

ELECTRIC FIELDS COLLABORATIVE PROBLEMS

p. 1

$$1. m = 2.6 \times 10^{-15} \text{ kg}$$

$$F_{\text{net}} = 0 \text{ N}$$

$$d = 0.50 \text{ cm}$$

$$F_g = F_e$$

$$= 5.0 \times 10^{-3} \text{ m}$$

$$mg = qE$$

$$V = 270 \text{ V}$$

$$\text{But } qV = qEd \Rightarrow E = \frac{V}{d}$$

$$N = ?$$

$$q_e = 1.602 \times 10^{-19} \text{ C}$$

$$mg = \frac{qV}{d}$$

$$\text{But } q = Nq_e$$

$$\therefore mg = \frac{Nq_e V}{d} \Rightarrow N = \frac{dmg}{q_e V}$$

$$N = \frac{(5.0 \times 10^{-3} \text{ m})(2.6 \times 10^{-15} \text{ kg})(9.8 \text{ N/kg})}{(1.602 \times 10^{-19} \text{ C})(270 \text{ V})}$$

$$N = 2.94539$$

You can only have whole numbers of electrons!

$$\therefore N = 3 \text{ electrons}$$

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p. 2

2a) $m_e = 9.11 \times 10^{-31} \text{ kg}$

$v_i = 0 \text{ m/s}$

$V = 110 \text{ V}$

$d = 0.75 \text{ cm}$
 $= 7.5 \times 10^{-3} \text{ m}$

$\Delta E_k = ?$

$q_e = 1.602 \times 10^{-19} \text{ C}$

$\Delta E_k = W = qEd = qV$

$\Delta E_k = (1.602 \times 10^{-19} \text{ C})(110 \text{ V})$

$\Delta E_k = 1.7622 \times 10^{-17} \text{ J}$

$\Delta E_k = 1.8 \times 10^{-17} \text{ J}$

b) $v_2 = ?$

$\Delta E_k = E_{k2} - E_{k1}$

but $v_i = 0 \text{ m/s}$, $\therefore \Delta E_k = E_{k2}$

$E_{k2} = \frac{1}{2} m v_2^2 \Rightarrow v_2 = \sqrt{\frac{2E_{k2}}{m}}$

$v_2 = \sqrt{\frac{2(1.7622 \times 10^{-17} \text{ J})}{9.11 \times 10^{-31} \text{ kg}}}$

$v_2 = 6.2199 \times 10^6 \text{ m/s}$

$v_2 = 6.2 \times 10^6 \text{ m/s}$

c) $a = ?$

$F_{\text{net}} = F_e$

$ma = qE$ but $qV = qEd \Rightarrow E = \frac{V}{d}$

$ma = \frac{qV}{d}$

$a = \frac{qV}{md}$

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p.3

$$2 \text{ count}) \quad a = \frac{(1.602 \times 10^{-19} \text{ C})(110 \text{ V})}{(9.11 \times 10^{-31} \text{ kg})(7.5 \times 10^{-3} \text{ m})}$$

$$a = 2.57914 \times 10^{15} \text{ m/s}^2$$

$$a = 2.6 \times 10^{15} \text{ m/s}^2$$

$$d) \quad t = ? \quad a = \frac{v_2 - v_1}{t} \Rightarrow t = \frac{v_2 - v_1}{a}$$

$$t = \frac{6.2199 \times 10^6 \text{ m/s} - 0 \text{ m/s}}{2.57914 \times 10^{15} \text{ m/s}^2}$$

$$t = 2.4116 \times 10^{-9} \text{ s}$$

$$t = 2.4 \times 10^{-9} \text{ s}$$