12 $V = J\frac{U}{R}$

4. $V_h dt \cdot r_h = V_L dt \cdot r_L$

$V_L = \frac{V_h \cdot r_h}{r_L} = \frac{7.23 \times 8910 + 6.4 \times 10^{-3}}{230 + 6.4 \times 10^{-3}}$ m/s

$= 7.95$ km/s

PSV 7/4/2015

1. $X_{12} = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$

$X = \frac{(m_1 + m_2) X_{12} + m_3 x_3}{m_1 + m_2 + m_3} = \frac{m_1 x_1 + m_2 x_2 + m_3 x_3}{m_1 + m_2 + m_3}$

2. i) $(0,0)$.

ii) $(0,\frac{R}{2})$.

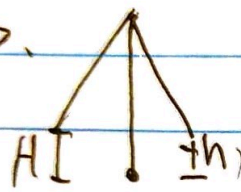
$$\vec{r} = \frac{4(0,0) - (\frac{1}{2},\frac{1}{2})}{3} = (-\frac{1}{6},-\frac{1}{6})$$

iii)

$$y = 0$$

$$x = \frac{\frac{\pi R^2}{4}\left(-\frac{R}{2}\right)}{\frac{\pi R^2}{2}R} = \frac{R}{8}$$

3.



$$mgH = \frac{1}{2}mv_1^2 \quad v_1 = \sqrt{2gH}$$

$$mv_1 = (m+m)v_2 \quad v_2 = \frac{mv_1}{m+m} = \frac{\sqrt{2m^2gH}}{m+m}$$

$$\frac{1}{2}(m+m)v_2^2 = mgh \quad v_2^2 = 2gh$$

$$\frac{2m^2gH}{(m+m)^2} = 2gh$$

$$2m^2H = 2gh(m+m)^2$$

$$H = \frac{(m+m)^2h}{m^2} = 10.1$$

4.

i) $\frac{GMm}{R^2} = m\frac{4\pi^2\frac{R}{2}}{T^2}$

$$\frac{GM}{R^2} = \frac{4\pi^2R}{T^2}$$

$$T^2 = \frac{2\pi^2R^3}{GM}$$

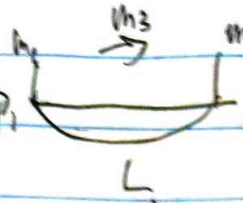
ii) $\frac{GMm}{R^2} = m\frac{4\pi^2x}{T^2}$

$$\frac{Gm}{4\pi^2R^2} = \frac{x}{m+M} \quad T^2 = \frac{4\pi^2R^3}{G(m+M)}$$

$$\frac{GMm}{x^2} = m\frac{4\pi^2(R-x)}{T^2}$$

$$\frac{GMT^2}{4\pi^2R^2} = \frac{mR}{m+M}$$

$$x = \frac{mR}{m+M}$$

6. 

i) $m_3 v = (m_1+m_2)V$

$V = \frac{m_3}{m_1+m_2} v$

ii) $(v+V)t = L$

$t = \frac{L}{v+V}$

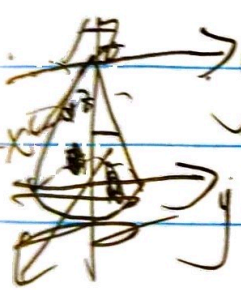
iii) $x = Vt = \frac{m_3 L}{m_1+m_2+m_3}$

iv) See P_1 is 0. $CM_{BEGIN} = \frac{m_2 L}{m_1+m_2+m_3}$

$CM_{End} = \frac{(m_2+m_3)L}{m_1+m_2+m_3} - x$

$= \frac{(m_2+m_3)L}{m_1+m_2+m_3} - \frac{m_3 V \cdot L}{m_2+m_1+m_3 V}$

$= \frac{m_2 L}{m_1+m_2+m_3} = CM_B$



$x=0, y=0$ $M = \frac{1}{3} \cdot \pi R^2 h$

$z = \frac{1}{M} \int_0^h z \left(\frac{z}{h} R\right)^2 \cdot \pi \cdot dz$

$= \frac{3}{\pi R^2 h} \cdot \pi \frac{R^2}{h^2} \cdot \frac{1}{4} z^4 \Big|_0^h$

$= \frac{3}{h^3} \cdot \frac{1}{4} h^4 = \frac{3}{4} h$

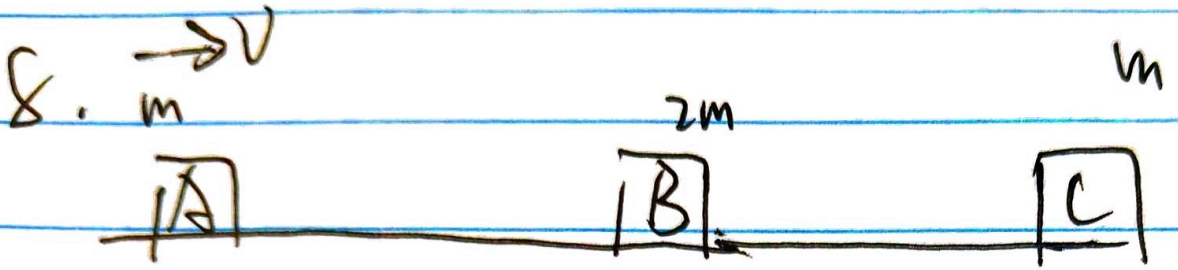
$\therefore \frac{3}{4} h$ from the top.

7. $V_0 = 12 m/s$

$t = 2 \frac{V_0 \sin\theta}{g}$

$x = V_0 \cos\theta \cdot t = 2 \frac{V_0^2 \sin\theta \cos\theta}{g} = \frac{V_0^2 \sin 2\theta}{g} = 15.2 m$

$\sin 2\theta = \frac{xg}{V_0^2} =$

8. 

C_1: $m_1 = m$, $m_2 = 2m$

$v_1 = V$ $\quad v_{02} = 0$

$v_2' = \frac{2m}{3m} V = \frac{2}{3}V$

$v_1' = \frac{-m}{3m} V = -\frac{1}{3}V$

C_2: $m_2 = 2m$, $m_3 = m$

$v_2' = \frac{2}{3}V$, $v_3 = 0$

$v_2'' = \frac{m}{3m} \cdot \frac{2}{3}V = \frac{2}{9}V$

$v_3' = \frac{4m}{3m} \cdot \frac{2}{3}V = \frac{8}{9}V$

$\vec{v_0} = v_0 \uparrow$

$v_0^2 = v_1^2 + 2v_2^2$

$m\vec{v_0} = m\vec{v_1} + m\vec{v_2} + m\vec{v_3}$

$m(v_0 \cdot 0) = m(v_1 \cdot 0) + 2m(v_2 \cos\theta)$

$\vec{v_2} = (|v_2|\cos\theta, |v_2|\sin\theta)$

$= \left(\frac{3}{5}v_0, \frac{\sqrt{3}}{5}v_0\right)$

$v_1 = \left(-\frac{1}{5}v_0, 0\right)$.

$$\begin{cases} v_0 = v_1 + \sqrt{3}v_2 \\ v_0^2 = v_1^2 + 2v_2^2 \end{cases}$$

$$\begin{cases} (v_0+v_1)(v_0-v_1) = 2v_2^2 \\ (v_0+v_1)(v_0-v_1) = (v_0+v_1)\sqrt{3}v_2 \end{cases}$$

$2v_2 = (v_0+v_1)\sqrt{3}$

$v_2 = \frac{\sqrt{3}}{2}(v_0+v_1)$

$v_1 = -\frac{3}{2}(v_0+v_1) + v_0 = -\frac{1}{5}v_0 - \frac{3}{2}v_1$

$\frac{5}{2}v_1 = -\frac{1}{2}v_0$

$v_1 = -\frac{1}{5}v_0$ $\quad v_2 = \frac{2\sqrt{3}}{5}v_0$