Question. Calculate the time in minutes required to electroplate an article of $S = 300\ cm^2$ with a layer of copper $h = 0.06\ mm$ in thick if a constant current of $I = 24\ A$ is maintained. Assume that the density of a copper is $\rho = 8.8\ g/cm^3$ and that 1 coulomb liberates $\Delta m = 0.0033\ g$ of copper.

Given. $S = 300\ cm^2$; $h = 0.06\ mm$; $I = 24\ A$; $\rho = 8.8\ g/cm^3$; $\Delta m = 0.0033\ g/C$.

Find. $t-?$

Solution.

So, the volume of copper

$$V = S \cdot h.$$

$$\rho = \frac{m}{V} \quad \rightarrow \quad m = \rho \cdot V = \rho \cdot S \cdot h.$$

For a constant current

$$I = \frac{q}{t} \quad \rightarrow \quad q = I \cdot t.$$

Hence

$$\frac{m}{\Delta m} = q \quad \rightarrow \quad \frac{m}{\Delta m} = I \cdot t \quad \rightarrow \quad \frac{\rho \cdot S \cdot h}{\Delta m} = I \cdot t \quad \rightarrow$$

$$\rightarrow t = \frac{\rho \cdot S \cdot h}{\Delta m \cdot I} = \frac{8800 \cdot 300 \cdot 10^{-4} \cdot 0.06 \cdot 10^{-3}}{0.0033 \cdot 10^{-3} \cdot 24} = 200\ s$$

Answer. $t = 200\ s$.

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