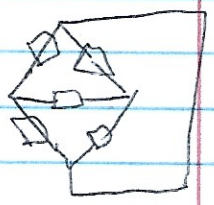
Ch 18 problems

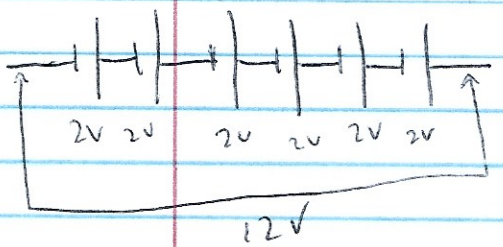
1) 3 nodes

5) D&E, A&B, B&C, C&D, D&E, ABC, CDE

C is in parallel?



9)



13) $C = \frac{Q}{V}$ $Q = CV = (15\times10^{-12}\,F)(150\,V)$

$= \boxed{2.25\times10^{-11}\,C}$

17) $C = \varepsilon_0 \frac{A}{d} = \varepsilon_0 \cdot \frac{\pi R^2}{nR}$

If R is doubled, C changes by a factor of 2

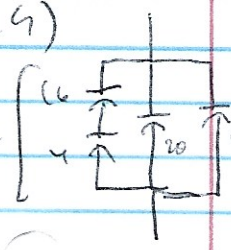
21) 

$C = \frac{ab}{(b-a)k}$

25) $C_{eq} = \left(\frac{1}{2.0\mu F} + \frac{1}{3.0\mu F} + \frac{1}{4.0\mu F}\right)^{-1}$

$= 0.92\,\mu F$

29)



$C_a = \left(\frac{1}{4\mu F} + \frac{1}{6\mu F}\right)^{-1}$

$= 3.2\,\mu F$

$C_{eq} = C_a + C_b + C_c$

$= \boxed{33.2\,\mu F}$

33) a) $Q = CV = (10\times10^{-12}\,F)(120\,V)$

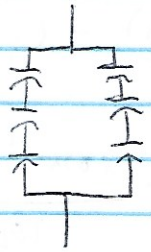
$= \boxed{1.2\times10^{-9}\,C}$

b) in parallel c) $Q = CV$

$C_q = \frac{Q}{V} = \frac{1.0C}{120V} = 8.33\times10^{-3}\,F$

$\frac{8.33\times10^{-3}\,F}{10\times10^{-12}\,F} = \boxed{8.33\times10^{8}}$ 10 pF capacitors in parallel

37) $\left(\frac{1}{15} + \frac{1}{15} + \frac{1}{15}\right)^{-1} = 5$



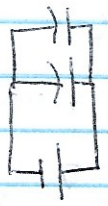
all 15 μF

$C_{eq} = 10\,\mu F$

41) $C = QV$ $PE_c = \frac{1}{2}CV^2$

$C = \frac{2PE_c}{V^2} = \frac{2(1.0\,J)}{(120V)^2}$

$= \boxed{1.39\times10^{-4}\,F}$

45) 

Because C_{eq} is the greatest when the capacitors are in parallel.

49) $PE_c = \frac{1}{2}CV^2$

$C = KC_0$ $\frac{K}{K_{air}} \approx K$

PE increases by a factor of K

53) $C_0 = \frac{\varepsilon_0 A}{d}$ $C = \frac{K\varepsilon_0 A}{d}$

$K = \frac{\varepsilon}{\varepsilon_0}$ equiv. to two capacitors in parallel?

$C_1 = \frac{K_1 \varepsilon_0 (\frac{1}{2}A)}{d} = \frac{K_1 \varepsilon_0 A}{2d}$

$C_2 = \frac{K_2 \varepsilon_0 (\frac{1}{2}A)}{d} = \frac{K_2 \varepsilon_0 A}{2d}$

$C_{total} = \frac{(K_1 + K_2)(\varepsilon_0 A)}{2d} = C_1 + C_2$

57) $C = \frac{Q}{V} = K\varepsilon_0 \frac{A}{d} = \frac{(8.85\times10^{-12}\ F/m)(25\ km^2)(\frac{(1000\ m)^2}{1\ km^2})}{2000\ m}$

$= 1.11\times10^{-7}\ F$

Med $E = \frac{\sigma}{\varepsilon_0} = \frac{Q}{\varepsilon_0 A}$

$Q = E\varepsilon_0 A = (3.0\times10^6\ V/m)(8.85\times10^{-12}\ F/m)(25\ km^2)$

$= 26.6\ C$

$PE_e = \frac{1}{2}QV = \frac{1}{2}(26.6\ C)(3.0\times10^6\ V)$

$= 3.99\times10^7\ J$