Answer on question #61367, Physics / Electromagnetism

19) The half-life of a certain radioactive isotope is 32 hours. What fraction of the sample would remain after 16 huors?

a) 0.50
b) 0.25
c) 0.62
d) 0.71

Solution:

The law radioactive decay is

$$N = N_0 \cdot 2^{-\frac{t}{T}}$$

Here N is the quantity at time t, and N_0 is the initial quantity, i.e. the quantity at time t = 0, T is the half-life.

From here,

$$\frac{N}{N_0} = 2^{-\frac{t}{T}}$$

$$\frac{N}{N_0} = 2^{-\frac{16}{32}} = 2^{-\frac{1}{2}} = 0.71$$

Answer: d) 0.71

20) A potentiometer wire of length 100 cm has a resistance of 10Ω. It is connected in series to a resistance R and a cell of emf 2V and negligible internal resistance. A source of emf of 10mV is balanced by a length of 40cm of the potentiometer wire. What is the value of the resistance R?

a) 200 Ω
b) 950 Ω
c) 2000 Ω
d) 790 Ω

Solution:

The current in the circuit

$$I = \frac{U}{R + r}$$

Now as the 100 cm wire has a resistance of 10 Ω, the resistance of 40 cm of wire will be 40 x (10/100) = 4 Ω.

Potential drop across 40 cm wire will be

$$V = 4I$$

$$I = \frac{2}{R + 10}$$

given V = 10 mv

$$10 \cdot 10^{-3} = 4 \cdot \frac{2}{R + 10}$$

$$R = 4 \cdot \frac{2}{10 \cdot 10^{-3}} - 10$$

$$R = 790\ \Omega$$

Answer: d) 790 Ω