long nichrome wire (B). Using the graph, find the ratio of the values of the resistance of filament lamp to the nichrome wire

   (i) when potential difference across them is 12 V.




(ii) when potential difference across them is 4V Give reason for the change in ratio of resistances in (i) and (ii).

8. Electron drift speed is estimated to be only a few mm/s for currents in the range of few amperes? How then is current established almost the instant a circuit is closed.

9. Give three points of difference between e.m.f and terminal potential difference of a cell.

10. Define the terms resistivity and conductivity and state their S.I. units. Draw a graph showing the variation of resistivity with temperature for a typical semiconductor.

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

12. Nichrome and copper wires of same length and area of cross section are connected in series, current is passed through them why does the nichrome wire get heated first?

13. Under what conditions is the heat produced in an electric circuit:

(i) directly proportional

(ii) inversely proportional to the resistance of the circuit

## LONG ANSWER QUESTIONS (5 Marks)

1. 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 in the laboratory? State the formula used.

2. Define emf and terminal potential difference of a cell. When is the terminal charging potertial difference greaterthan emf? Explainhow emf and terminal

potential difference can be compared using a potentiometer and hence determine internal resistance of the cell.

3. For three cells of emf $E_1$, $E_2$ and $E_3$ with internal resistances $r_1$, $r_2$, $r_3$ respectively connected in parallel, obtain an expression for net internal resistance and effective current. What would be the maximum current possible if the emf of each cell is E and internal resistance is $r$ each?

4. Derive an expression for drift velocity of the electron in conductor. Hence deduce ohm's law.

5. State the principle of potentiometer. How can it be used to :

   (i) Compare e.m.f of two cells

   (ii) Measure internal resistance of a cell?

6. Explain how does the conductivity of a :

   (i) Metallic conductor

   (ii) Semi conductor and

   (iii) Insulator varies with the rise of temperature.

7. Derive expression for equivalent e.m.f and equivalent resistance of a :

   (a) Series combination

   (b) Parallel combination

   of three cells with e.m.f $E_1$, $E_2$, $E_3$ & internal resistances $r_1$, $r_2$, $r_3$ respectively

8. Deduce the condition for balance in a Wheatstone bridge. Using the principle of Wheatstone bridge, describe the method to determine the specific resistance of a wire in the laboratory. Draw the circuit diagram and write the formula used. Write any two important precautions you would observe while performing the experiment.