CLASS XII
Current Electricity

Section A Conceptual and Application Type Questions

| S.No.	Question	Mark/Year
1	Two wires of equal length, one of copper and the other of manganin have the same resistance. Which wire is thicker?	1/2012
2	A wire of resistance 8R is bent in the form of a circle. What is the effective resistance between the ends of a diameter AB?	1/2010
3	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?	1/2012
4	Two identical slabs, of a given metal, are joined together, in two different ways, as shown in figures (a) and (b). What is the ratio of the resistances of these two combinations?	1/2010
5	A cylindrical metallic wire is stretched to increase its length by 5%. Calculate the percentage change in its resistance.	2/2007
6	A steady current flows in a metallic conductor of non-uniform cross-section. Which of these quantities is constant along the conductor: current, current density, electric field, drift speed?	1/2009
7	A low voltage supply from which one needs high currents must have very low internal resistance. Why?	1
8	A high tension (HT) supply of, say, 6 kV must have a very large internal resistance. Why?	1
9	The electron drift speed is estimated to be only a few mm s^{-1} for currents in the range of a few amperes? How then is current established almost the instant a circuit is closed?	1
10	Two conducting wires X and Y of same diameter but different materials are joined in series across a battery. If the number density of electrons in X is twice that in Y, find the ratio of drift velocity of electrons in the two wires?	2/2010
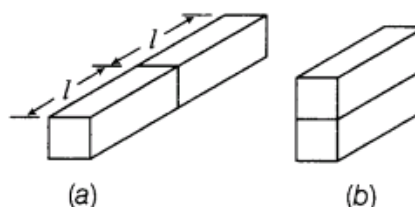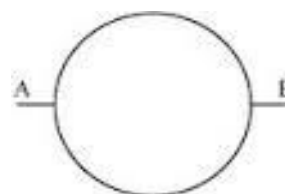
| 11 | In an experiment on metre bridge, if the balancing length AJ is 'l', what would be its value, when the radius of the metre bridge wire AB is doubled? Justify your answer. | 2/2011 |

| 12 | The sequence of coloured bands in two carbon resistors R_1 and R_2 is (i) brown, green, blue and (ii) orange, black, green. Find the ratio of their resistances. | 2/2010 |

| 13 | The emf of a cell is always greater than its terminal voltage. Why? | 1/2013 |

| 14 | A (i) series (ii) parallel combination of two given resistors is connected, one-by-one, across a cell. In which case will the terminal potential difference, across the cell, have a higher value? | 2/2008 |

| 15 | V- I graph for a metallic wire at two different temperatures T_1 and T_2 is shown in the figure. Which of the two temperatures is higher and why? | 1 |

| 16 | A cell of emf E and internal reistance r is connected across a variable resistor R. Plot a graph showing the variation of terminal potential difference V with resistance R. Predict from the graph the condition under which V becomes equal of E. Also plot a graph showing the variation of ε with R. | 3/2009 |

| 17 | A heating element is marked 210V, 630W. What is the value of the current drawn by the element when connected to a 210 V DC source? | 2/2013 |

| 18 | Two bulbs of same wattage, one having a carbon filament and the other having a metallic filament, are connected in series to the mains. Which one will glow more? | 1 |

| 19 | Of the bulbs in a house, one glows brighter than the other. Which of the two has a large resistance? | 1 |

| 20 | Two electric bulbs of 50W and 100W are given. When they are (i) connected in series (ii) connected in parallel, which bulb will glow more? | 2 |

| 21 | A cell of emf 'E' and internal resistance 'r' is connected across a variable resistor 'R'. Plot a graph showing variation of terminal voltage 'V' of the cell versus the current 'I'. Using the plot, show how the emf of the cell and its internal resistance can be determined. | 2/2014 |

| 22 | A conductor of length 'l' is connected to a dc source of potential 'V'. If the length of the conductor is tripled by gradually stretching it, keeping 'V' constant, how will (i) drift speed of electrons and (ii) resistance of the conductor be affected? Justify your answer. | 2/2015 |

| 23	Two materials Si and Cu, are cooled from 300 K to 60 K. What will be the effect on their resistivity?	1/2013
24	Plot a graph showing the variation of resistance of a conducting wire as a function of its radius, keeping the length of the wire and its temperature as constant.	1/2013
25	Two metallic wire of same material have the same length but cross sectional area in the ratio 1:2. They are connected (i) in series and (ii) in parallel. Compare the drift velocities of electrons in the two wires in both cases.	3/2008
26	A potential difference V is applied to a conductor of length L, diameter D. How are the electric field E, drift velocity v and resistance R are affected when (i) V is doubled, (ii) L is doubled, (iii) D is doubled.	3
27	Answer the following: (i) Why are the connections between resistors in a meter bridge made of thick copper strips? (ii) Why is it generally preferred to obtain the balance point near the middle of the bridge wire in meter bridge experiments? (iii) Which material is used for the meter bridge wire and why?	3/2013
28	A cell of emf (ε) and internal resistance (r) is connected across a variable external resistance (R) Plot graphs to show variation of (i) ε with R, and (ii) terminal potential difference of the cell (V) with R.	

Section B Numerical Problems

1	Given the resistances of 1 Ω, 2 Ω, 3 Ω, how will be combine them to get an equivalent resistance of (i) (11/3) Ω (ii) (11/5) Ω, (iii) 6 Ω, (iv) (6/11) Ω?	3/2015
2	(a) Six lead-acid type of secondary cells each of emf 2.0 V and internal resistance 0.015 Ω are joined in series to provide a supply to a resistance of 8.5 Ω. What are the current drawn from the supply and its terminal voltage? (b) A secondary cell after long use has an emf of 1.9 V and a large internal resistance of 380 Ω. What maximum current can be drawn from the cell? Could the cell drive the starting motor of a car?	3
3	Two wires of equal length, one of aluminium and the other of copper have the same resistance. Which of the two wires is lighter? Hence explain why aluminium wires are preferred for overhead power cables. (ρ_{Al} = 2.63 × 10–8 Ω m, ρ_{Cu} = 1.72 × 10–8 Ω m, Relative density of Al = 2.7, of Cu = 8.9.)	3
4	At room temperature (27.0 °C) the resistance of a heating element is 100 Ω. What is the temperature of the element if the resistance is found to be 117 Ω, given that the temperature coefficient of the material of the resistor is 1.70×10^{-4} °C^{-1}.	2

5   (a) In a metre bridge, the balance point is found to be at 39.5 cm from the end A, when the resistor Y is of 12.5 Ω. Determine the resistance of X. Why are the connections between resistors in a Wheatstone or meter bridge made of thick copper strips?
(b) Determine the balance point of the bridge above if X and Y are interchanged.
(c) What happens if the galvanometer and cell are interchanged at the balance point of the bridge? Would the galvanometer show any current?
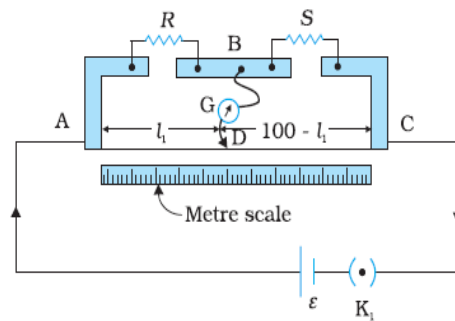
3/2011

6   Two students 'X' and 'Y' perform an experiment on potentiometer separately using the circuit given: Keeping other parameters unchanged, how will the position of the null point be affected it (*i*) 'X' increases the value of resistance R in the set-up by keeping the key K_1 closed and the key K_2 open? (*ii*) 'Y' decreases the value of resistance S in the set-up, while the key K_2 remain open and the key K_1 closed? Justify. (foreign2015)
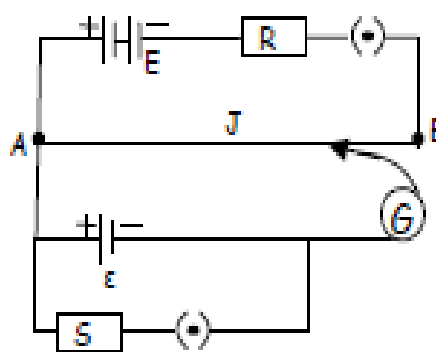
2/2012

7   Calculate the value of the current drawn from a 5 V battery in the circuit as shown.
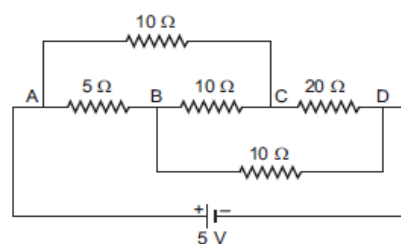
2

8   In the figure a long uniform potentiometer wire AB is having a constant potential gradient along its length. The null points for the two primary cells of emfs ε_1 and ε_2 connected in the manner shown are obtained at a distance of 120 cm and 300 cm from the end A. Find (*i*) $\varepsilon_1/\varepsilon_2$ and (*ii*) position of null point for the cell ε_1.
How is the sensitivity of a potentiometer increased?
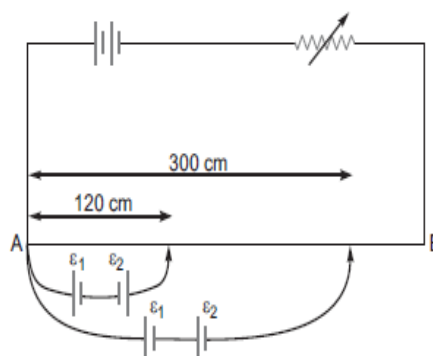
3/2012

9   A cell of emf E and internal resistance r is connected to two external resistances R_1 and R_2 and a perfect ammeter. The current in the circuit is measured in four different situations:
(*i*) without any external resistance in the circuit.
(*ii*) with resistance R_1 only
(*iii*) with R_1 and R_2 in series combination
(*iv*) with R_1 and R_2 in parallel combination.
The currents measured in the four cases are 0.42 A, 1.05 A, 1.4 A and 4.2 A, but not necessarily in that order. Identify the currents corresponding to the four cases mentioned above.

3/2012

10 A straight line plot showing the terminal potential difference (V) of a cell as a function of current (I) drawn from it is shown in the figure. Using this plot, determine (i) the emf and (ii) internal resistance of the cell.   3/2011
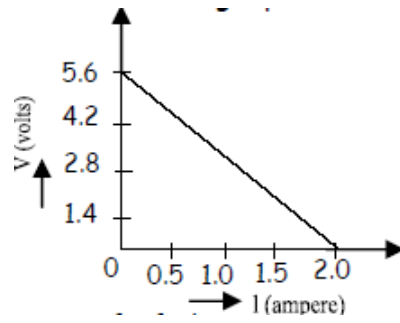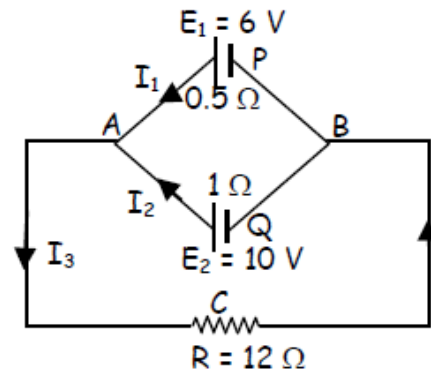

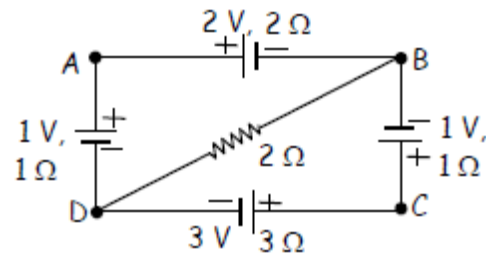11 Using Kirchoff's rule, find the currents I_1, I_2 and I_3.   3
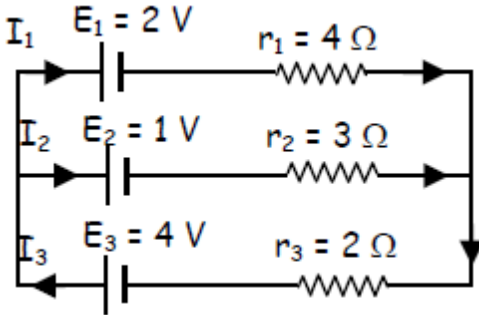
12 State Kirchhoff's rules. Apply Kirchhoff's rules to the loops ACBPA and ACBQA to write the expressions for the currents I_1, I_2 and I_3. in the network.

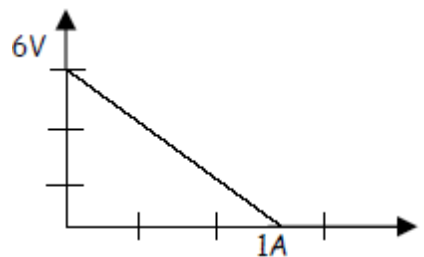13 For the circuit shown here, calculate the potential difference between the points B and D.   2


14 The plot of the variation of potential difference across a combination of three identical cells in series versus current is as shown below. What is the emf of each cell?   1/2008
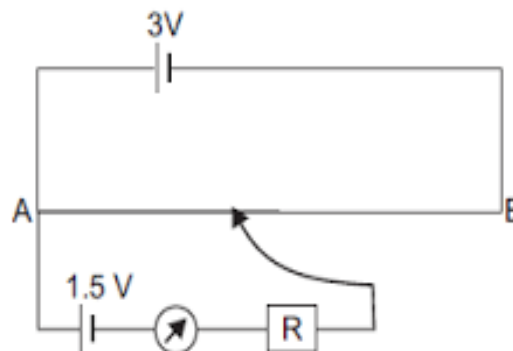

15 In the circuit of fig. a metre bridge is shown in its balanced state. The metre bridge wire has a resistance of 1 ohm/cm. Calculate the value of the unknown resistance X and the current drawn from the battery of negligible internal resistance.
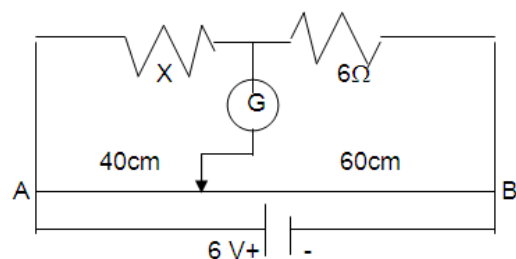
16   Find the value of the unknown resistance X in the circuit of fig. if no current flows through the section AO. Also calculate the current drawn by the circuit from the battery of emf 6 V and negligible internal resistance.
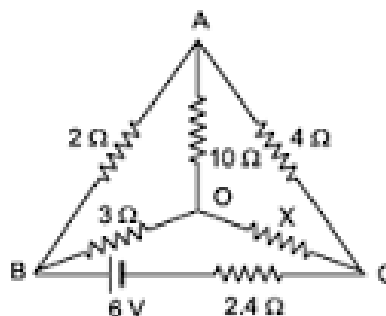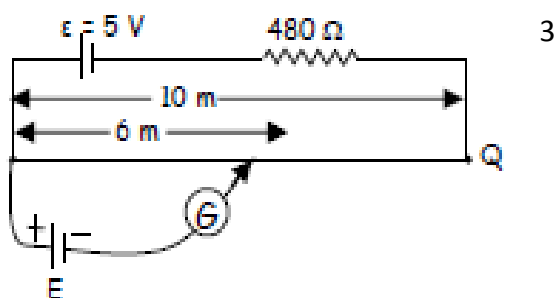
17   A potentiometer wire of length 1 m is connected to a driver cell of emf 3 V as shown in the figure. When a cell of 1.5 V emf is used in the secondary circuit, the balance point is found to be 60 cm. On replacing this cell and using a cell of unknown emf, the balance point shifts to 80 cm.
(i) Calculate unknown emf of the cell.
(ii) Explain with reason, whether the circuit works, if the driver cell is replaced with a cell of emf 1 V.
(iii) Does the high resistance R, used in the secondary circuit affect the balance point? Justify your answer

18   A 10 m long wire of uniform cross-section and 20 Ω resistance is used in a potentiometer. The wire is connected in series with a battery of 5 V along with an external resistance of 480 Ω. If an unknown emf E is balanced at 6.0 m length of the wire calculate
(i) the potential gradient of the potentiometer wire, (ii) the value of unknown emf.   3

19   Potentiometer wire PQ of 1 m length is connected to a standard cell E_1. Another cell E2 of emf 1.02 V is connected as shown in the circuit diagram with a resistance 'r' and switch S. With switch S open, null position is obtained at a distance of 51 cm from P. Calculate (i) potential gradient of the potentiometer wire and (ii) emf of the cell E_1. (iii) When switch S is closed, will null point towards P or towards O? Give reason for your answer.   3
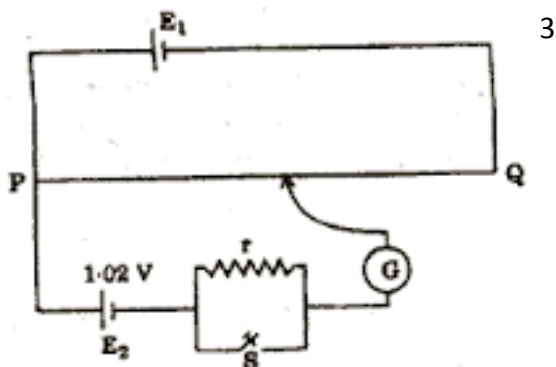
20   For the potentiometer circuit shown in the given figure, points X and Y represent the two terminals of an unknown emf ε. A student observed that when the jockey is moved from the end A to the end B of the potentiometer wire, the direction of the deflection in the galvanometer remains in the same direction. What may be the two possible faults in the circuit that could result in this observations? If   3
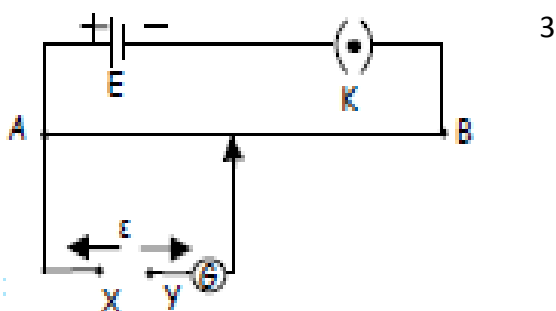
the galvanometer deflection at the end B is (i) more, (ii) less, than that at the end A which of the two faults, listed above, would be there in the circuit? Give reasons in support of your answer in each case.

21   The storage battery of a car has an emf of 12 V. If the internal resistance of the battery is 0.4 Ω, what is the maximum current that can be drawn from the battery?   1

22   A battery of emf 10 V and internal resistance 3 Ω is connected to a resistor. If the current in the circuit is 0.5 A, what is the resistance of the resistor? What is the terminal voltage of the battery when the circuit is closed?   2