Physics 172
Winter Quarter 1988
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George Williams

$\bar{x} = 16.3$

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SECOND EXAM

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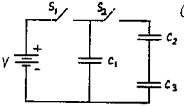
Discussion Section #:________

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

In the arrangement shown both switches are initially open and all capacitors are fully discharged. First, close S_1 with S_2 open. Then open S_1, leaving S_2 open. Finally, close S_2 with S_1 still open. Work part (a) with the switches in this state. Capacitance values are without dielectric.

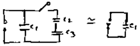
$V = 110$ V
$C_1 = 7.25$ pF
$C_2 = 2.00$ pF
$C_3 = 5.00$ pF



(6) $V_1 = 91.93$ volt $\equiv \boxed{91.9 \text{ V}}$
$Q_1 = 6.66 \times 10^{-10}$ C
$\boxed{V_2 \equiv 65.6 \text{ volt}}$
$V_3 = 26.3$ volt
$Q_2 = Q_3 = 1.31 \times 10^{-10}$ C

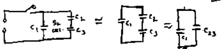
15 (a) Calculate the charge on and the potential difference across each capacitor.
10 (b) With S_2 closed and S_1 open, as in (a), insert a dielectric with $\kappa = 5.00$, into C_2. Recalculate the charge and potential difference for each capacitor.

(9) Initial Step:



C_1 is being charged
$\therefore \boxed{Q_1 = VC_1 = 797.5 \times 10^{-12} C \equiv Q_{To}}$
$\Rightarrow Q_{TOT}$ For S_2-circuit.

Final Step:



where $\boxed{C_{23} = \frac{C_2 C_3}{C_2 + C_3}} = 1.43$ pF

parallel connection

$C_{eq} = C_1 + C_{23} = 8.68$ PF.

Set-up 9
Answer 6

For parallel connection, Both C_1 and C_2 should have same p.d.

C_1: $V_1 = $ P.D in $C_1 = \frac{Q_{Tot\ in\ S_2}}{C_{eq}} = V_{23} \Rightarrow \frac{7.98 \times 10^{-10} C}{8.68 \times 10^{-12} F} = \boxed{91.93 \text{ volt}} = 91.9$ volt

$\therefore \boxed{Q_1 = V_1 C_1 = -6.66 \times 10^{-10} C}$

NOW $Q_T = Q_1 + Q_{23}$ where $Q_{23} = Q_3 = Q_2$ as C_2 & C_3 are in series.

By conservation of charge, $Q_{23} = Q_3 = Q_2 \Rightarrow Q_T - Q_1 = 132.82 \times 10^{-12}$ C $= 1.313 \times 10^{-10}$ C.

OVER.

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5 (a) contd

$\therefore V_2 = \frac{Q_2}{C_2} = \frac{132.82 \times 10^{-12}\,C}{2 \times 10^{-12}\,F} = 66.41$ volt.

$= 66.4$ volt.

$V_3 = \frac{Q_3}{C_3} = \frac{132.82 \times 10^{-12}\,C}{5 \times 10^{-12}\,F} = 26.56$ volt $\equiv 26.6$ volt.

(6)

only C_2 will change in magnitude.

Now, $C_2' = KC_2 = 5 \times 2 \times 10^{-12}\,F = 1 \times 10^{-11}\,F$

use $C_2' = 1 \times 10^{-11}\,F$ in the equation of part (a) for C_2.

$\therefore C_{23}' = \frac{C_2' C_3}{C_2' + C_3} = \frac{10 \times 5}{15}\,pF = 3.33 \times 10^{-12}\,F.$

$\therefore C_{eq}' \Rightarrow C_1 + C_{23}' = (7.25 + 3.33) \times 10^{-12}\,F = 10.58 \times 10^{-12}\,F$

$\therefore V_1' = V_{23}' = \frac{798 \times 10^{-12}}{10.58 \times 10^{-12}} = \boxed{75.4 \text{ Volt}}$

$Q_1' = V_1' C_1 = 75.4 \times 7.25 \times 10^{-12} = 546.65 \times 10^{-12}\,C$

$= \boxed{5.47 \times 10^{-10}\,C}$.

6 set up

$Q_2' = Q_3' = Q_T - Q_1 \equiv \boxed{2.51 \times 10^{-10}\,C}$

$\because Q_T = 7.98 \times 10^{-10}\,C$

4 ans + calc.

$\therefore V_2 = \frac{Q_2'}{C_2'} = \frac{251 \times 10^{-12}}{10 \times 10^{-12}} = \boxed{25.1 \text{ volt}}$

$V_3 = \frac{Q_3'}{C_3} = \frac{251 \times 10^{-12}}{5 \times 10^{-12}} = 50.2$ volt.