Name (print)_____ Name (signed)_____

Discussion Instructor (circle): Basko Chakhbazian DiCarlo Gundlach Romer Wei

Discussion Section # _____

-1 UNITS
-1 SF

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) The electric potential difference between two charged metal plates that are parallel is 127.0 V. Calculate the magnitude of the work to move an external small charge of 7.25 μC from one plate to another. (The charge is moved slowly.)

$W = q\Delta V = 7.25\times10^{-6}\,C \times 127.0 = 9.21\times10^{-4}\,J$

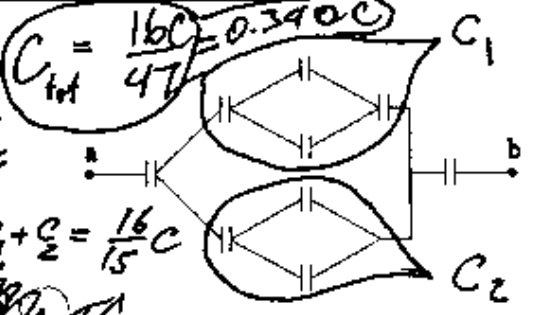
(b) A capacitor of C = 17.2 pF is given a potential of 75.0 V. Calculate the charge on the capacitor.

$Q = VC = 75.0 \times 17.2\times10^{-12}\,F = 1.29^{0}\times10^{-9}\,C$

(c) If the potential in a region of space is given by $V = +A\,xy^2z^3$ volts, where A is a positive constant, calculate the y component of the electric field at the point x = +2.00 m, y = +3.00 m, z = +2.00 m.

$E_y = -\frac{\partial V}{\partial y} = -2Ayxz^3 = -96.0A$ sign (3)

(d) If all capacitors in the arrangement shown have the same value C, calculate the effective capacitance between a and b.



$C_{tot} = \frac{16C}{47} = 0.340C$

$\frac{1}{C_1} = \frac{1}{C}+\frac{1}{C}+\frac{1}{2C} \Rightarrow C_1 = \frac{2}{5}C$; $\frac{1}{C_2} = \frac{1}{C}+\frac{1}{2C} \Rightarrow C_2 = \frac{2}{3}C$; $C_1 + C_2 = \frac{16}{15}C$

$\frac{1}{C_{total}} = \frac{1}{C}+\frac{1}{C}+\frac{15}{16C} \Rightarrow$

(e) Calculate the capacitance of a parallel plate capacitor if the plates are squares with sides of 1.50×10^{-2} m, and the gap between plates is 0.275 mm.

$C = \varepsilon_0\frac{A}{d} = 8.85\times10^{-12}\,\frac{F}{m}\,\frac{(1.50)^2\times10^{-4}\,m^2}{2.75\times10\times10^{-4}\,m}$

$C = 7.24\times10^{-12}\,F = 7.24\,pF$