1. $L = \frac{L_p}{\gamma} \qquad \gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$

$\frac{2}{5} = \sqrt{1 - \frac{v^2}{c^2}}$

$\frac{4}{25} = 1 - \frac{v^2}{c^2}$

$\frac{v^2}{c^2} = \frac{21}{25}$

$v = \sqrt{\frac{21}{25}}\, c$

$= \frac{3 \times 10^8 \times \sqrt{21}}{5}$

3. $f' = \frac{\sqrt{1 + v/c}}{\sqrt{1 - v/c}}\, f$

$\frac{c}{\lambda'} = \sqrt{\frac{c+v}{c-v}}\, \frac{c}{\lambda}$

$\frac{\lambda}{\lambda'} = \sqrt{\frac{c+v}{c-v}}$

$\left(\frac{650}{520}\right)^2 = \frac{c+v}{c-v}$

$(c-v)\left(\frac{650}{520}\right)^2 = c+v$

$v = (c-v)\left(\frac{650}{520}\right)^2 - c$

$v = \left(\frac{650}{520}\right)^2 c - \left(\frac{650}{520}\right)^2 v - c$

$v + \left(\frac{650}{520}\right)^2 v = \left(\frac{650}{520}\right)^2 c - c$

$\frac{41}{25} v = \frac{25}{25} c - c$

$\frac{}{16}$ $\frac{}{16}$

$$v = \frac{16}{41}\left(\frac{9}{16}\right)c$$

$$= 65.85 \text{ Mm/s}$$

$$= 237.06 \times 10^6 \text{ km/h}$$

5. $x_R = 3\text{m}$ $t_R = 1\text{ ns}$ $x_B = 5\text{m}$ $t_B = 9\text{ ns}$ $\Big\} \Rightarrow S$

$\Delta x' = 0$

a) $\Delta x' = \gamma(\Delta x - v\Delta t)$

$0 = \gamma(2 - v(8\times10^{-9}))$

$0 = 2 - v(8\times10^{-9})$

$v = \frac{2}{8\times10^{-9}}$ m/s

$v = 2.5\times10^8$ m/s

b) $x'_R = x'_B = x'$

$\gamma = \frac{1}{\sqrt{1-(\frac{v}{c})^2}} = 1.81$

$x' = \gamma(x_R - vt_R)$

$= 1.81(3 - (0.25\times10^9)(1\times10^{-9}))$

$= 1.81(3 - 0.25)$

$= 1.81 \times 2.75$

$= \underline{4.98\text{ m}}$

c) $t' = \gamma\left(t - \frac{v}{c^2}x\right)$

$t'_R = 1.81\left(1\times10^{-9} - \frac{0.25\times10^{-9}}{}\times 5\right)$

$\left(\qquad (3\times10^8)^2 \right)$

$=$

Chapter 40

4. $\lambda_g = 546.1\times10^{-9}\ m$

$\Delta V_s = 0.376\ V$

a) $\Delta V_s = \dfrac{K_{max}}{e}$

$= \dfrac{hf - \varphi}{e}$

$e\Delta V_s = h\dfrac{c}{\lambda} - \varphi$

$\varphi = \left(\dfrac{6.626\times10^{-34}\times 3\times10^8}{546.1\times10^{-9}}\right)\left(\dfrac{1}{1.602\times10^{-19}}\right) - 0.376$

$= 2.27 - 0.376$

$= \underline{1.89\ eV}$

b) $e\Delta V = hf - \varphi$

$= h\dfrac{c}{\lambda} - \varphi$

$= \dfrac{6.626\times10^{-34}\times 3\times10^8}{587.5\times10^{-9}\times 1.6\times10^{-9}} - 1.89$

$e\Delta V = 0.216\ eV$

$\Delta V_s = 0.216\ V$