Blame 16 Ant 10
Blue 2 Total 28
B + B 18

PR8 SHM

MC) 1) II & III (d) ✓

2) (c) ✓

3) $\frac{1}{2}kA^2 = \frac{1}{2}k\left(\frac{A}{2}\right)^2 + \frac{1}{2}mv^2$

$= \frac{1}{8}kA^2 + \frac{1}{2}mv^2$

$kA^2 = \frac{1}{4}kA^2 + mv^2$

$\frac{3}{4}$ (e) ✓

4) $\frac{1}{2}kA^2 \rightarrow 16\,m$ ~~(d)~~

~~both~~ $\frac{1}{2}kA^2 = \frac{1}{2}(m)v^2$

~~double speed~~ half speed

(b) (c) ✗

5) $T = 2\pi\sqrt{\frac{m}{k}}$ (d) ✓

6) $f = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$

$f^2 = \frac{1}{4\pi^2}\cdot\frac{k}{m}$ slope $= \frac{k}{4\pi^2}$ (d) ✓

7) ? (A)

8) $F = kx = ma$

$a = \frac{k}{m}x = \frac{k}{m}A$

$f = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$

$\omega = 2\pi f = \sqrt{\frac{k}{m}}$

$A\omega^2$ (C) ~~(A)~~

(A)

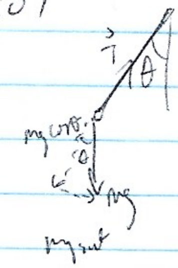
5

~~Blu~~ ~~Blu~~

9) ~~amplitude doe~~

amplitude doesn't matter if the $\angle$ is small (c) ✓

10)



$T = mg\cos\theta_{max}$ (b) ✓

FR)

1) ~~for~~ A) $\Sigma F = \cancel{\frac{1}{2}k\,x} = ma$

$\cancel{= \frac{1}{2}k\left(\frac{1}{4}L\right)} = ma$

$kx = ma$

$\frac{1}{4}kL = ma$

$\boxed{a = \frac{kL}{4m}}$ ✓

b) $\frac{1}{2}\left(\frac{1}{2}mv_1^2\right) = \cancel{\frac{1}{2}} m v_{1a}^2 + \cancel{\frac{1}{2}} m v_{2a}^2$

$v_{2a}^2 + v_{1a}^2 = \frac{1}{2}v_1^2$ $\quad v_{2a} = v_{1a}$

$2v_a^2 = \frac{1}{2}v_1^2$

$v_a^2 = \sqrt{\frac{v_1^2}{4}} = \frac{1}{2}v_1$ ✓

c) $\frac{1}{2}m(v_{1a})^2 = \frac{1}{2}kA^2$

$\frac{1}{2}(PE_{s_1}) = \frac{1}{2}kA^2$

$\frac{1}{2}\left(\cancel{\frac{1}{2}}k\left(\frac{1}{4}L\right)^2\right) = \cancel{\frac{1}{2}k}A^2$

$\frac{1}{32}L^2 = A^2$ $\quad$ ~~$A = $~~

$A = \frac{1}{4\sqrt{2}}L = \boxed{\frac{\sqrt{2}}{8}L}$ ~ 4

$\sqrt{32}$

$4\sqrt{2}$

$\sqrt{\frac{1}{32}}$

d) $T = 2\pi\sqrt{\frac{m}{k}}$ $\quad T = T_0$ ✓

e) $\frac{1}{4}\left(\frac{1}{2}k(x_0)^2\right) = mgH + \frac{1}{2}mv_a^2 = \frac{1}{2}mv_f^2$

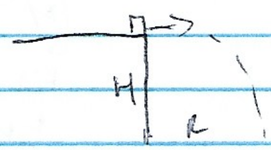
$\frac{1}{2}mv_a^2 = \frac{1}{8}k\left(\frac{1}{4}L\right)^2 - \cancel{mgH}$

$\frac{1}{2}mv_a^2 = \frac{1}{8}k\frac{1}{16}L^2 - \cancel{mgH}$

$mv_a^2 = \frac{1}{64}kL^2 - \cancel{mgH}$

$v_a = \sqrt{\frac{kL^2}{64m} - \cancel{gH}}$

$v = \sqrt{\frac{kL^2}{64m}}$



$v_{f_y}^2 = \cancel{v_{0_y}^2} + 2gH$

$v_f = \cancel{v_0} + gt$

$\sqrt{2gH} = gt$

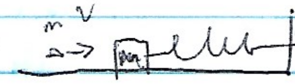
$t = \sqrt{\frac{2H}{g}}$

$R = vt = \sqrt{\frac{kL^2}{64m}\cdot\frac{2H}{g}}$

$= \boxed{\sqrt{\frac{kL^2H}{32mg}}}$ ~

$\frac{\sqrt{2}}{8} = \frac{1}{\sqrt{32}}$

1

2) 

A) $mv = (m+M)v_a$

$v_a = \frac{mv}{m+M}$ ✓

B) $\frac{1}{2}(m+M)v_a^2 = \frac{1}{2}kA^2$

$A^2 = \frac{\cancel{m+M}}{k}\cdot\frac{m^2v^2}{(m+M)^{\cancel{2}}}$

$= \frac{m^2v^2}{k(m+M)}$

$\boxed{A = \frac{mv}{\sqrt{k(m+M)}}}$ ✓

C) $f = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{k}{(m+M)}}$ ✓

D) ? ~

3) a) $\frac{1}{2}kA^2 = \frac{1}{2}mv^2 + \frac{1}{2}k\left(\frac{A}{2}\right)^2$

$\frac{1}{2}kA^2 = \frac{1}{2}mv^2 + \frac{1}{8}kA^2$

$kA^2 - \frac{1}{4}kA^2 = mv^2 = \frac{3}{4}kA^2$

$v = \sqrt{\frac{3kA^2}{4M}}$ ✓

b) $\frac{1}{2}(m+M)v^2 + \frac{1}{2}k\left(\frac{A}{2}\right)^2 = \frac{1}{2}kA^2$

$v^2(m+M) = kA^2 - k\left(\frac{A}{2}\right)^2$

$v^2 = \frac{3kA^2}{4(m+M)}$

$v = \sqrt{\frac{3kA^2}{4(m+M)}}$ ~

4

c) $T = 2\pi\sqrt{\frac{m}{k}} = 2\pi\sqrt{\frac{(m+M)}{k}}$ ✓

d) $\frac{1}{2}(m+M)v^2 + \frac{1}{2}kA^2 = \frac{1}{2}kA_f^2$

$A_f^2 = A^2 + \frac{m+M}{k}v^2$

$A_f = A + v\sqrt{\frac{m+M}{k}}$ ~

e) no, it only depends on the mass ✓

f) No, energy is conserved ~

4) ?

2

FR 1) c) $\frac{1}{2}m(v_{1a})^2 = \frac{1}{2}kA^2$

$PE_{s_1} = \frac{1}{2}kA^2$

$\frac{1}{2}\left(\frac{1}{2}\cancel{k}\left(\frac{1}{4}L\right)^2\right) = \frac{1}{2}\cancel{k}A^2$

$A = \frac{1}{\sqrt{8}}L$ ~

MC 4) $\frac{1}{2}mv^2 = \frac{1}{2}kA^2$

$v = A\sqrt{\frac{k}{m}}$

$\frac{1}{\sqrt{2}}$ (C) ✓

7) $x = A\sin(\omega t + \phi)$

$\omega = 2\pi f = \frac{2\pi}{T} = \cancel{\frac{2\pi}{2\pi}\sqrt{\frac{k}{m}}}$

$= \frac{2\pi}{2\pi}\sqrt{\frac{k}{m}} = 10$

$6 = 6\sin(\phi)$

$\sin(\phi) = 1$

$\phi = \frac{\pi}{2}$ (A) ✓

8) a_{max} @ $x = A$

$F = kA = ma$

$a = \frac{k}{m}A$

$\omega = \sqrt{\frac{k}{m}}$ $= A\omega^2$ (C) ~

2

1) c) $K_{1a} \rightarrow U_{sa} \rightarrow \frac{1}{2}mv_{1a}^2 = \frac{1}{2}kA_a^2$

$A_a^2 = \frac{mv_1^2}{4k}$

$U_{s_b} = \frac{1}{2}k\left(-\frac{L}{4}\right)^2$; K_{1b} $= \frac{1}{2}mv_{1b}^2$

$mv_1^2 = \frac{1}{16}kL^2$ $A_a = \frac{1}{8}L$; $v_b = \sqrt{\frac{k}{m}}\frac{L}{4}$ ✓

e) $H = \frac{1}{2}gt^2$ $t = \sqrt{\frac{2H}{g}}$ $v_1 = \sqrt{\frac{k}{m}}\frac{L}{4}$

$R = v_{0x}t = \frac{1}{2}v_b\sqrt{\frac{2H}{g}} = \boxed{\frac{L}{8}\sqrt{\frac{2kH}{mg}}}$ ✓

2) d) $x = A\sin(\omega t + \phi)$

$\phi = 0$ $x = 0$ $t = 0$

$x = \frac{mv}{\sqrt{k(m+M)}}\sin\left(\sqrt{\frac{k}{m+M}}t\right)$ ✓

3) b) $Mv = (M+m)v_a$

$v_a = \frac{M}{(M+m)}\sqrt{\frac{3gh}{4}}$ ✓

RY

3) d) $E_a = \frac{1}{2} k A^2$

$K_a + U_s = \frac{1}{2}(M+m) v_a^2 + \frac{1}{2} k \left(\frac{A}{2}\right)^2$

$E_a = \frac{1}{2} k A_a^2 = K_a + U_s$

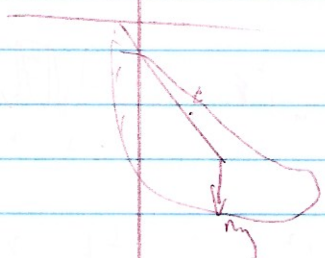
$\frac{1}{2}(M+m)\left(\frac{A}{M+m}\sqrt{\frac{3kM}{4}}\right)^2 + \frac{1}{2}k\left(\frac{A}{2}\right)^2$

$= \frac{1}{2} k A_a^2$

$A_a = \frac{A}{2}\sqrt{\frac{4M+m}{M+m}}$ ✓

f) Yes; cons. of momentum !

4) a)



$\tau = Mgd\sin\theta \otimes$ ✓

b) $\sin\theta \approx \theta$ $\tau = Mgd\theta$ ✓

c) $\vec{\tau} = I\vec{\alpha}$

$dMg\theta \otimes = I\vec{\alpha} = I\frac{d^2\theta}{dt^2}$

$\frac{d^2\theta}{dt^2} = -\left(\frac{dMg}{I}\right)\theta = -b\theta$

$T = \frac{2\pi}{\sqrt{\omega}} = \frac{2\pi}{\sqrt{b}} = 2\pi\sqrt{\frac{I}{dMg}}$ ✓

d) $I = \frac{1}{3}ML^2$; $d = \frac{L}{2}$

$T = 2\pi\sqrt{\frac{2L}{3g}}$ ✓ R6