Review for Quiz 5: HW Problem 64 from Chapter 30

C_1 ⊣⊢ $4\ \mu F$ C_2 ⊣⊢ $12\ \mu F$

9 V

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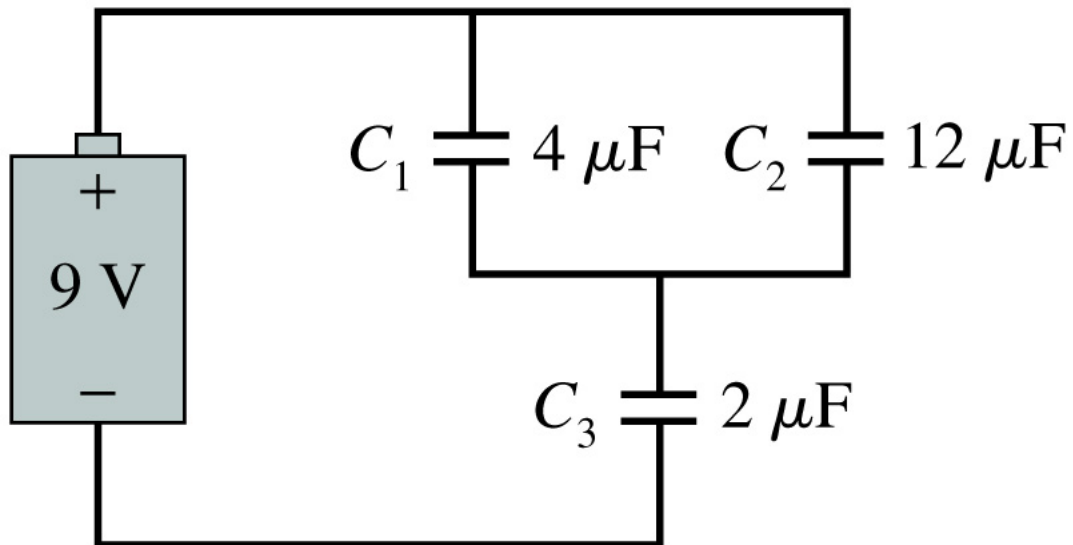
C_3 ⊣⊢ $2\ \mu F$
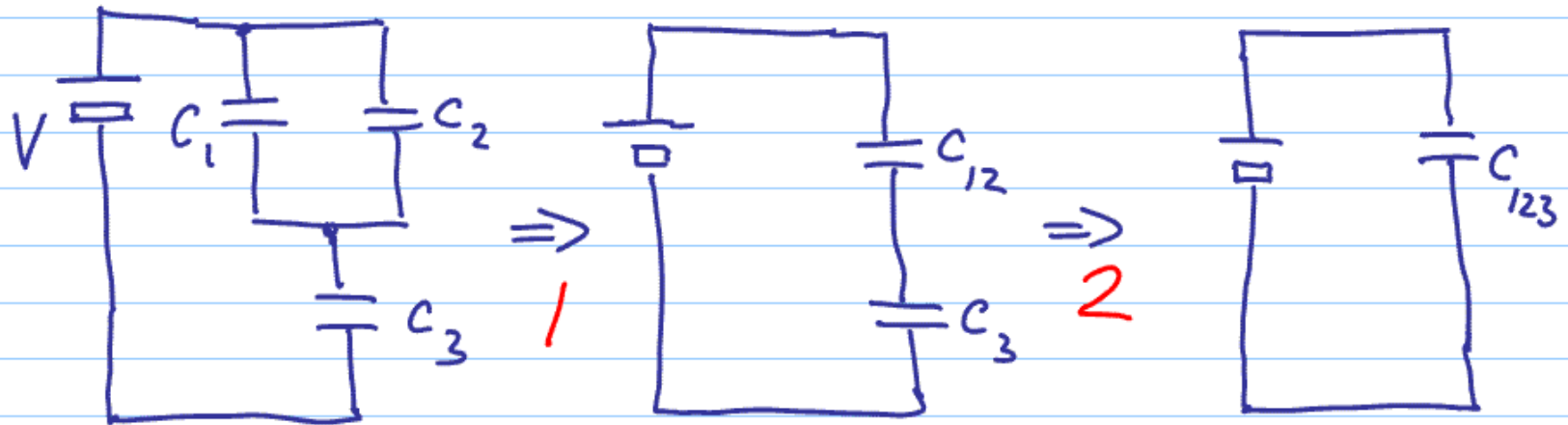
What are the charge and potential difference across each capacitor?

$$V = 9V, \quad C_1 = 4\mu F, \quad C_2 = 12\mu F, \quad C_3 = 2\mu F$$
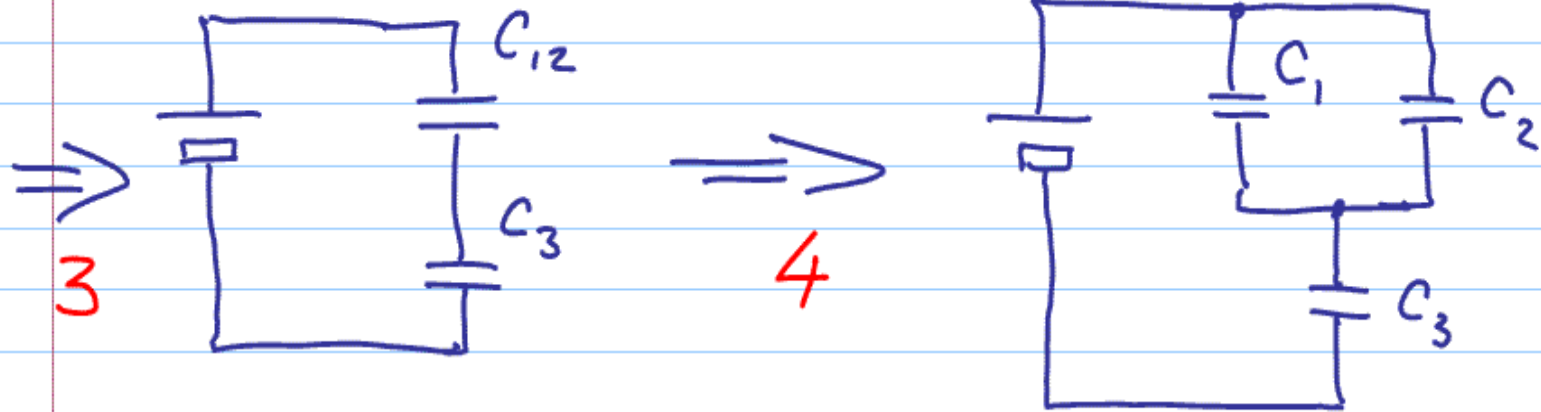

$$1: \quad C_{12} = C_1 + C_2 = 16 \mu F$$

$$2: \quad \frac{1}{C_{123}} = \frac{1}{C_{12}} + \frac{1}{C_3} = \frac{1}{16} + \frac{1}{2} = \frac{1+8}{16} = \frac{9}{16} \Rightarrow$$

$$C_{123} = \frac{16}{9} \mu F, \quad C = \frac{Q}{\Delta V} \Rightarrow$$

$$Q_{123} = C \cdot \Delta V = \frac{16}{9} \mu F \cdot 9V = 16 \mu C$$

As a result of simplifying the circuit we found

Now go back with this information added Q_{123}

3: $Q_{12} = Q_3 = Q_{123} = 16 \mu C$

$C = \dfrac{q}{V} \implies V = \dfrac{Q}{C}$

$V_{12} = \dfrac{Q_{12}}{C_{12}} = \dfrac{16 \mu C}{16 \mu F} = \dfrac{16 \cdot 10^{-6} C}{16 \cdot 10^{-6} F} = 1V$

$$V_3 = \frac{Q_3}{C_3} = \frac{16 \cdot 10^{-6}}{2 \cdot 10^{-6}} = 8V$$

4: $V_1 = V_2 = V_{12} = 1V$

$$C = \frac{Q}{V} \implies Q = C \cdot V$$

$$Q_1 = C_1 \cdot V_1 = 4 \cdot 10^{-6} \cdot 1 = 4 \cdot 10^{-6} C = 4\mu C$$

$$Q_2 = C_2 \cdot V_2 = 12 \cdot 10^{-6} \cdot 1 = 12\mu C$$

Check: $Q_1 + Q_2 = Q_{12} \iff 4\mu C + 12\mu C = 16\mu C$

Answers: $V_1 = 1V$, $Q_1 = 4\mu C$

$V_2 = 1V$, $Q_2 = 12\mu C$

$V_3 = 8V$, $Q_3 = 16\mu C$