Chapter 26 Capacitance

26.1 a. & b. $Q = C \cdot \Delta V$.

26.2 a. $C = \frac{Q}{\Delta V}$

b. $\Delta V = \frac{Q}{C}$

26.5. Assume the smaller sphere has ~~charge~~ charge Q_1 & the larger sphere has charge Q_2. From the definition of capacitance, we have

$$C_1 = \frac{Q_1}{V_1} \qquad C_2 = \frac{Q_2}{V_2}$$

Also, $C_1 = 4\pi\epsilon_0 R_1$ $\quad C_2 = 4\pi\epsilon_0 R_2$

$Q_1 = 4\pi\epsilon_0 R_1 V_1$ $\quad Q_2 = 4\pi\epsilon_0 R_2 V_2$

But $V_1 = V_2$, therefore

$$\frac{Q_1}{Q_2} = \frac{R_1}{R_2}$$

the total charge on two spheres are $Q_1 + Q_2$

Solve Q & Q_2. then V_1 or V_2 for part b.

26.7 a) $E = \frac{\Delta V}{d}$

b. $\sigma = E \cdot \epsilon_0$

c. $C = \frac{\epsilon_0 A}{d}$

d. $Q = C \cdot \Delta V$

26.9 $Q = C\Delta V = \left(\frac{\epsilon_0 A}{d}\right)\Delta V$, $\quad Q = \sigma A$.

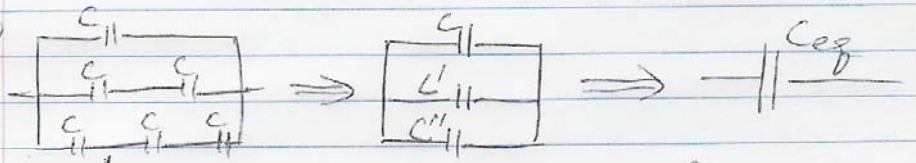
$$\Rightarrow \quad d = \frac{\epsilon_0 (\Delta V)/\sigma}{}$$

26.16 a) $C_{eq} = C_1 + C_2$

b) the potential difference across each capacitor is the same, ΔV = total potential difference of the battery.

c) $Q_1 = C_1 \Delta V \qquad Q_2 = C_2 \Delta V$

6.18

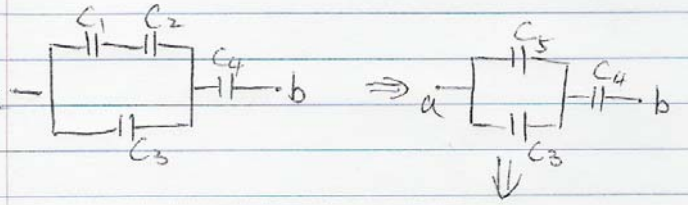


$$\frac{1}{C'} = \frac{1}{C} + \frac{1}{C} \Rightarrow C' = \frac{C}{2}$$

$$\frac{1}{C''} = \frac{1}{C} + \frac{1}{C} + \frac{1}{C} \Rightarrow C'' = \frac{C}{3}$$

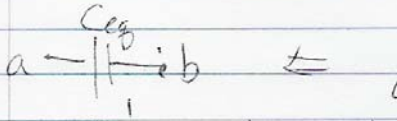
$$C_{eq} = C + \frac{C}{2} + \frac{C}{3} = \frac{11}{6}C$$

6.21



$$\frac{1}{C_5} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C_5 = \frac{C_1 C_2}{C_1 + C_2}$$



$$C_6 = C_3 + C_5$$

$$\frac{1}{C_{eq}} = \frac{1}{C_4} + \frac{1}{C_6} \qquad C_{eq} = \frac{C_4 C_6}{C_4 + C_6}$$

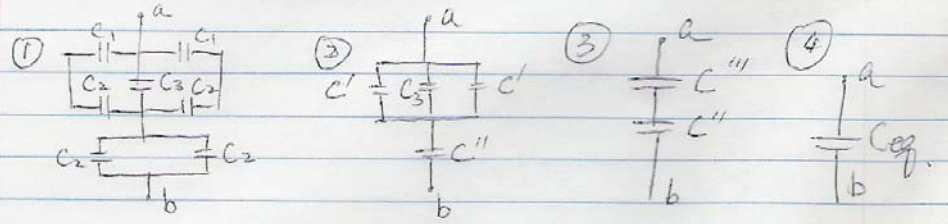
b. $Q_4 = C_4 \Delta V_{ab}$ on C_4

the potential drop across C_4 is $\Delta V_{C4} = \frac{Q_4}{C_4}$

the potential drop across C_6 is $\Delta V_{ab} - \Delta V_{C4} = \Delta V_{C6}$

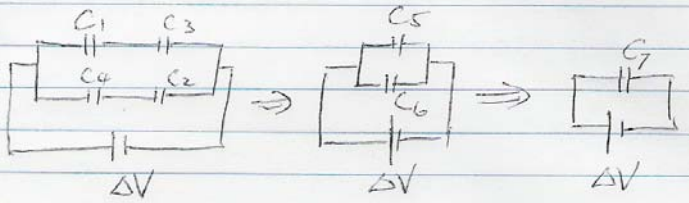
$Q_{C3} = C_3 \cdot \Delta V_{C6}$ $\quad Q_{C1} = Q_{C2} = C_5 \cdot \Delta V_{C6}$.

26.31 a+b $\quad U = \frac{1}{2} C (\Delta V)^2$

26.27 

$C' = \frac{C_1 C_2}{C_1 + C_2}$, $C'' = C_2 + C_2 = 2C_2$ $\quad C''' = C' + C_3 + C'$

$C_{eq} = \frac{C'' C'''}{C'' + C'''}$

26.54 a) 

$C_5 = \frac{C_1 C_3}{C_1 + C_3}$ $\quad C_6 = \frac{C_2 C_4}{C_2 + C_4}$ $\quad C_7 = C_5 + C_6$

c) $Q_{C1} = Q_{C3} = \Delta V / C_5$

$Q_{C2} = Q_{C4} = \Delta V / C_6$

b) $\Delta V = Q/C$ $\quad$ d) $U = \frac{1}{2} C_7 (\Delta V)^2$

b. QQ2 QQ8 answers to QQ problems are in the text book.