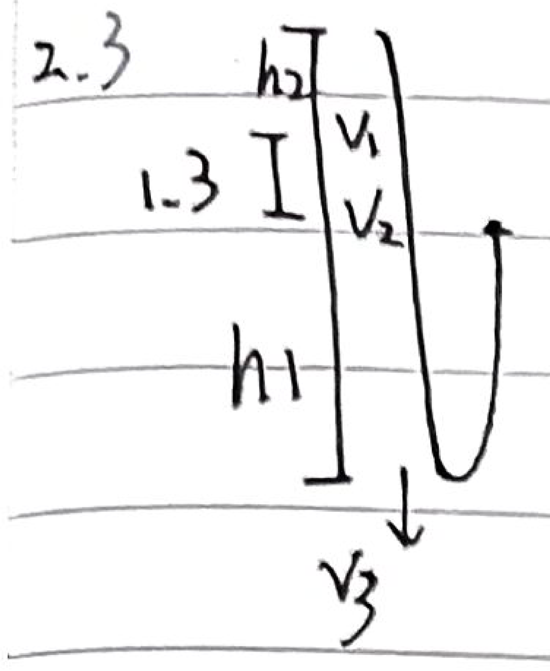
CH2.

2.3

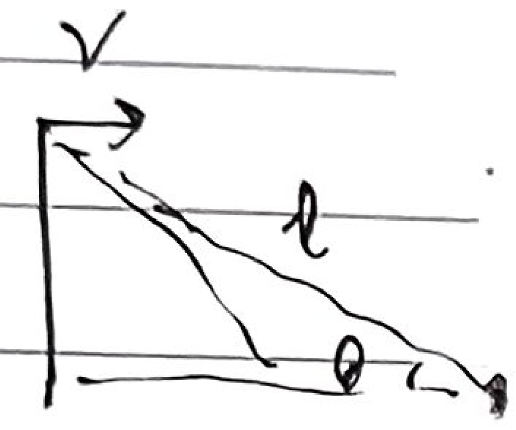


$$\because \begin{cases} H = \frac{1}{2}gt^2 \\ v_1 = g(t - t_0 - \frac{1}{2}t_1) \\ h = v_1 t_0 + \frac{1}{2}g t_0^2 \end{cases}$$

$\therefore t = 2.12s$

$H = 22.1\,m$

2.5.



(a) $\begin{cases} \frac{1}{2}gt^2 = l\sin\theta \\ d = l\cos\theta - vt \end{cases}$

$\therefore d = l\cos\theta - v\sqrt{\frac{2l\sin\theta}{g}}$

(b) if $l\cos\theta > v\sqrt{\frac{2l\sin\theta}{g}}$

then $\frac{l\cos^2\theta}{\sin\theta} > \frac{v^2}{g}$

$\therefore$ $d > 0$. before

$d = 0$. hit

$d < 0$. pass.

2.9. v_1. $v_2 = 384/s$.

$\because \frac{db}{dv_1} > 0$

$\therefore b = 2 \times \frac{v_1 - v_2}{2} = v_1 - v_2$

$\therefore v_1 = b + v_2 = 387$, $f = 387\,Hz$.

2.14. (a) $t = \frac{2S_{AB}}{v'}$

(b) $t = \frac{S_{AB}}{v'+u} + \frac{S_{AB}}{v'-u}$

(c) $t = \frac{2S_{AB}}{\sqrt{v'^2 - u^2}}$. $\left(\cos\theta_{uv'} = \frac{-u}{v'}\right)$

$v' > u$

2.16. (a) In tube system.

$V_{virus} = V_0$.

$a' = 0$, $F_{virus} = 0$

$\therefore G = mg$.

$F_{float} = mg$.

(b) In the lab system

$V_{v \to t} = V_0$.

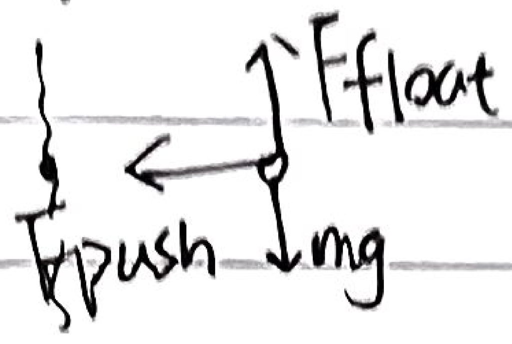
$V_{t \to lab} = \frac{n\pi}{30} \times r$

$\therefore V_{virus \to lab} = \vec{V_0} + \frac{n\pi r}{30}$.

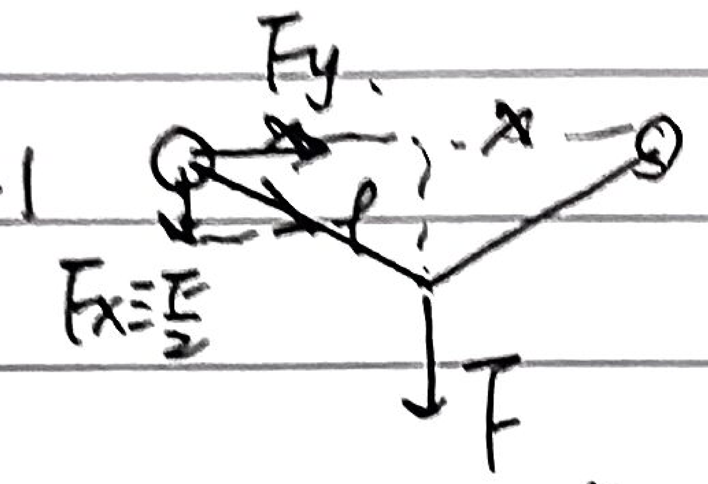
$= V_0 \vec{e_\rho} + \frac{n\pi r}{30} \vec{e_\varphi}$

$G = mg$. $F_{float} = mg$.

$F_{push} = m \times \frac{n^2\pi^2}{900} r$.



3.1

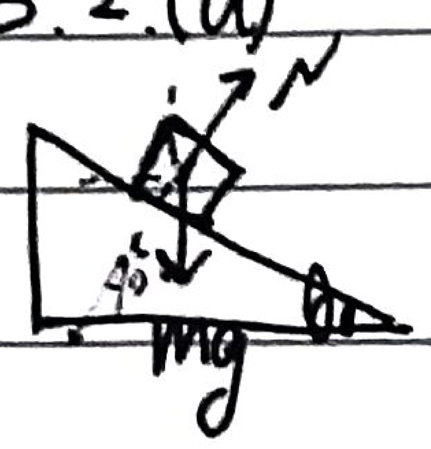


$F_y = -\frac{F}{2} \times \frac{x}{\sqrt{l^2 - x^2}}$

$\therefore F_y = ma$.

$a = \frac{-F}{2m} \times \frac{x}{\sqrt{l^2 - x^2}}$

3.2 (a)



$F_i = mg \tan\theta$.

$\therefore a_x = \frac{F_i}{m}$

$= g \tan\theta$

...

(b) $F = (m' + m) g \tan\theta$

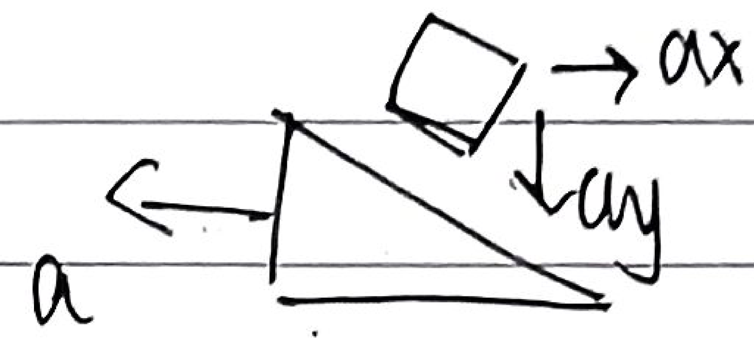
(c) $\begin{cases} F_n \sin\theta + (-m a_1) = m_1 a_x \\ F_n \cos\theta - mg = m\, a_y \end{cases}$

$$\begin{cases} -F_n \sin\theta = m'a \\ F_N - F_n \cos\theta = m'g. \end{cases}$$

$\therefore$ $m'a = -m(a+a_x)$. that is $(m'+m)a = -m a_x$

$-\frac{m'}{\tan\theta} a = mg - m a_x \tan\theta$

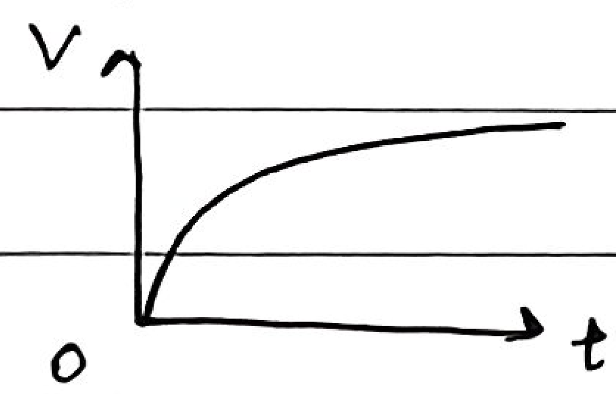
$\therefore$
$$\begin{cases} a_x = \dfrac{g}{\tan\theta + \frac{m'}{(m+m')\tan\theta}} = \dfrac{g\tan\theta}{(\tan\theta)^2 + \frac{m'}{m+m'}} \\ a = -\dfrac{mg\tan\theta}{(m'+m)(\tan^2\theta) + m'} \\ a_y = \dfrac{-g\tan^2\theta}{\tan^2\theta + \frac{m'}{m+m'}} \end{cases}$$



3.5 (a) $-kv = -mg$

$v = \frac{mg}{k}$

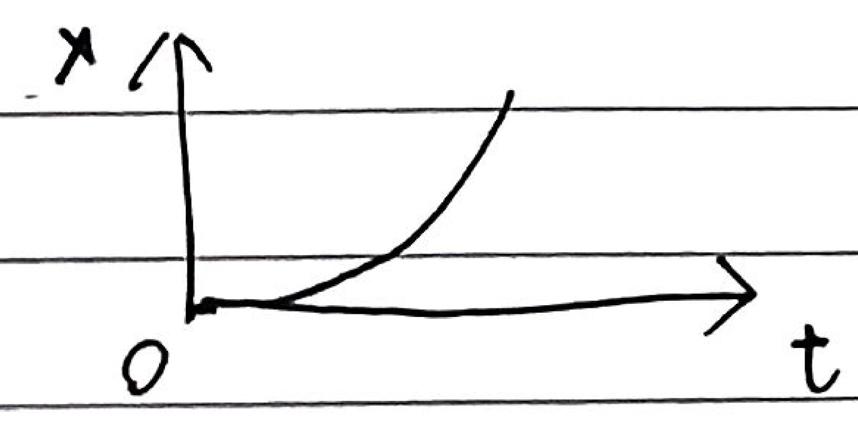
(b) $mg - kv = mv'$



(c) $\int (mg - kv)dt = \int mv' dt$

$mgt - kx = mv$

$kx = mgt - mv$



3.10 $Ft = 2mv$

$F = 2v \times \mu$

$\frac{1}{2}mv_0^2 = \frac{1}{2}mv^2 + 2mgr$

$v_0^2 = v^2 + 4gr.$

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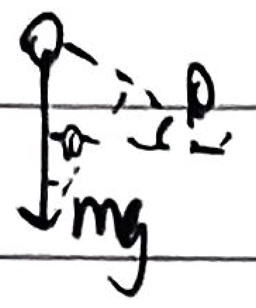
3.13 (a) $\begin{cases} -mg2r = \frac{1}{2}m \times v^2 - \frac{1}{2}mv_0^2 \\ mg = m \times \frac{v^2}{r} \end{cases}$

$\therefore \begin{cases} v = \sqrt{gr}. \\ v_0 = \sqrt{5gr}. \end{cases}$

$\therefore v_m = \sqrt{5gr}$

(b) $\begin{cases} mg\sin\theta = mv^2 \times \frac{1}{r} & (1) \\ -mg \times (r + r\sin\theta) = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2 & (2) \end{cases}$



$\therefore \begin{cases} v_0^2 = 3gr\sin\theta + 2gr \\ v_0 = \sqrt{5gr} \times \frac{31}{40} \end{cases}$

$\therefore \sin\theta = \frac{1}{3} \times \frac{1}{gr}(v_0^2 - 2gr)$

$= \frac{1}{3} \times \left[\left(\frac{31}{40}\right)^2 \times 5 - 2\right]$

$\approx \frac{1}{3}.$

$\theta \approx 19°$