

# ASSIGNMENT #3 (23K-0609)



## CURRENT & RESISTANCE

12

Suppose that the material composing a fuse melts once the current density rises to  $440 \text{ A/cm}^2$ . What diameter of cylinder wire should be used for the fuse to limit the current to  $0.552 \text{ A}$ ?

$$\Delta p = 440 \times 100 \times 100 \frac{\text{A}}{\text{cm}^2} = 4400000 \text{ A/m}^2$$

$$d = 2r = ? \quad \Delta I = 0.522 \text{ A}$$

$$\therefore \Delta p = \frac{\Delta I}{A}$$

$$A = \frac{\Delta I}{\Delta p}$$

$$A = 1.186 \times 10^{-7}$$

$$\therefore \pi r^2 = 1.186 \times 10^{-7}$$

$$r^2 = \frac{1.186 \times 10^{-7}}{\pi}$$

$$r = \sqrt{\frac{1.186 \times 10^{-7}}{\pi}}$$

$$r = 1.992 \times 10^{-4}$$

$$\therefore 2r = d$$

$$\therefore d = 3.985 \times 10^{-4} \text{ m}$$

Q#2

QUESTION #2

$$I = 115 \text{ A}$$

$$A = 31.2 \text{ mm}^2 = 3.12 \times 10^{-5} \text{ m}^2$$

$$t = ?$$

$$\text{length} = L = 85.5 \text{ cm} = 0.855 \text{ m}$$

$$n = 8.49 \times 10^{28} \text{ m}^{-3}$$

$$I = \frac{Q}{t}$$

$$\therefore Q = nALe$$

$$\therefore t = \frac{nALe}{I}$$

$$t = \frac{8.49 \times 10^{28} (3.12 \times 10^{-5}) (0.855) (1.6 \times 10^{-19})}{115}$$

$$t = 3.15 \times 10^3 \text{ sec}$$

QUESTION #3

$$\therefore R = \rho \cdot \frac{L}{A} \quad \& \quad C = \frac{A \epsilon_0}{d}$$

$$d = \frac{A \epsilon_0}{C}$$

$$d = \frac{A \times 8.85 \times 10^{-12}}{110 \times 10^{-12}}$$

$$d = 0.080 \text{ A}$$



$$R = \frac{9.4 \times 0.080 \text{ A}}{A}$$

$$\rightarrow R = 0.756 \Omega$$

### QUESTION #4

$$\therefore V = IR$$

$$R = V/I$$

$$R = 3.55 \text{ i}^2 / i$$

$$R = 3.55 \times 2.4 \times 10^{-3}$$

$$R = 8.52 \times 10^{-3} \Omega$$

Alc to condition:-  
 $R = 16 \Omega$

$$I = V/R$$

$$I = 3.55 \text{ i}^2 / 16$$

$$i = 3.55 \text{ i}^2 / 16$$

$$i = 16 / 3.55$$

$$i = 4.51 \text{ A}$$

### QUESTION #5

$$\therefore P = VI$$

$$I = \frac{P}{V}$$

$$I = 7.5 / 9$$

$$I = 0.83 \text{ A}$$

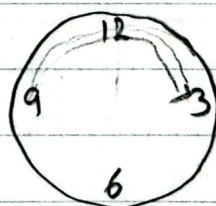
$$\therefore I = Q/t$$

$$\therefore Q = It$$

$$Q = 0.83 \times 21600$$

$$Q = 17928 \text{ C}$$

is the ~~total~~ charged passed through the wires.



→ 6 hours total.

$$t = 6 \text{ hours} \rightarrow$$

$$t = 6 \times 60 \times 60 = 21600 \text{ sec.}$$