p 490 31 – 37, 41, 46 – 48, 61, 69, 75

(31) $C = \frac{q}{V} = \frac{2500\ \mu C}{850\ V} = 2.9\ \mu F$

(32) $C = \frac{q}{V} \quad V = \frac{q}{C} = \frac{16.5 \times 10^{-8} C}{9500 \times 10^{-12} F} = 17\ V$

(33) $C = \frac{q}{V} = \frac{95 \times 10^{-12} C}{120 V} = 7.9 \times 10^{-13} F$ or $0.79\ pF$

(34) $C = \frac{q}{V} \quad q = CV = (7.00\ \mu F)(12.0 V) = 84\ \mu C$

(35) $C = \frac{\varepsilon A}{d} \quad A = \frac{dC}{\varepsilon} = \frac{(2.2 \times 10^{-3} m)(0.20 F)}{8.85 \times 10^{-12} C^2 N^{-1} m^{-1}} = 5.0 \times 10^{7} m^2$

(36) $C = \frac{q}{V} = \frac{18\ \mu C}{(121 - 97 V)} = 750\ nF$ or $7.5 \times 10^{-7} F$

(37) $E = \frac{V}{r} \quad C = \frac{q}{V} \quad C = \frac{\varepsilon A}{d}$

$q = CV = \frac{\varepsilon A V}{d} = \frac{\varepsilon A E \cancel{r}}{\cancel{r}} = (8.85 \times 10^{-12} C^2 N^{-1} m^{-1})(35.0 \times 10^{-4} m^2)(8.5 \times 10^{5} V m^{-1})$

$= 2.63 \times 10^{-8} C$

(41) $C = \frac{q}{V}$

Total Charge $= V_1 C_1 + V_2 C_2 = 857 V (2.50 \mu F) + 652 V (6.80 \mu F)$

$= 6.576 \times 10^{-3} C$

Total Capacitance $= C_1 + C_2 = 2.5 \mu F + 6.8 \mu F = 9.3 \mu F$

$V = \frac{q}{C} = \frac{6.576 \times 10^{-3} C}{9.3 \times 10^{-6} F} = 707\ V$ (on each)

$q = CV = (2.50 \mu F)(707 V) = 1.77 \times 10^{-3} C$ and $(6.80 \mu F)(707 V) = 4.81 \times 10^{-3} C$

(46) $E = \frac{1}{2}CV^2 = \frac{1}{2}(2200\times10^{-12}F)(650V)^2 = \underline{4.6\times10^{-4}\,J}$

(47) $E = \frac{1}{2}CV^2$

$$C = \frac{2E}{V^2} = \frac{2(1200J)}{(5\times10^3V)^2} = \underline{9.6\times10^{-5}F}$$

(48) $E = \frac{1}{2}CV^2 \qquad C = \frac{\varepsilon A}{d} \qquad C = \frac{q}{V}$

$$E = \frac{1}{2}C\left(\frac{q}{C}\right)^2 = \frac{1}{2}\frac{q^2}{C} = \frac{1}{2}\frac{dq^2}{\varepsilon A} = \frac{1}{2}\frac{(1.5\times10^{-3}m)(420\times10^{-6}C)^2}{(8.85\times10^{-12}C^2N^{-1}m^{-1})(8\times10^{-2}m)^2}$$

$$= \underline{2.3\times10^3\,J}$$

(61) $E = \frac{V}{r} \qquad C = \frac{\varepsilon A}{d} \qquad C = \frac{q}{V}$

$$E = \frac{q}{Cr} \qquad q = ECr = \frac{E\varepsilon A\cancel{r}}{\cancel{d}} = (3.0\times10^6\,Vm^{-1})(8.85\times10^{-12}C^2N^{-1}m^{-1})(56\times10^{-4}m^2)$$

$$= \underline{1.5\times10^{-7}C}$$

(69) (a) $E = \frac{1}{2}CV^2 = \frac{1}{2}(0.05\times10^{-6}F)(30\times10^3V)^2 = \underline{23J}$

(b) $\frac{23J(.12)}{8\times10^{-6}s} = \underline{3.4\times10^5W}$

(75) (a) $C = \frac{q}{V} \qquad C = \frac{\varepsilon A}{d}$

$$q = \frac{V\varepsilon A}{d} = \frac{(12V)(8.85\times10^{-12}C^2N^{-1}m^{-1})(2.0\times10^{-4}m^2)}{0.5\times10^{-3}m} = \underline{4.2\times10^{-11}C}$$

(b) the same, $\underline{4.2\times10^{-11}C}$

75 (c) $C = \frac{q}{V}$ $\quad C = \frac{\varepsilon A}{d}$

$$V = \frac{qd}{\varepsilon A} = \frac{(4.2\times10^{-11}\,C)(.75\times10^{-3}\,m)}{(8.85\times10^{-12}\,C^2N^{-1}m^{-1})(2.0\times10^{-4}\,m^2)} = \underline{18\,V}$$

(d) Work $= \Delta E$

$$\Delta E = \frac{1}{2}\Delta C(\Delta V)^2 = \frac{1}{2}\frac{\varepsilon A}{\Delta d}(\Delta V)^2$$

$$= \frac{1}{2}\frac{(8.85\times10^{-12}\,C^2N^{-1}m^{-1})(2\times10^{-4}\,m^2)(18-12\,V)^2}{(.75\times10^{-3}\,m - .5\times10^{-3}\,m)}$$

$$= \underline{1.3\times10^{-10}\,J}$$