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

The capacitor system shown is connected to a battery with \( V_b = 180 \text{ V} \).

(a) \( [9 \text{ pts.}] \) Calculate the equivalent capacitance between points A and B.
(b) \( [8 \text{ pts.}] \) Calculate the potential across \( C_6 \).
(c) \( [8 \text{ pts.}] \) Calculate the charge on \( C_6 \).

\[
C_1 = 1.00 \mu\text{F} \quad C_4 = 4.00 \mu\text{F} \\
C_2 = 2.00 \mu\text{F} \quad C_5 = 5.00 \mu\text{F} \\
C_3 = 3.00 \mu\text{F} \quad C_6 = 6.00 \mu\text{F}
\]

\[
\frac{1}{C_e} = \frac{1}{C_{123}} + \frac{1}{C_{45}} + \frac{1}{C_6}
\]

\[
C_{123} = C_1 + C_2 + C_3 = 6 \mu\text{F} \quad (2 \text{ points})
\]

\[
C_{45} = C_4 + C_5 = 9 \mu\text{F} \quad (2 \text{ points})
\]

\[
\frac{1}{C_e} = \frac{1}{6 \mu\text{F}} + \frac{1}{9 \mu\text{F}} + \frac{1}{6 \mu\text{F}} = \frac{8}{18 \mu\text{F}} = \frac{4}{9 \mu\text{F}} = \frac{4}{9 \mu\text{F}} =>
\]

\[
C_e = \frac{9}{4} \mu\text{F} = 2.25 \mu\text{F} \quad (5 \text{ points})
\]

(b) \( \boxed{Q_{123} = Q_{45} = Q_6 = Q_{\text{total}}} \quad (3 \text{ points}) \)

\[
Q_{\text{total}} = C_e V_b 
\]

\[
\Rightarrow Q_6 = C_e V_b \quad \Rightarrow C_e V_b = C_6 V_6 \quad \Rightarrow V_6 = \frac{C_e}{C_6} V_b
\]

\[
V_6 = \frac{2.25 \mu\text{F}}{6 \mu\text{F}} \cdot 180 \text{ V} = 67.5 \text{ V} \quad (5 \text{ points})
\]
Q_{total} = Q_{123} \quad (2 \text{ points})

Q_{total} = C_e V_B

V_{123} = \frac{Q_{123}}{C_{123}} \quad (3 \text{ points})

V_{123} = V_3 = \frac{Q_{123}}{C_{123}} = \frac{Q_{total}}{C_{123}} = \frac{C_e V_B}{C_1 + C_2 + C_3} = 67.5 \text{ V}

Q_3 = C_3 V_3 = C_3 V_{123} = C_3 \frac{C_e V_B}{C_1 + C_2 + C_3} =

= 3 \mu F \times 67.5 \text{ V} = 2.025 \times 10^{-4} C \approx 2.03 \times 10^{-4} C \quad (5 \text{ points})

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