

SECOND MIDTERM

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Name: _____

Discussion Instructor (circle): Billeter Blake Gillman Herring

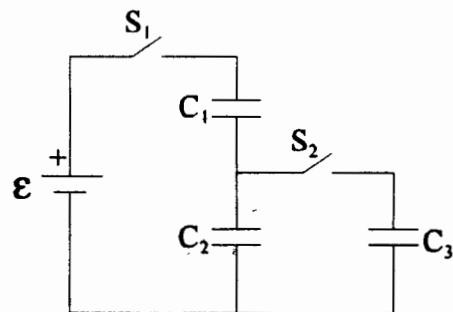
Student ID #: _____

SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

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First S_1 is closed with S_2 open. Then S_1 is opened, and finally, S_2 is closed. Calculate the voltage and charge for each capacitor in the final configuration

- $\epsilon = 12$ Volts
- $C_1 = 10 \mu\text{F}$
- $C_2 = 23 \mu\text{F}$
- $C_3 = 6 \mu\text{F}$



First S_1 is closed with S_2 open

$$\begin{cases} C_1 V_1 = C_2 V_2 \\ V_1 + V_2 = \epsilon \end{cases} \Rightarrow V_1 = \frac{C_2 \epsilon}{C_1 + C_2} \quad V_2 = \frac{C_1 \epsilon}{C_1 + C_2}$$

$$Q_1 = Q_2 = Q = \frac{C_1 C_2 \epsilon}{C_1 + C_2}$$

Then S_1 is opened S_2 is closed

$$\begin{cases} Q_2' + Q_3' = Q \\ \frac{Q_2'}{C_2} = \frac{Q_3'}{C_3} \end{cases} \Rightarrow Q_2' = \frac{C_1 C_2^2 \epsilon}{(C_1 + C_2)(C_2 + C_3)}$$

$$Q_3' = \frac{C_1 C_2 C_3 \epsilon}{(C_1 + C_2)(C_2 + C_3)}$$

$$V_2' = V_3' \quad V_2' = \frac{Q_2'}{C_2} \quad V_3' = \frac{Q_3'}{C_3}$$

final configuration

$$V_1 = 8.36 \text{ V}$$

$$Q_1 = 83.6 \mu\text{C}$$

$$V_2' = 2.88 \text{ V}$$

$$Q_2' = 66.3 \mu\text{C}$$

$$V_3' = 2.88 \text{ V}$$

$$Q_3' = 17.3 \mu\text{C}$$