p.354 #2,3,5–7 ; p.365 #5

2. $\Delta V = ?$
$d = 3.0\,mm$
$= 3.0\times10^{-3}\,m$
$\mathcal{E} = 250\,V/m$

$qV = q\mathcal{E}d$
$V = \mathcal{E}d$
$= (250\,V/m)(3.0\times10^{-3}\,m)$
$= 0.75\,V$

3. $m_p = 1.67\times10^{-27}\,kg$
$V_i = 75.0\,V$
$V_f = -20.0\,V$

a) $\Delta E_K = ?$
$q_p = 1.602\times10^{-19}\,C$

$\Delta E_E = \Delta E_K = qV_f - qV_i$
$\Delta E_K = q(V_f - V_i)$
$= (1.602\times10^{-19}\,C)(-20.0\,V - 75.0\,V)$
$= -1.5219\times10^{-17}\,J$
$= -1.52\times10^{-17}\,J$

b) For an electron, same magnitude, but positive
The electron will travel in the opposite direction.

5. $V = 2.5\times10^{4}\,V$
a) low to high

b) $\Delta E_K = ?$

$\Delta E_K = q\Delta V$
$= (1.602\times10^{-19}\,C)(2.5\times10^{4}\,V)$
$= 4.005\times10^{-15}\,J$
$= 4.0\times10^{-15}\,J$

c) $v_1 = 0$
$v_2 = ?$

$\Delta E_K = E_{K2} = \frac{1}{2}mv_2^2$

$v_2 = \sqrt{\frac{2E_K}{m}}$
$= \sqrt{\frac{2(4.0\times10^{-15}\,J)}{9.11\times10^{-31}\,kg}}$

$= 9.4\times10^{7}\,m/s$

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6. $\mathcal{E} = 2.26 \times 10^5$ N/C
$\Delta V = ?$
$d_1 = 2.55$ m
$d_2 = 4.55$ m

$qV = q\mathcal{E}d$
$V = \mathcal{E}(d_2 - d_1)$
$V = (2.26 \times 10^5 \text{ N/C})(4.55\text{ m} - 2.55\text{ m})$
$V = 4.52 \times 10^5$ V

7. $v_x = 4.0 \times 10^6$ m/s
$\mathcal{E} = 150$ N/C [down]
$\Delta x = 6.0$ cm
$= 6.0 \times 10^{-2}$ m

a) $v_{y_2} = ?$
$v_{y_1} = 0$ m/s

$F_e = q\mathcal{E} = F_{NET}$

But $F_{NET} = ma$

$\therefore ma = q\mathcal{E}$

$\therefore a = \dfrac{q\mathcal{E}}{m}$

But $a = \dfrac{v_2 - v_1}{\Delta t}$, but $v_1 = 0$

$\therefore a = \dfrac{v_2}{\Delta t}$

To find $\Delta t$, $v_x = \dfrac{\Delta x}{t} \Rightarrow t = \dfrac{\Delta x}{v_x}$

$\therefore a = \dfrac{v_2 v_x}{\Delta x}$

$\therefore \dfrac{v_2 v_x}{\Delta x} = \dfrac{q\mathcal{E}}{m} \Rightarrow v_2 = \dfrac{q\mathcal{E}\Delta x}{m v_x}$

$$v_2 = \frac{(1.602 \times 10^{-19}\text{ C})(150\text{ N/C})(6.0 \times 10^{-2}\text{ m})}{(9.11 \times 10^{-31}\text{ kg})(4.0 \times 10^6\text{ m/s})} = 4.0 \times 10^5\text{ m/s}$$

p.354 # 2, 3, 5 – 7; p.365 # 5

7b) $V_f = ?$


$\tan\theta = \frac{V_y}{V_x} = \frac{4.0\times10^5}{4.0\times10^6}$

$\theta = 5.7°$

$V_f = \sqrt{V_x^2 + V_y^2}$

$= \sqrt{(4.0\times10^6\ m/s)^2 + (4.0\times10^5\ m/s)^2}$

$= 4.0\times10^6\ m/s$

$\therefore\ V_f = 4.0\times10^6\ m/s$ [forward 5.7° up].

p.365 #5 $m = 5.2\times10^{-15}\ kg$
$d = 0.21\ cm$
$= 2.1\times10^{-3}\ m$
$\Delta V = 220\ V$

a) $q = ?$

$q = \frac{mgd}{V}$

$= \frac{(5.2\times10^{-15}\ kg)(9.8\ N/kg)(2.1\times10^{-3}\ m)}{220\ V}$

$= 4.9\times10^{-19}\ C$

b) $Q = Ne \Rightarrow N = \frac{q}{q_e}$

$N = \frac{4.9\times10^{-19}\ C}{1.602\times10^{-19}\ C}$

$N = 3$