

→ Solution ←

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FINAL EXAM

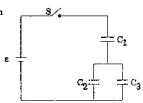
Name (print) Walker Name (signed) _____

Discussion Instructor (circle): Brown Chakhbazian Condella Portnoi Zhukov

Discussion Section # _____

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

Initially the switch in the circuit is closed for a long time. Initially there is a dielectric with $\kappa = 4.25$ in C_3 . (All capacitor values are given *without* dielectric.) Now the switch is opened.



- (a) Calculate the charge and potential on each capacitor.
 (b) After (a) the dielectric is moved from C_3 to C_2 with the switch still open. Calculate the charge and potential for each capacitor in this new situation.

- $\epsilon = 250 \text{ V}$
 $C_1 = 90 \mu\text{F}$
 $C_2 = 125 \mu\text{F}$
 $C_3 = 40 \mu\text{F}$

a) $C_{\text{eff}} = 68.96$ $Q_{\text{TOT}} = C_{\text{eff}} \cdot \epsilon = 17240 \mu\text{C}$
 $Q_1 = Q_{23} = Q_{\text{TOT}}$ $V_1 + V_2 = \epsilon$ $V_1 = 191$ $V_{23} = \epsilon - V_1 = 58.4$
 $Q_2 + Q_3 = Q_{\text{TOT}}$ $V_2 = V_3 \Rightarrow Q_3 = 9935 \mu\text{C} = 9.93 \text{ mC}$
 $Q_2 = 7305 \mu\text{C} = 7.31 \text{ mC}$

5 per capacitor
 15 points

b) Charge on system stays the same

5 per capacitor
 15 points

$Q_1 = 17.2 \text{ mC}$ $V_1 = \frac{Q_1}{C_1} = 45.1$
 $Q_1 = Q_{23} = Q_{\text{TOT}}$ $V_2 = V_3$
 $Q_3 = 4.18 \text{ mC}$
 $Q_2 = 13.1 \text{ mC}$
 105 V