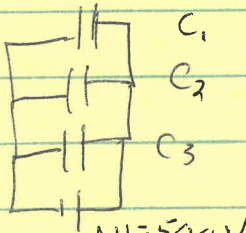# Homework 8   solutions

20) $Q = CV = 5.50V \cdot 8.00 \, pF = \boxed{44.0 \, pC}$

30) $\Delta Q = C \Delta V \Rightarrow \Delta Q = (20 \, \mu F)(100 V) = \boxed{2 \, mC}$

32)

$\boxed{\Delta V = 500 V \text{ for all}}$

$\boxed{Q_1 = C_1 \Delta V = 1.0 \, mC}$ $Q_2 = 1.5 \, mC$ $Q_3 = 3.0 \, mC$

$\Delta V = 500 V$

36)

$C_{12} = \dfrac{10 \cdot 0.3}{10 + 0.3}$ $C_{123} = C_{12} + C_3 = 2.79 \, \mu F$

$\rightarrow \boxed{2.8 \, \mu F}$

44)

a) $U = \dfrac{1}{2} \dfrac{Q^2}{C} \Rightarrow \dfrac{1}{2} CV^2 \Rightarrow V = \sqrt{\dfrac{2U}{C}} = \boxed{3.16 \cdot 10^3 V}$

b) and $Q = \sqrt{2UC} = \boxed{25.3 \, mC}$

48)

$C_1 = \dfrac{\varepsilon_0 A}{d_1} = 0.553 \, nF$

$C_2 = \dfrac{\varepsilon_0 A}{d_2} = C_1 / 2$

$U_1 = \dfrac{1}{2} C_1 V^2 = \boxed{0.69 \, \mu J}$

$U_2 = \dfrac{1}{2} C_2 V^2 = \dfrac{1}{2} U_2 = \boxed{0.35 \, \mu J}$

$\boxed{\text{charge is transferred to the battery}}$

51) a) $C_1 = \dfrac{\varepsilon_0 A}{d} = \boxed{7.1 \cdot 10^{-12} \, F}$

b) $C_2 = k C_1 = \boxed{42 \cdot 10^{-12} \, F}$

52) $C_1 = 4 \pi \varepsilon_0 \dfrac{R_1 R_2}{R_2 - R_1} = \boxed{14.8 \, pF}$ $C_2 = 6 C_1 = \boxed{89.0 \, pF}$

62) a) $U = \dfrac{1}{2} CV^2 \Rightarrow V = \sqrt{\dfrac{2U}{C}} = \boxed{0.1 V}$

b) $C_2 = 2 U_2 / V^2 = 2 . 41.7 \, nJ / (0.14 V)^2 = 811.46 \, nF \Rightarrow C_2 = k C_1 \Rightarrow \boxed{k = 2.25}$

70) $U_1 = \dfrac{1}{2} C_1 V^2 = 3.6 \cdot 10^{-4} J$ $Q = \text{constant} = 2 U_1 / V = 6 \cdot 10^{-5} C$

$U_2 = \dfrac{1}{2} \dfrac{Q^2}{C_2} = \dfrac{\frac{1}{2} Q^2}{C_1 / 3} = 1.08 \cdot 10^{-3} J \Rightarrow W = U_2 - U_1 = \boxed{7.2 \cdot 10^{-4} \, J}$