

HW 5

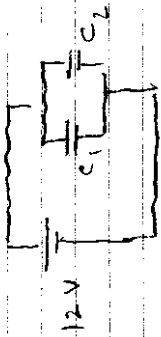
$$U = \frac{1}{2} \frac{Q^2}{C} = \frac{1}{2} C V^2$$

24-45

1 needs this

49 (as only

a)



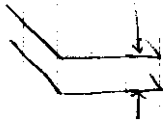
$$C_1 = 0.15 \mu F$$

$$C_2 = 0.20 \mu F$$

Parallel Plate Capacitor

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

Energy Stored



$$P. 620 \rightarrow U = \frac{1}{2} \frac{Q^2}{C}$$

$$= \frac{1}{2} Q^2 \frac{d}{\epsilon_0 A}$$

Work to change d to d'

$$\Delta W = \frac{1}{2} \frac{Q^2}{\epsilon_0 A} (d' - d)$$

$$= \frac{1}{2} \frac{Q^2}{\epsilon_0 A} \Delta d$$

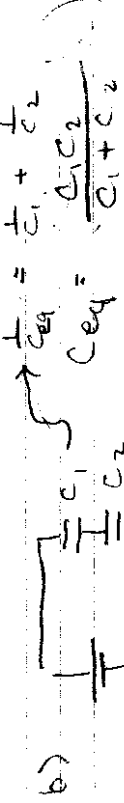
$$F = \frac{dW}{dx} = \frac{\Delta W}{\Delta d} = \frac{1}{2} \frac{Q^2}{\epsilon_0 A}$$

$$C_{eq} = C_1 + C_2 = 0.35 \mu F$$

$$U = \frac{1}{2} C_{eq} V^2$$

$$= \frac{1}{2} (0.35 \mu F) (12 V)^2$$

$$= 25.2 \times 10^{-6} J$$



$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C_{eq} = \frac{C_1 C_2}{C_1 + C_2}$$

$$= 8.6 \times 10^{-2} \mu F$$

$$U = \frac{1}{2} (8.6 \times 10^{-2} \mu F) (12 V)^2$$

$$= 6.2 \times 10^{-6} J$$

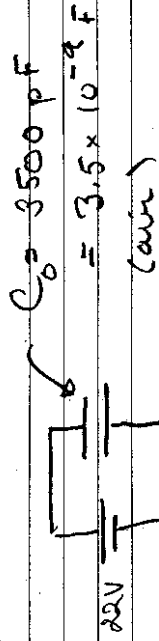
c) Get charges from

$$Q = C_{eq} V$$

$$= 4.2 \times 10^{-6} C \text{ (parallel)}$$

$$= 1.0 \times 10^{-6} C \text{ (series)}$$

24-53



$$Q_0 = C_0 V = 7.7 \times 10^{-7} \text{ C} = 0.77 \mu\text{C}$$

Replace air gap with mica

$$C = K C_0 \quad \text{p. 621}$$

$$\text{Mica: } K = 7 \quad \text{p. 622}$$

$$C = 2.45 \times 10^{-8} \text{ F}$$

$$Q = C V$$

$$= (22 \text{ V})(2.45 \times 10^{-8} \text{ F}) \quad \text{C/V}$$

$$= 53.9 \times 10^{-7} \text{ C}$$

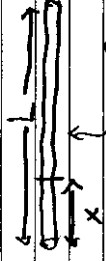
$$= 5.39 \mu\text{C}$$

$$\text{Change } Q - Q_0 = (5.39 - 0.77) \mu\text{C}$$

$$= 4.62 \mu\text{C flows}$$

into the capacitor

25-15



$$R = 10 \Omega$$

$$R_L = \rho \frac{L}{A} \quad \text{p. 640} \quad \text{wire pie}$$

cut into length

x and L-x

want

$$R_x = 5 R_{L-x}$$

$$\frac{\rho x}{A} = 5 \frac{\rho (L-x)}{A}$$

$$x = 5(L-x)$$

$$6x = 5L$$

$$x = \frac{5}{6} L$$

$$L-x = \frac{1}{6} L$$

The resistances are now

$$R_{L-x} = \frac{\rho (\frac{1}{6} L)}{A} = \frac{1}{6} (10 \Omega) = 1.67 \Omega$$

$$R_x = \frac{\rho (\frac{5}{6} L)}{A} = \frac{5}{6} (10 \Omega) = 8.33 \Omega$$