7.37

The electric field strength between two parallel conducting plates are separated by 4.00 cm is 7.50×10^4 V/m.

(a) What is the potential difference between the plates?

$d = 4$ cm $= 0.04$ m　　$E = 7.50 \times 10^4$ V/m

$\frac{\Delta V}{d} = E \rightarrow \Delta V = Ed$

$= (7.50 \times 10^4 \text{ V/m})(0.04 \text{m})$

$\boxed{\Delta V = 3000 \text{ V}}$

(b) The plate with the lowest potential is taken to be zero volts. What is the potential 1.00 cm from that plate & 3.00 cm from the other.

$d_1 = 0.01$ m　　$E = 7.50 \times 10^4$ V/m

$d_2 = 0.03$ m

$\Delta V_1 = (0.01 \text{m})(7.50 \times 10^4 \text{ V/m})$

$\boxed{\Delta V_1 = 750 \text{V}}$

$\Delta V_2 = (0.03 \text{m})(7.50 \times 10^4 \text{ V/m})$

$\boxed{\Delta V_2 = 2250 \text{ V}}$

$\Delta V = \Delta V_1 + \Delta V_2 = 3000$ ✓

7.41 An electron is to be accelerated in a uniform electric field having a strength of 2.00×10^6 V/m.

ⓐ What energy in keV is given ~~by 50.0 GeV~~ to the electron if it is accelerated through 0.400 m?

$\Delta V = Ed$

$= (2.00 \times 10^6 \text{ V/m})(0.400 \text{ m})$

$\boxed{\Delta V = (8.0 \times 10^{-5} \text{ V})}$

$U = q\Delta V$

$= (1.602 \times 10^{-19} \text{ C})(8.0 \times 10^{-5} \text{ V})$

$= 1.28 \times 10^{-23} \left(\frac{1 \text{ keV}}{1.6 \times 10^{-16} \text{ J}}\right)$

$\boxed{U = 8.01 \times 10^{-8} \text{ keV}}$

ⓑ Over what distance would it have to be accelerated to increase its energy by 50.0 GeV?

$U = q\Delta V$

$\Rightarrow \Delta V = \frac{U}{q} \rightarrow Ed = \frac{U}{q}$

$d = \frac{U}{qE} = \frac{(50 \times 10^9 \text{ eV})\left(\frac{1.602 \times 10^{-19}}{1 \text{ eV}} \frac{\text{J}}{\text{eV}}\right)}{(2.00 \times 10^6 \text{ V/m})(1.602 \times 10^{-19} \text{ C})}$

$= 25 \times 10^3 \text{ m} \left(\frac{1 \text{ Km}}{10^3 \text{ m}}\right)$

$= 25 \text{ km}$

$\boxed{d = 25 \text{ km}}$

7.51 what is the potential between two points situated 10cm & 20cm from a 3.0 μC point charge?

$V = \frac{kQ}{r}$

$\Delta V = \frac{kQ}{r_2} - \frac{kQ}{r_1}$ $r_1 = 0.10\ m$, $r_2 = 0.20\ m$

$= kQ\left(\frac{1}{r_2} - \frac{1}{r_2}\right)$

$= (9.00 \times 10^9\ Nm^2/C^2)(3.0 \times 10^{-6} C)\left(\frac{1}{0.20_m} - \frac{1}{0.10_m}\right)$

$= |-135 \times 10^3 V|$

$\boxed{\Delta V = 135 \times 10^3 V}$

(b) Two what location should the point at 20 cm be moved to increase this potential difference to a factor of 2.

$= (9.00 \times 10^{+9}\ Nm^2/C^2)(3.0 \times 10^{-6}\ C)\left(\frac{1}{\infty} - \frac{1}{0.10_m}\right)$

$\boxed{\Delta V = 270{,}000}$

↳ need to get rid of this value r_2.

7.61 Two large charged plates of charge density $\pm 30 \mu C/m^2$ face each other at a seperation of 5.0 mm.

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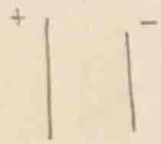
a) Find the electric potential everywhere.

$\sigma = \pm 30 \times 10^{-6}\ C/m^2$, $d = 5. \times 10^{-3} m$



$\sigma_{\ldots}$ = neutral

$E = 0$

$$E = \frac{\sigma}{\varepsilon_0} = \frac{30 \times 10^{-6}\ C/m^2}{8.85 \times 10^{-12}\ \frac{C^2}{Nm^2}} = 3.39 \times 10^{6}\ N/C$$

$$\Delta V = Ed = (3.39 \times 10^{6}\ N/C)(5 \times 10^{-3}\ m)$$

$$= 16950\ V$$

$$\boxed{\Delta V = 16950\ V}$$

@ $d = 0$ $\Delta V = 0$, changed to find max values.

ⓑ An electron is realeased from rest at the negative plate, with what speed will it strike the positive plate?

$U = qV$, $U = \frac{1}{2} mv^2$

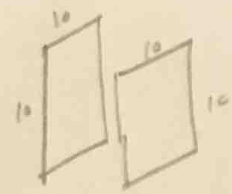
$$\frac{1}{2} mv^2 = qV$$

$$v = \sqrt{\frac{2qV}{m}} = \sqrt{\frac{2(1.602 \times 10^{-19} c)(16950 V)}{9.11 \times 10^{-31}}}$$

$$\boxed{V = 77209709.15\ m/s}$$

7.63 Equipotential Surfaces & conductors.

Two parallel plates 10 cm on a side are given equal & opposite charges of magnitude 5.0×10^{-9} C. The plates are 1.5 mm apart. What is potential difference between the two plates?



$$\Delta V = E d$$

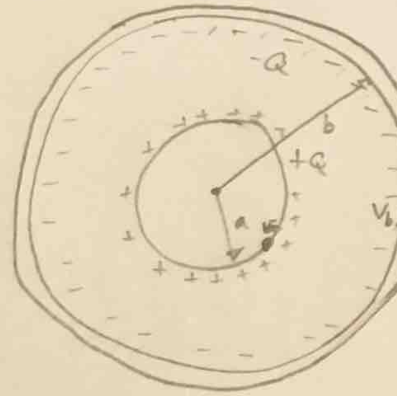
$$E = \frac{Q}{\varepsilon_0 A}, \quad A = \text{area} \rightarrow (10\,\text{cm})^2$$

$$\Delta V = \frac{Q}{\varepsilon_0 A} d$$

$$= \frac{(5.0 \times 10^{-9}\,\text{C})}{(8.85 \times 10^{-12})(.10\,\text{m})^2} \cdot (1.5 \times 10^{-3}\,\text{m})$$

$$\boxed{\Delta V = 84.75\,\text{V}}$$

7.65 Concentric Conducting spherical shells carry charges Q & -Q respectively. The inner shell has negligible thickness. What is the potential difference between the shells?



$$V(r) = \frac{kQ}{r}$$

$$V(a) = \frac{kQ}{a}, \quad V(b) = \frac{kQ}{b}$$

$$V(a) = \frac{kQ}{a} - \frac{kQ}{b}$$

$$V(b) = \frac{kQ}{b} - \frac{kQ}{b} = 0$$

$$V(b) - V(a) = 0 - \left(\frac{kQ}{a} - \frac{kQ}{b}\right)$$

$$= -\frac{kQ}{a} + \frac{kQ}{b}$$

$$= kQ\left(\frac{a}{a}\frac{1}{b} - \frac{1}{a}\frac{b}{b}\right)$$

$$\boxed{\Delta V = kQ\left(\frac{a-b}{ab}\right)}$$