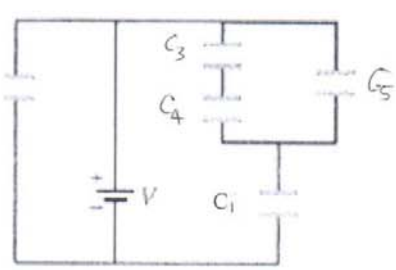
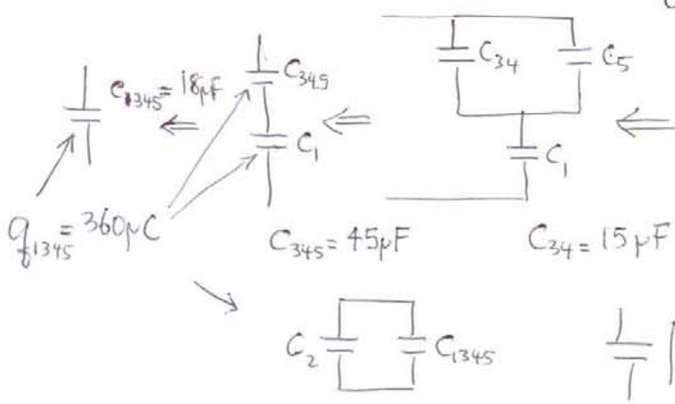
Physics 102Rec
Quiz #10
Chapter 25

Name: Key Id#: Sect#:

In the figure, the battery has a potential difference of V = 20 V and the five capacitors each has a capacitance of 30 μF.



(a) What is the equivalent capacitance?



$C_{eq} = C_2 + C_{1345} = 48\mu F$

(b) What is the voltage across capacitor C_1?

$q_1 = q_{1345} = 360\mu C$

$V_1 = \frac{q_1}{C_1} = \frac{360\mu C}{30\mu F} = 12V$

(c) What is the charge on capacitor C_2?

$q_2 = C_2 V = 30\mu F \times 20V = 600\mu C$

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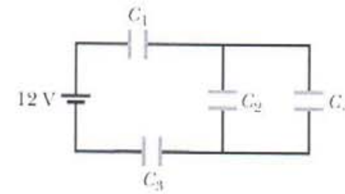
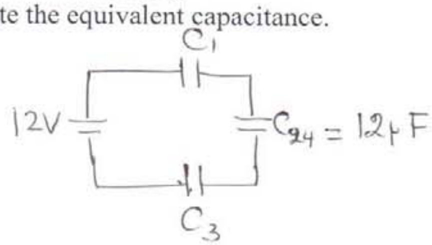
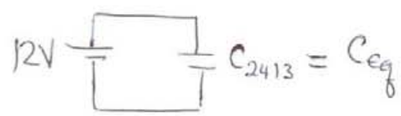
The figure shows a combination of four capacitors $C_1 = C_3 = 8.0\ \mu F$ and $C_2 = C4 = 6.0\ \mu F$ connected to a 12-V battery.



(a) Calculate the equivalent capacitance.





$$\frac{1}{C_{2413}} = \frac{1}{C_{24}} + \frac{1}{C_3} + \frac{1}{C_1} = \frac{1}{12} + \frac{1}{8} + \frac{1}{8} \Rightarrow \boxed{C_{2413} = 3\mu F}$$

(b) Calculate the voltage across capacitor C2.

$$q_{eq} = C_{eq} \cdot V = 36\mu C$$

$$q_{24} = 36\mu C \Rightarrow V_{24} = V_2 = \frac{q_{24}}{C_{24}} = \frac{36\mu C}{12\mu F} = \boxed{3V}$$

(c) Calculate the voltage across capacitor C1.

$$q_1 = q_{eq} = 36\mu C$$

$$V_1 = \frac{q_1}{C_1} = \frac{36\mu C}{8\mu F} = \boxed{4.5V}$$

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(a) A 20-V battery is connected to a series of **N** capacitors, each of capacitance 4.0 μF. If the total energy stored in the capacitors is 50 μJ, what is **N**?

$$U_{Total} = \frac{1}{2} C_{eq} V^2$$

$$= \frac{1}{2} \frac{C_1}{n} V^2$$

$$n = \frac{C_1 V^2}{2 U_{Total}} = \frac{4 \times 10^{-6} \times (20)^2}{2 \times (50 \times 10^{-6})}$$

$$\boxed{n = 16}$$

(b) A 100-V battery is connected to **N** capacitors connected in parallel, each of capacitance 4.0 μF. If the total charge of 1.0 C is stored on the capacitors, what is **N**?

$$q_{net} = n q_1 = n C_1 V$$

$$n = \frac{q_{net}}{C_1 V} = \frac{1}{4 \times 10^{-6} \times 100} = 2500$$

$$\boxed{n = 2500}$$