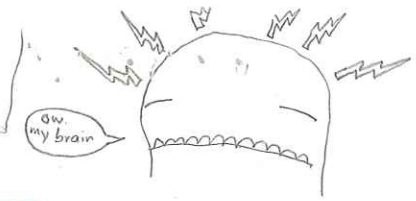
Simple Harmonic Motion



① $T = 2\pi\sqrt{\frac{m}{k}}$

$k = \frac{(2\pi)^2 m}{T^2}$

$k = 110\ N/m$

② $k = 110\ N/m$

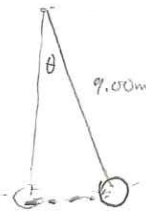
③ $\Sigma_T = \frac{1}{2}kA^2$

$\Sigma_T = 0.79\ J$

④a. $T = 2\pi\sqrt{\frac{l}{g}}$

$T = 6.02\ s$

b.



$\theta = \frac{A}{9.00\ m}$ (in radians)

$6.00° \times \frac{\pi}{180} = \frac{A}{9.00m}$

$A = 0.942m$

c. $v_{max} = \frac{2\pi A}{T} = A\omega$

$v_{max} = 0.983\ m/s$

d. $a_{max} = A\omega^2$ (or $a = \frac{v^2}{A}$)

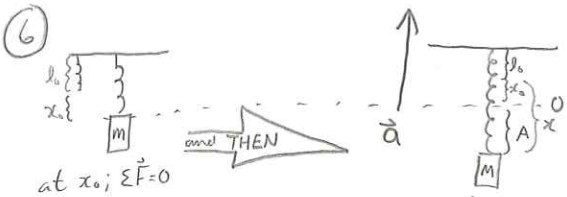
$a_{max} = A\frac{g}{l}$

$a_{max} = 1.03\ m/s^2$

⑤ Version 1

* Answers may vary.

⑥



at x_0; $\Sigma\vec{F} = 0$

$kx_0 = mg$

$x_0 = 0.0490m$

$\Sigma\vec{F} = m\vec{a}$

$kx - mg = ma$

$x = \frac{0.4(2.0\ m/s^2) + 0.4(9.8\ m/s^2)}{80.0\ N/m}$

$x = 0.0590m$

$A = x - x_0 = 0.0100m$

b. $W_{nc} = 0$ (relative to new 0m position it's identical to a horizontal spring)

$\frac{1}{2}kA^2 = \frac{1}{2}mv_{max}^2$

$v_{max} = \sqrt{\frac{k}{m}}A$

$v_{max} = 0.834\ m/s$

⑦ a. $1.40\ m/s$

b. $2\ s$

c. $19.7\ N/m$

d. $0.446m$

e. $4.40\ m/s^2$

f. $\vec{x} = -0.446\sin(\pi t)$

$\vec{a} = +4.40\sin(\pi t)$