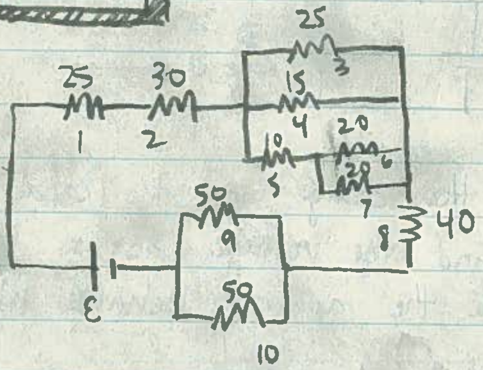
HW#10 Solutions

26.1



need to find most R_{eq}: $\quad R_{9,10}$: $\dfrac{1}{R_{eq}} = \dfrac{1}{R_9} + \dfrac{1}{R_{10}} = \dfrac{2}{50}$

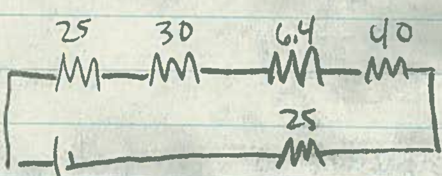
$$R_{9,10} = \underline{25\,\Omega}$$

$$\frac{1}{R_{6,7}} = \frac{1}{20} + \frac{1}{20} \Rightarrow R_{6,7} = \underline{10\,\Omega}$$

$$R_{5,6,7} = \underline{20\,\Omega}$$

$$\frac{1}{R_{3,4,5,6,7}} = \frac{1}{25} + \frac{1}{15} + \frac{1}{20} \Rightarrow 6.4\,\Omega$$

$\Longrightarrow$



$R = 40\,\Omega$ is the largest resistance so it will limit the max current

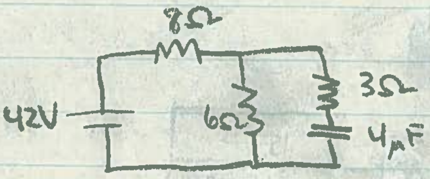
$$P = I^2 R \Longrightarrow 2.5 = I^2 (40)$$

$$\Longrightarrow \boxed{I = 0.25\text{ A}}$$

$$\varepsilon_{max} = IR = (0.25)(25 + 30 + 6.4 + 40 + 25)$$

$$= \boxed{31.6\text{ V}}$$

26.2



a.) Initially the charge on the capacitor is Ø and the voltage across it is also Ø.
→ So the capacitor behaves like a wire.

$$\frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{3} = \frac{3}{6} \Longrightarrow R_{eq} = 2\,\Omega$$

$$42\text{V} = I(2+8) \Longrightarrow I = \frac{42}{10} = 4.2\text{ A}$$

$\boxed{I_{R8} = 4.2\text{ A}}$

$\boxed{I_{R6} = 1.4\text{ A}}$

$\boxed{I_{R3} = 2.8\text{ A}}$

b.) Once the capacitor is charged there is no current through it or $R = 3\,\Omega$.

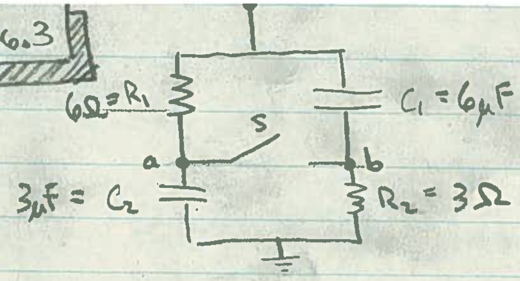
$$R_{eq} = 8 + 6 = 14\text{ A}$$

$$\varepsilon = IR \Rightarrow 42 = I(14) \longrightarrow \frac{42}{14} = I = 3\text{ A}$$

↳ the voltage drop across the capacitor and $R = 6\,\Omega$ is $V = (3)(6) = 18\text{V}$

$$Q = VC = (18)(4\times10^{-6}) = \boxed{7.2\times10^{-5}\text{ C}}$$

26.3



a.) When S is open we have a parallel circuit. When the capacitors are fully charged no current flows

$\Longrightarrow \boxed{V_a = V_b = 18\,V}$

b.) Point a is directly connected to the positive terminal so it is at a higher potential.

c.) when S is closed

$$V = IR \rightarrow I = \frac{18}{(6+3)} = 2\,A$$

$$\Longrightarrow V_b = (2)(3) = 6\,V$$

d.) Initial values:

$$Q_1 = C_1 V = (6\mu F)(18) = \boxed{1.08 \times 10^{-4}\ C}$$
$$Q_2 = C_2 V = (3\mu F)(18) = \boxed{5.4 \times 10^{-5}\ C}$$

Final Values:

$$Q_1 = C_1(V_i - V_f) = (6\mu F)(18 - 6)$$
$$= \boxed{7.2 \times 10^{-5}\ C}$$
$$Q_2 = C_2(V_i - V_f) = (3\mu F)(18 - 2 \cdot 6)$$
$$= \boxed{1.8 \times 10^{-5}\ C}$$

$$Q_{2i} - Q_{2f} = \boxed{3.6 \times 10^{-5}\ C}$$

$$Q_{1i} - Q_{1f} = \boxed{3.6 \times 10^{-5}\ C}$$