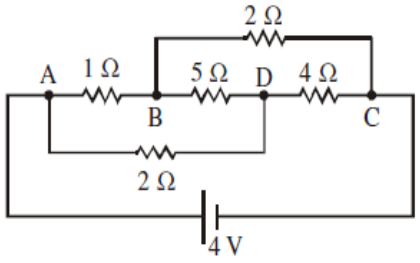
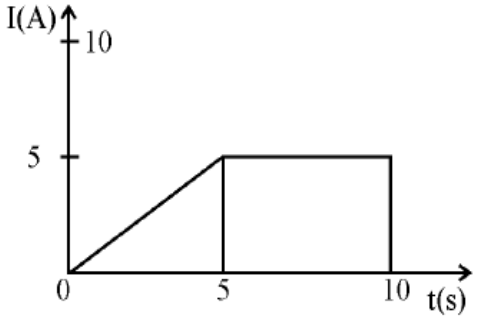
CURRENT ELECTRICITY

1 Calculate the current drawn from the battery by the network of resistors shown in the figure.




2 (a) Deduce the relation between current I flowing through a conductor and drift velocity $\overrightarrow{v_d}$ of the electrons.

(b) Figure shows a plot of current 'I' flowing through the cross-section of a wire versus the time 't'. Use the plot to find the charge flowing in 10s through the wire.

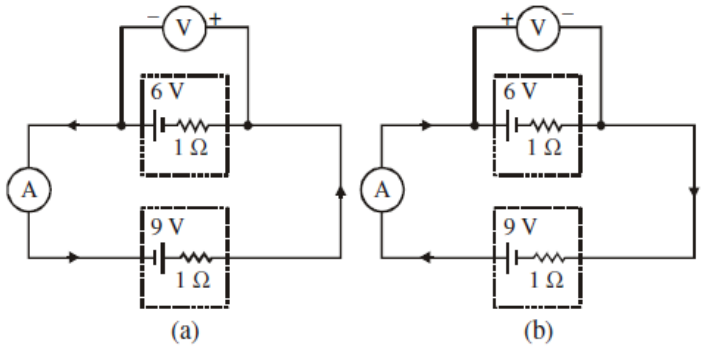



3 Draw a circuit diagram of a potentiometer. State its working principle. Derive the necessary formula to describe how it is used to compare the emfs of the two cells.

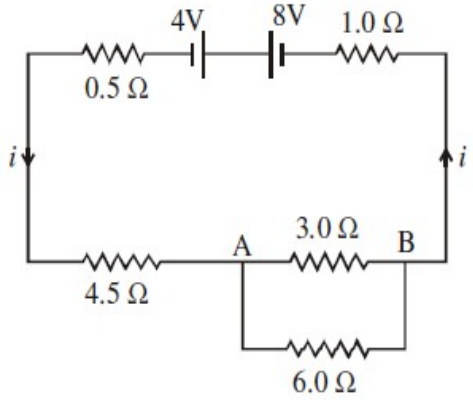
4 With the help of the circuit diagram, explain the working principle of meter bridge. How is it used to determine the unknown resistance of a given wire ? Write the necessary precautions to minimize the error in the result.

5 Using the concept of drift velocity of charge carriers in a conductor, deduce the relationship between current density and resistivity of the conductor.

6 In the two electric circuits shown in the figure, determine the readings of ideal ammeter (A) and the ideal voltmeter (V).




7 In the circuit shown in the figure, find the current through each resistor.

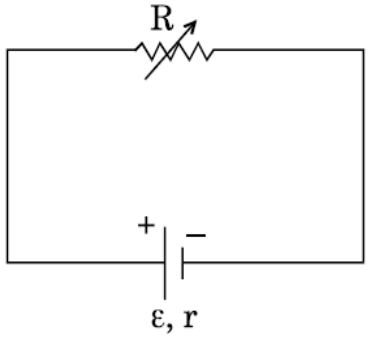



8 A cell of emf 'E' and internal resistance 'r' is connected across a variable load resistor R. Draw the plots of the terminal voltage V versus (i) R and (ii) the current I.

It is found that when R = 4 Ω, the current is 1 A and when R is increased to 9 Ω, the current reduces to 0.5 A. Find the values of the emf E and internal resistance r.

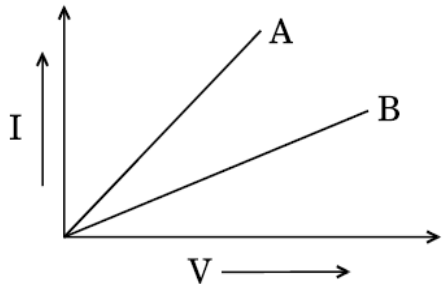
9 Use Kirchhoff's rules to obtain conditions for the balance condition in a Wheatstone bridge.

10 A variable resistor R is connected across a cell of emf ε and internal resistance r as shown in the figure. Draw a plot showing the variation of (i) terminal voltage V and (ii) the current I, as a function of R.




11 A potential difference V is applied across a conductor of length L and diameter D. How is the drift velocity, $v_d$, of charge carriers in the conductor affected when (i) V is halved, (ii) L is doubled and (iii) D is halved ? Justify your answer in each case.

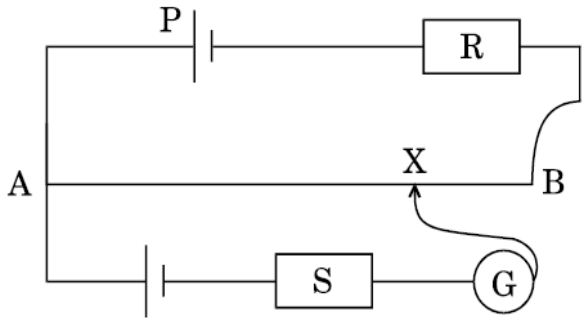
12 Two metallic resistors are connected first in series and then in parallel across a d.c. supply. Plot of I – V graph is shown for the two cases. Which one represents a parallel combination of the resistors and why ?



13 In the potentiometer circuit shown, the null point is at X. State with reason, where the balance point will be shifted when

(a) resistance R is increased, keeping all other parameters unchanged;

(b) resistance S is increased, keeping R constant.

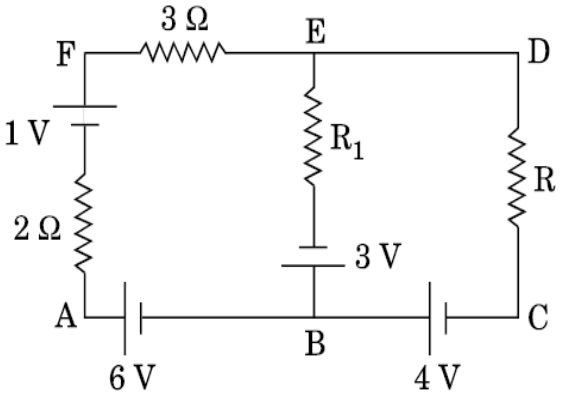



14 Define the electric resistivity of a conductor.

Plot a graph showing the variation of resistivity with temperature in the case of a (a) conductor, (b) semiconductor.

Briefly explain, how the difference in the behaviour of the two can be explained in terms of number density of charge carriers and relaxation time.

15 Use Kirchhoff's rules to determine the potential difference between the points A and D when no current flows in the arm BE of the electric network shown in the figure.



16 Find the relation between drift velocity and relaxation time of charge carriers in a conductor.

A conductor of length L is connected to a d.c. source of emf 'E'. If the length of the conductor is tripled by stretching it, keeping 'E' constant, explain how its drift velocity would be affected.