PHYS 1304, HW #5 Solutions

P27.5 $q = 4t^3 + 5t + 6$

$$A = (2.00\ \text{cm}^2)\left(\frac{1.00\ \text{m}}{100\ \text{cm}}\right)^2 = 2.00 \times 10^{-4}\ \text{m}^2$$

(a) $$I(1.00\ \text{s}) = \left.\frac{dq}{dt}\right|_{t=1.00\ \text{s}} = \left.(12t^2 + 5)\right|_{t=1.00\ \text{s}} = \boxed{17.0\ \text{A}}$$

(b) $$J = \frac{I}{A} = \frac{17.0\ \text{A}}{2.00 \times 10^{-4}\ \text{m}^2} = \boxed{85.0\ \text{kA/m}^2}$$

P27.11 $R = \rho \frac{L}{A} = (5,6 \times 10^{-8})\ \frac{1,5}{0,6 \times 10^{-6}} = 14 \times 10^{-2} = 0,14\ \Omega$

$\Delta V = I.R \Rightarrow I = \frac{\Delta V}{R} = \frac{0,900}{0.14} \Rightarrow \boxed{I = 6,43\ A}$

P27.12 $I = \frac{\Delta V}{R} = \frac{120\ \text{V}}{240\ \Omega} = 0.500\ \text{A} = \boxed{500\ \text{mA}}$

P27.13 (a) Given $M = \rho_d V = \rho_d A \ell$ where ρ_d = mass density,

we obtain: $A = \frac{M}{\rho_d \ell}$. Taking ρ_r = resistivity, $R = \frac{\rho_r \ell}{A} = \frac{\rho_r \ell}{M/\rho_d \ell} = \frac{\rho_r \rho_d \ell^2}{M}$.

Thus, $\ell = \sqrt{\frac{MR}{\rho_r \rho_d}} = \sqrt{\frac{(1.00 \times 10^{-3})(0.500)}{(1.70 \times 10^{-8})(8.92 \times 10^3)}}$ $\ell = \boxed{1.82\ \text{m}}$.

(b) $V = \frac{M}{\rho_d}$, or $\pi r^2 \ell = \frac{M}{\rho_d}$.

Thus, $r = \sqrt{\frac{M}{\pi \rho_d \ell}} = \sqrt{\frac{1.00 \times 10^{-3}}{\pi (8.92 \times 10^3)(1.82)}}$ $r = 1.40 \times 10^{-4}\ \text{m}$.

The diameter is twice this distance: diameter = $\boxed{280\ \mu\text{m}}$.

P27.15 $J = \sigma E \Rightarrow \sigma = \frac{J}{E} = \frac{6 \times 10^{-13}}{100} \Rightarrow \boxed{\sigma = 6 \times 10^{-15}\ /\Omega.m}$

P27.23 $P = \Delta V . I \Rightarrow I = \frac{P}{\Delta V} = \frac{600}{120} \Rightarrow \boxed{I = 5A}$

$\Delta V = I.R \Rightarrow R = \frac{\Delta V}{I} = \frac{120}{5} \Rightarrow \boxed{R = 24\Omega}$

P27.27 $P = \frac{\Delta V^2}{R} \Rightarrow R = \frac{\Delta V^2}{P} = \frac{120^2}{100} = 144\Omega$

$P_{140} = \frac{140^2}{144} = 136,1\ W$ $\%P = \frac{136,1 - 100}{100} \Rightarrow$ **36,1 %**