Homework 6

topic: Current and Ohms Law

Giancoli Chapter 25:
Question 1
Problems 1, 8

Review Question:
Giancoli Chapter 21, Problem 11

This homework is due Friday Jul 16 by noon in the locker.

\[ Q_1 \quad I = \frac{dQ}{dt} \quad \frac{dQ}{dt} = I \Delta t = \Delta Q \]

\[ A \cdot h = \text{amount of charge available} \]

\[ P25-1 \quad I = \frac{\Delta Q}{\Delta t} \quad \Delta Q = \Delta t \cdot I \]

\[ 1e^- = 1.6 \times 10^{-19} C \]

\[ = (15)(1.30 A) \]

\[ = 1.95 C \]

\[ \# e^- = \frac{\Delta Q}{16 \times 10^{-9}} = 8.13 \times 10^{-18} \text{ electrons per second} \]

\[ P25-8 \quad \text{given} \quad I = 3100 A \]

\[ \frac{R}{I} = 2.5 \times 10^{-5} \frac{m}{l} \]

\[ R = \frac{R}{l} = 2.5 \times 10^{-5} \frac{m}{l} (0.04 m) \]

\[ V = IR \]

\[ = (3100 A)(2.5 \times 10^{-5} \frac{m}{l})(0.04 m) \]

\[ V = 3.1 \times 10^{-3} V \]
\[ Q_1 + Q_2 = Q_t \]
\[ Q_1 = Q_t - Q_2 \]

\[ F = k \frac{Q_1 Q_2}{r^2} = k \frac{(Q_t - Q_2)Q_2}{r^2} \]

a) Force maximum when \((Q_t - Q_2)Q_2 = Q_t Q_2 - Q_2^2\) is maximum.

I'm guessing \(Q_2 = \frac{Q_t}{2}\), but I can take derivatives re: equal to zero:

\[ Q_t - 2Q_2 = 0 \]
\[ Q_2 = \frac{Q_t}{2} \]
\[ Q_1 = \frac{Q_t}{2} \]

\[ Q_t - 2 \cdot \frac{Q_t}{2} = 0 \]
\[ Q_2 = \frac{Q_t}{2} \]
\[ Q_1 = \frac{Q_t}{2} \]

b) If \(Q_2 = 0\), \(Q_1 = Q_t\), \(F = 0\) (minimum)