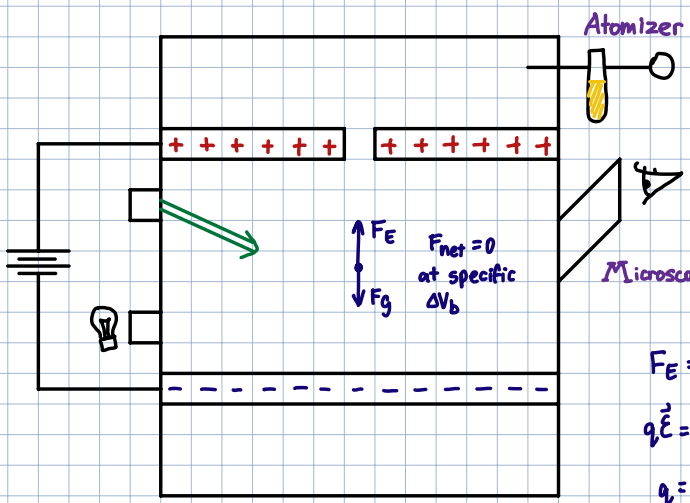


$F_E = F_g$

$q\vec{E} = mg$

$q = \frac{mg}{\vec{E}}$

$q_e = e = -1.6 \times 10^{-19} C$

Ex 1:

What is the charge on a small particle with an excess of 5x10^4 electrons?

What would the charge be if it were a deficit?

a)

$q = Ne$ (N: # of electrons; e: charge of an electron (proton is same but positive))

$q = 5 \times 10^4 (-1.6 \times 10^{-19})$

$q = -8 \times 10^{-15} C$

b)

Same magnitude but positive charge

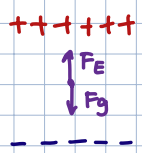
Ex 2:

Two horizontal plates are 2.5cm apart. A latex sphere, mass 1.5*10^-15 kg, remains stationary when the potential difference between the plates is 460V with the upper plate positive.

a) Is the sphere charged positively or negatively?

b) What is the magnitude of charge on the sphere?

c) How many excess or deficit electrons does it have?



a) Must be Negative

b)

$r = 2.5cm = 0.025m$

$m = 1.5 \times 10^{-15} kg$

$\Delta V = 460V$

$F_E = F_g$

$qE = mg$

$q\left(\frac{\Delta V}{\Delta r}\right) = mg$

$q = \frac{mg\Delta r}{\Delta V}$

$q = \frac{1.5 \times 10^{-15}(9.81)(0.025)}{460}$

$q = 8 \times 10^{-19} C$

c)

Excess, because negative charge

$q = Ne$

$-8 \times 10^{-19} = N(-1.6 \times 10^{-19})$

$N = 5$ electrons

Energy

$E_T = E_T'$

$\Delta E = W = Fd$

$E_E + E_K = E_E' + E_K'$

$E_E - E_E' = E_K' - E_K$

$-\Delta E_E = \Delta E_K$

Electrical Energy Loss = Kinetic Energy gain

Reverse : $-\Delta E_K = \Delta E_E$ (loss = gain)

Ex:

In a uniform field of conducting plates, the electrical potential difference is 1.5x10^4 V. What is the speed of the electron as it reaches the positive plate. Assume it is initially at rest. me = 9.11x10^-31 kg

at negative plate

$\Delta V = 1.5 \times 10^4 V$

$v_i = 0 m/s$

$m_e = 9.11 \times 10^{-31} kg$

$q = -1.6 \times 10^{-19} C$

$E_E + \cancel{E_K}^{0} = E_E' + E_K'$

$E_E - E_E' = E_K'$

$-\Delta E_E = E_K'$

$-q\Delta V = \frac{1}{2} m v_f'^2$

$v' = \sqrt{\frac{-2qV}{m}}$

$v' = \sqrt{\frac{-2(-1.6 \times 10^{-19})(1.5 \times 10^4)}{9.11 \times 10^{-31}}}$

$v' = 7.3 \times 10^7 m/s$