Class 12 Physics · Chapter 3: Current Electricity

Worksheet · 20 marks · about 40 minutes · based on NCERT

Name _____ Class and section _____ Date _____

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1. The SI unit of resistivity is [1]

(a) S m^{-1} (b) Ω m^{-1}

(c) Ω m^{-2} (d) Ω m

2. A heater is rated 1.0 kW at 220 V. Assuming its resistance does not change, the power it draws when connected to a 110 V supply is [1]

(a) 125 W (b) 500 W

(c) 1000 W (d) 250 W

3. A steady current of 2.0 A flows through a wire of uniform cross-section 0.50 mm^2. The magnitude of the current density in the wire is [1]

(a) 8.0×10^6 A m^{-2} (b) 1.0×10^6 A m^{-2}

(c) 0.25×10^6 A m^{-2} (d) 4.0×10^6 A m^{-2}

4. In a conductor placed in a uniform electric field of 0.60 V m^{-1}, the charge carriers drift at 0.30 mm s^{-1}. [1] Their mobility is

(a) 500 cm^2 V^{-1} s^{-1} (b) 0.050 cm^2 V^{-1} s^{-1}

(c) 5.0 cm^2 V^{-1} s^{-1} (d) 0.20 cm^2 V^{-1} s^{-1}

5. A steady potential difference is maintained across a metal wire. The drift velocity of its free electrons is [1]

(a) along the field, and increases steadily with time (b) opposite to the field, and constant in time

(c) opposite to the field, and equal to the electrons' thermal speed (d) zero, since the random velocities of the electrons average to zero

6. Ohm's law is not a fundamental law of nature. State two different ways in which a device can depart from it, naming a device or material for each. [2]

7. State the condition for balance of a Wheatstone bridge with arms P, Q, R and S. Why does the balance point not depend on the resistance of the galvanometer? [2]

8. A copper wire (resistivity 1.7×10^{-8} Ω m) carries a current density of 2.0×10^6 A m^{-2}. Find the electric field inside the wire and state its direction relative to the current density. [2]

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9. Three identical cells, each of emf 2.0 V and internal resistance 0.60 Ω, are joined in parallel across a 1.8 Ω resistor. (a) Find the emf and internal resistance of the equivalent cell. (b) Find the current in the resistor and in each cell. (c) Find the current in the resistor if the three cells are instead joined in series. [3]

10. A coil of metal X (temperature coefficient of resistivity $5.0 \times 10^{-3}\ °C^{-1}$, referred to 20 °C) and a manganin coil Y each have a resistance of 10.0 Ω at 20 °C. Treat the resistance of Y as constant and ignore changes in dimensions. (a) At what temperature is the resistance of X 1.5 times that of Y? (b) What is the resistance of X and Y in parallel at that temperature? [3]

11. Electrons in a conductor of cross-section A, with n free electrons per unit volume and relaxation time τ, are in a uniform field E. Starting from the drift velocity, show that the conductivity is $\sigma = ne^2\tau/m$. [3]

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