

Second Midterm

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3

(a). C_2, C_3 are series, they are parallel ~~to~~ with C_1 ,

$$V_1 = \Sigma = 2.00V, \quad Q_1 = C_1 V_1 = 2.40 \mu C.$$

$$Q_2 = Q_3 = Q_{23} = \Sigma \cdot \frac{C_2 C_3}{C_2 + C_3} = 2 \times \frac{1.5 \times 0.5}{1.5 + 0.5} = 0.75 \mu C.$$

$$V_2 = \frac{Q_2}{C_2} = 0.50V \quad V_3 = \frac{Q_3}{C_3} = 1.50V$$

(b). Insert the dielectric into C_3 , ~~C_3 will~~ capacitance of C_3 increases, voltage will decrease, the charge on C_1 will flow to C_3 , but the total charge on C_1 and C_3 will not change.

$$Q_1 + Q_3 = 2.40 \mu C + 0.75 \mu C = 3.15 \mu C$$

C_2 and C_3 are series,

~~$V_2 = V_3 = V_1$~~

$$Q_2 = Q_3 \rightarrow C_2 V_2 = K C_3 V_3 \Rightarrow 1.5 V_2 = 2 V_3$$

$$V_3 = 0.75 V_2$$

$$V_1 = V_2 + V_3 = V_2 + 0.75 V_2 = 1.75 V_2$$

$$\Sigma Q_1 + Q_3 = C_1 V_1 + K C_3 V_3 = 3.15 \mu C$$

$$1.75 \times 1.2 V_2 + 2 \times 0.75 V_2 = 3.15$$

$$V_2 = .875V$$

$$Q_2 = C_2 V_2 = 1.31 \mu C$$

$$V_1 = 1.53V$$

$$Q_1 = C_1 V_1 = 1.84 \mu C$$

$$V_3 = .656V$$

$$Q_3 = Q_2 = 1.31 \mu C$$