

CURRENT ELECTRICITY

1. 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 ?
2. 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?
3. 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?
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4. A low voltage supply from which one needs high currents must have very low internal resistance. Why?
5. 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?
6. 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 affected when (i) V is doubled, (ii) L is doubled, (iii) D is doubled.
7. At room temperature ($27.0\text{ }^\circ\text{C}$) the resistance of a heating element is $100\ \Omega$. What is the temperature of the element if the resistance is found to be $117\ \Omega$, given that the temperature coefficient of the material of the resistor is $1.70 \times 10^{-4}\text{ }^\circ\text{C}^{-1}$
8. 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.
9. The storage battery of a car has an emf of 12 V. If the internal resistance of the battery is $0.4\ \Omega$, what is the maximum current that can be drawn from the battery?
10. A battery of emf 10 V and internal resistance $3\ \Omega$ 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?