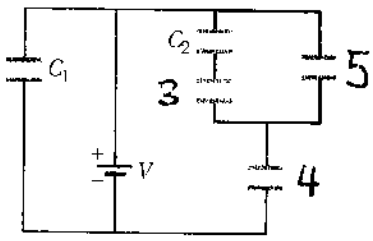
Quiz 5 – PH242 **Name**_____ ☐ **Pledged**

In the figure below assume the battery has a potential difference of 10.0 V and all five capacitors shown have a capacitance of 10.0 μF.

(A) Calculate the equivalent (or total) capacitance for this circuit.

(B) Calculate the charge on C_1.

(C) Calculate the charge on C_2.



Equations

Three capacitors in

Series: $V = V_1 + V_2 + V_3 \quad Q = Q_1 = Q_2 = Q_3 \quad \frac{1}{C_{EQ}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

Three capacitors in

Parallel: $V = V_1 = V_2 = V_3 \quad Q = Q_1 + Q_2 + Q_3 \quad C_{EQ} = C_1 + C_2 + C_3$

$$Q = CV$$

(A) $\frac{1}{C_{23}} = \frac{1}{C_2} + \frac{1}{C_3} = \frac{2}{10\mu F} \Rightarrow \underline{C_{23} = 5\mu F}$

$\underline{C_{235} = C_{23} + C_5 = 15\mu F}$ | $\frac{1}{C_{4235}} = \frac{1}{C_4} + \frac{1}{C_{235}} = \frac{1}{10} + \frac{1}{15} = \frac{5}{30\mu F}$

so $\underline{C_{4235} = 6\mu F}$

$C_{12345} = C_1 + C_{4235} = \boxed{16\mu F}$

(B) $C_1 = \frac{Q_1}{V_1}$ so $Q_1 = (10\mu F)(10V) = 100\mu VF = 100\mu C$

$= 1 \times 10^{-4} C$

C) $V_4 + V_{235} = 10V$, $V_2 = V_3 = V_{23}/2$, $Q_4 = Q_{235}$ $Q_2 = Q_3 = Q_{23}$

so $C_{235}V_{235} = C_4 V_4$, $\frac{V_{235}}{V_4} = \frac{C_4}{C_{235}} = \frac{10\mu F}{15\mu F} = \frac{2}{3}$, $V_4 + \frac{2}{3}V_4 = 10V$

so [illegible]

$V_4 = 6V$, $V_2 = V_3 = 2V$, $V_5 = 4V$ so $\boxed{Q_2 = C_2 V_2 = 20\mu C}$