Q. 03

(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?

Answer

(a) Number of secondary cells, $n = 6$

Emf of each secondary cell, $E = 2.0$ V

Internal resistance of each cell, $r = 0.015\ \Omega$

series resistor is connected to the combination of cells.

Resistance of the resistor, $R = 8.5\ \Omega$

Current drawn from the supply $= I$, which is given by the relation,

$$I = \frac{nE}{R + nr}$$

$$= \frac{6 \times 2}{8.5 + 6 \times 0.015}$$

$$= \frac{12}{8.59} = 1.39 \text{ A}$$

Terminal voltage, $V = IR = 1.39 \times 8.5 = 11.87$ A

Therefore, the current drawn from the supply is 1.39 A and terminal voltage is 11.87 A.

(b) After a long use, emf of the secondary cell, $E = 1.9$ V

Internal resistance of the cell, $r = 380\ \Omega$

Hence, maximum current $= \frac{E}{r} = \frac{1.9}{380} = 0.005$ A

Therefore, the maximum current drawn from the cell is 0.005 A. Since a large current is required to start the motor of a car, the cell cannot be used to start a motor.