CLASS XII – PHYSICS (042)
PRACTICE PAPER – CHAPTER 3: CURRENT ELECTRICITY

Academic Session 2026–27

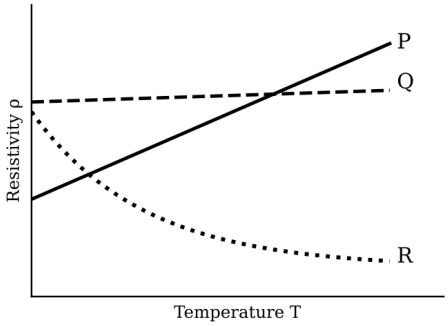
Maximum Marks : 35 **Time Allowed : 1 hour 15 minutes**

General Instructions

(1) There are 18 questions in all. All questions are compulsory.
(2) The question paper has five sections: Section A, B, C, D and E.
(3) Section A (Q.1–9) has seven MCQs and two Assertion–Reasoning questions of 1 mark each. Section B (Q.10–13) has four questions of 2 marks each. Section C (Q.14–16) has three questions of 3 marks each. Section D (Q.17) is one case study based question of 4 marks. Section E (Q.18) is one long answer question of 5 marks.
(4) There is no overall choice. An internal choice is provided in Q.12 (Section B), Q.15 (Section C), Q.17 part (iv) (Section D) and Q.18 (Section E). Attempt only one of the choices in such questions.
(5) Use of calculators is not allowed.
(6) You may use the following values of physical constants wherever necessary: $e = 1.6 \times 10^{-19}$ C, $m_e = 9.1 \times 10^{-31}$ kg.

SECTION A (9 × 1 = 9)

1. The figure shows how the resistivity of three materials P, Q and R varies with temperature. Which of the following correctly identifies a semiconductor and an alloy suitable for making standard resistors? **1**



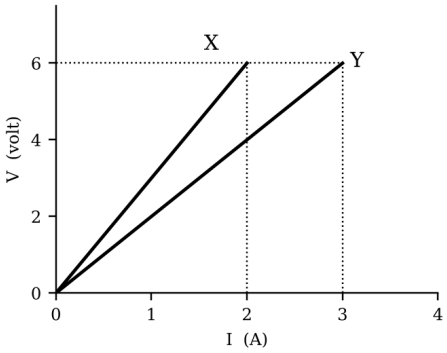
(a) semiconductor: P; standard resistor: Q
(b) semiconductor: R; standard resistor: Q
(c) semiconductor: R; standard resistor: P
(d) semiconductor: Q; standard resistor: R

2. The table gives the dimensions of four wires made of the same material and kept at the same temperature. The wire having the maximum resistance is **1**

Wire	P	Q	R	S
Length (m)	1.0	2.0	1.5	3.0
Diameter (mm)	1.0	2.0	1.0	2.0

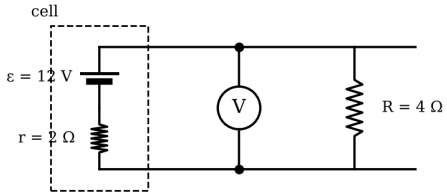
(a) P
(b) Q
(c) R
(d) S

3. The V–I graphs for two wires X and Y of the same material and the same length are shown. The ratio of the cross-sectional area of X to that of Y is **1**



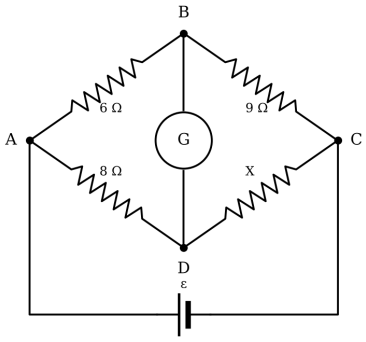
(a) 3 : 2
(b) 2 : 3
(c) 9 : 4
(d) 4 : 9

4. A cell of emf 12 V and internal resistance 2 Ω is connected to an external resistor of 4 Ω, as shown. The reading of the ideal voltmeter is **1**



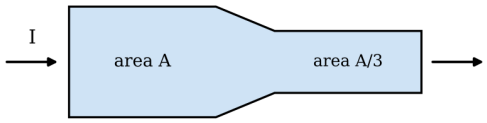
(a) 12 V
(b) 10 V
(c) 8 V
(d) 6 V

5. The Wheatstone bridge shown is balanced (the galvanometer G shows no deflection). The value of the unknown resistance X is **1**



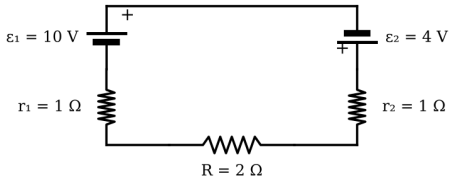
(a) 4.5 Ω
(b) 5.3 Ω
(c) 10 Ω
(d) 12 Ω

6. A steady current I flows through a conductor whose cross-section reduces from A to A/3, as shown. The ratio of the drift speed of electrons in the narrow part to that in the wide part is **1**



(a) 1 : 3
(b) 1 : 1
(c) 3 : 1
(d) 9 : 1

7. Two cells are connected in series opposition with an external resistor, as shown. The current in the circuit is **1**



(a) 2 A
(b) 1.5 A
(c) 3.5 A
(d) 1 A

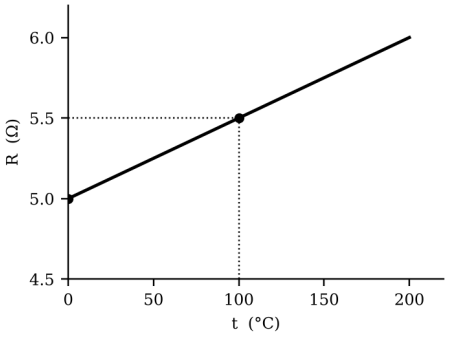
For Questions 8 and 9, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct answer from the options below.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

8. **Assertion (A):** The drift speed of electrons in a copper wire is only of the order of a fraction of a millimetre per second, yet a lamp glows almost the instant the switch is closed. **1**
Reason (R): The electric field is established throughout the circuit almost instantly, so electrons everywhere start drifting together.

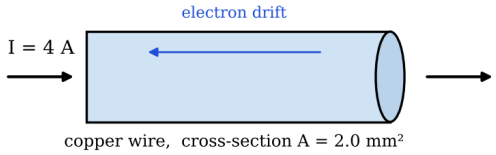
9. **Assertion (A):** Electric current is a scalar quantity even though it is represented by an arrow. **1**
Reason (R): Electric currents obey the law of vector addition.

SECTION B (4 × 2 = 8)

10. The graph shows the variation of the resistance of a metallic wire with temperature. Find the temperature coefficient of resistance of the metal and the temperature at which its resistance becomes 5.85 Ω. **2**



11. A copper wire carries a current of 4 A, as shown. The number density of free electrons in copper is 8.5×10^{28} m^{-3}. Find (i) the current density in the wire, (ii) the drift speed of the electrons. **2**

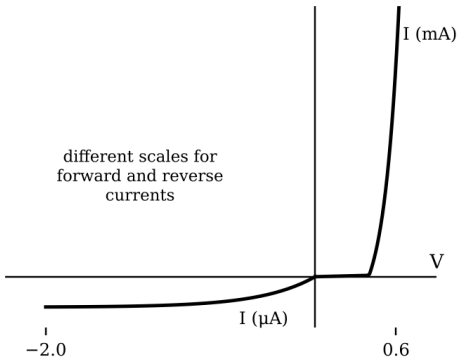


12. **(A)** When a cell delivers a current of 1.0 A, the potential difference across its terminals is 2.4 V; when it delivers 2.0 A, the potential difference is 2.0 V. Find the emf and the internal resistance of the cell. **2**

OR

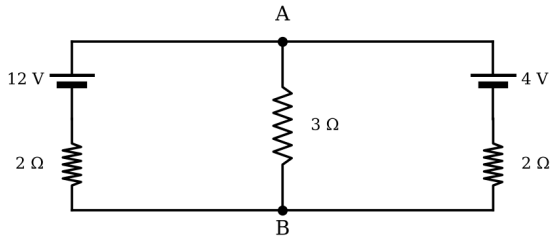
(B) A wire of resistance 8 Ω is stretched uniformly to three times its original length. Find its new resistance. State the assumption you made.

13. The figure shows the current–voltage characteristic of a certain electronic device. (i) Does the device obey Ohm's law? (ii) Give two features of the graph that support your answer. **2**



SECTION C (3 × 3 = 9)

14. Two cells of emf 12 V and 4 V (negligible internal resistance) and three resistors are connected as shown. Using Kirchhoff's rules, find the current in each branch and state its direction. **3**

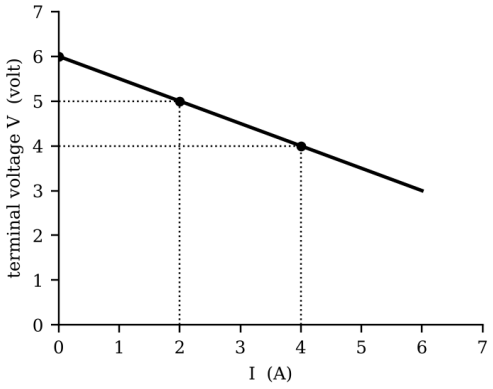


15. **(A)** Define drift velocity. Derive an expression for it in terms of the electric field and the relaxation time of the electrons. Hence obtain an expression for the resistivity of the conductor. **3**

OR

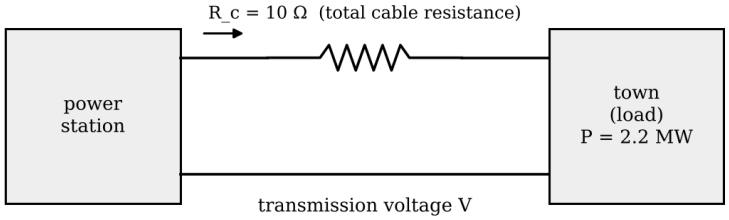
(B) Two cells of emf ε_1 and ε_2 and internal resistances r_1 and r_2 are connected in parallel (positive terminals joined together). Derive the emf and the internal resistance of the equivalent single cell.

16. The graph shows how the potential difference across the terminals of a cell varies with the current drawn from it. Use the graph to find (a) the emf and the internal resistance of the cell, and (b) the maximum current that can be drawn from the cell. **3**



SECTION D (1 × 4 = 4)

17. **Case Study.** Electrical power from a power station is sent to a town through long cables. The total resistance of the cables is $R_c = 10\ \Omega$ and the town needs a power of P = 2.2 MW. The power can be sent at different transmission voltages. Because the power wasted in the cables is I^2R_c, power companies prefer to transmit at very high voltage and then use transformers to step it down near the town. Answer the following: **4**



(i) The current in the cables when the power is transmitted at 11 kV is
(a) 0.2 A (b) 20 A (c) 200 A (d) 2000 A

(ii) The power wasted in the cables at 11 kV is
(a) 40 kW (b) 4 kW (c) 4000 kW (d) 400 kW

(iii) The power wasted in the cables at 220 kV is
(a) 1 kW (b) 10 kW (c) 100 W (d) 20 kW

(iv) If the transmission voltage is doubled for the same power, the power loss becomes
(a) half (b) one-fourth (c) two times (d) four times

OR

(iv) If the same power were sent at the same voltage through a cable of the same material and length but half the diameter, the power loss would become
(a) half (b) one-fourth (c) two times (d) four times

SECTION E (1 × 5 = 5)

18. **(A)** Draw the circuit of a Wheatstone bridge. Using Kirchhoff's rules, derive the condition for the bridge to be balanced. (3) **5**
In a Wheatstone bridge ABCD the arms have resistances AB = 12 Ω, BC = 18 Ω and AD = 20 Ω. A galvanometer is connected between B and D and a 10 V battery of negligible internal resistance between A and C. Find the resistance of the arm DC for which the galvanometer shows no deflection, and the total current drawn from the battery in that case. (2)

OR

(B) Two cells of emf ε_1 and ε_2 and internal resistances r_1 and r_2 are connected in series. Derive the emf and internal resistance of the equivalent cell. (3)
Three identical cells, each of emf 2 V and internal resistance 0.5 Ω, are connected in series with an external resistor of 2.5 Ω. Find the current in the circuit and the potential difference across the external resistor. (2)

— End of Question Paper —