Homework 25.1

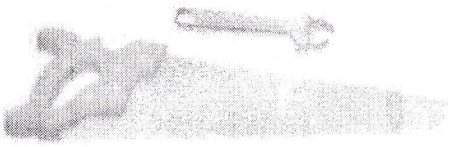

Figure 25-24

The two metal objects in Fig. 25-24 have net charges of +70 pC and -70 pC, which results in a 20 V potential difference between them. (a) What is the capacitance of the system? (b) If the charges are changed to +200 pC and -200 pC, what does the capacitance become? (c) What does the potential difference become?

$$q = CV$$

a) $C = q/V = \frac{70 \times 10^{-12}}{20} = 3.5\ pF$

b) No change $3.5\ pF$

c) $\frac{V_2}{V_1} = \frac{q_2}{q_1}$

$$V_2 = \frac{q_2}{q_1} * V_1 = \frac{200}{70} * 20$$

$$= \frac{400}{7} = 57.1\ V$$

Homework 25.3

A parallel plate capacitor has circular plates of 8.20 cm radius and 1.30 mm separation. (a) Calculate the capacitance. (b) Find the charge for a potential difference of 120V

$$C = \epsilon_0 \frac{A}{d} = \frac{8.854 \times 10^{-12} \pi (.082)^2}{1.3 \times 10^{-3}}$$

$$= \frac{8.854 \pi 8.2^2 \times 10^{-12+3}}{1.3}$$

$$C = 0.144 \text{ nF} = 144 \text{ pF}$$

$$q = CV = 17.3 \times 10^{-9} \text{ C}$$

$$= 144 \times 10^{-12} \times 120 = 17 \times 10^{-9} \text{ C}$$

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Homework 25.9

Each of the uncharged capacitors in Fig. 25-27 has a capacitance of 25.0 *uF*. A potential difference of *V = 4200* V is established when the switch is closed. How many coulombs of charge then pass through meter A?

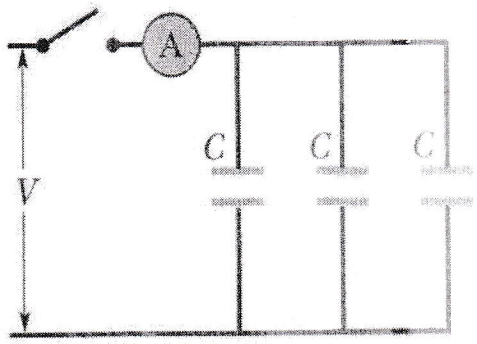


Figure 25-27

$$Q = CV = (C_1 + C_2 + C_3)V$$

$$= 3 \times 25 \times 10^{-6} \times 4200$$

$$= 0.315\ C$$

Homework 25.11

In Fig. 25-29, find the equivalent capacitance of the combination. Assume that C_1 = *10.0 uf,* C_2 = *5.00 uf,* and C_2 = *4.00 uf.*

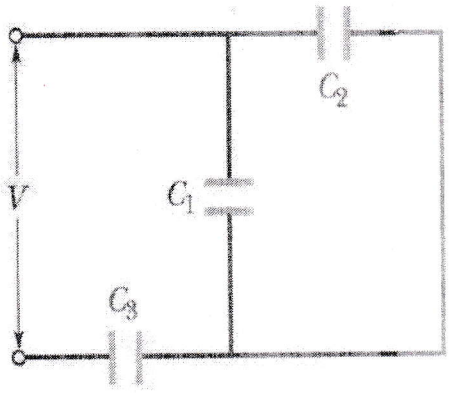


Figure 25-29

$$\frac{1}{C_{eq}} = \frac{1}{C_3} + \frac{1}{C_2 + C_1}$$

$$= \frac{1}{4} + \frac{1}{15} = \frac{19}{60}$$

$$C_{eq} = \frac{60}{19} = 3.16\,\mu F$$

Homework 25.15

In Fig. 25-31, a 20.0 V battery is connected across capacitors of capacitance $C_1 = C_6 = 3.00\ uF$ and $C_3 = C_5 = 2.00C_2 = 2.00C_4 = 4.00\ uF$. What are (a) the equivalent capacitance C_{eq} of the capacitors and (b) the charge stored by C_{eq}? What are (c) V_1 and (d) q_1 of capacitor 1, (e) V_2 and (f) q_2 of capacitor 2, and (g) V_3 and (h) q_3 of capacitor 3?

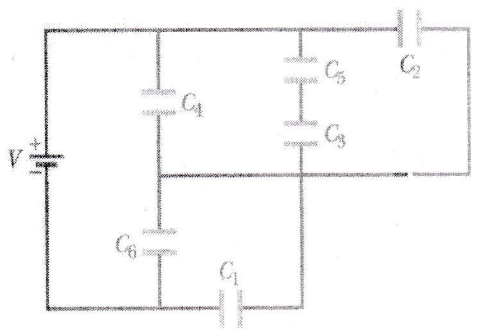


Figure 25-31

$C_1 = 3\mu F$

$C_6 = 3\mu F$

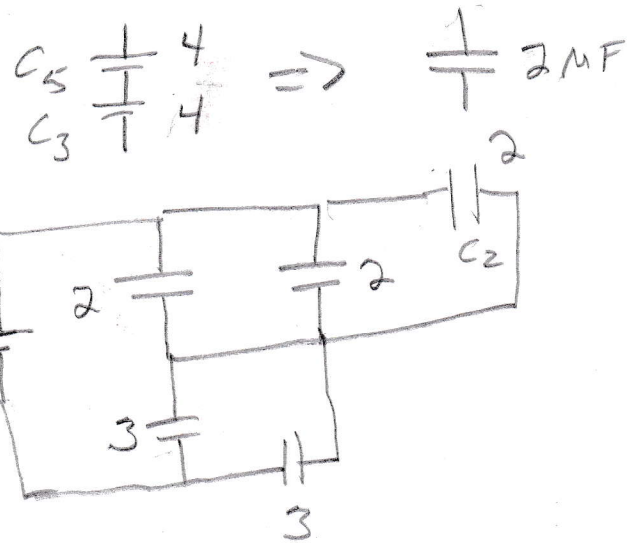
$C_5 = 4\mu F$

$C_3 = 4\mu F$

$C_2 = 2\mu F$

$C_4 = 2\mu F$

a) $C_{eq} = 3\mu F$



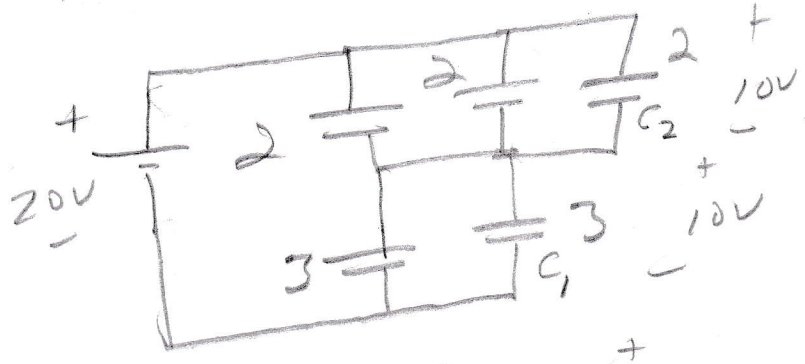
b) $Q = CV = 3\mu F \times 20V = 60\mu C$

c) $V_1 = 10V$

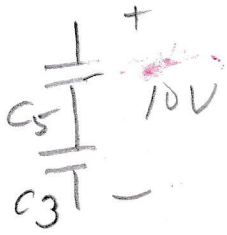
d) $q_1 = C_1 V_1 = 30\mu C$

e) $V_2 = 10V$

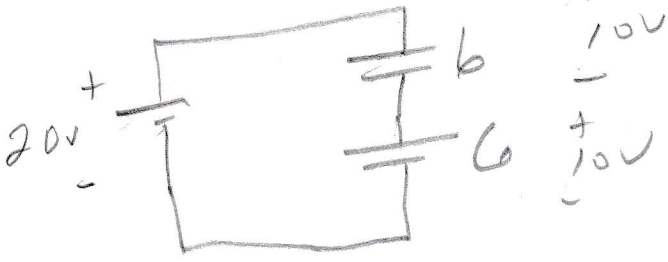
f) $q_2 = V_2 C_2 = 20\mu C$

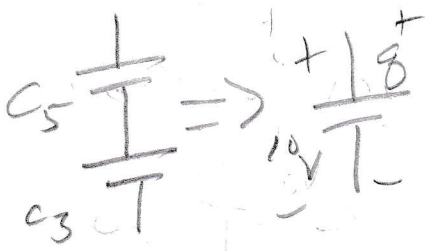


g)



$V_3 = 5V$





$q = CV$

$= 2\mu F * 10V$

$= 20\mu C = q_5 = q_3$