Ws #5

(22) $m = 0{,}200\,kg$
$T = 0{,}250\,s$
$E = 2{,}00\,J$
a) $k = ?$
b) $A = ?$

a) $T = 2\pi\sqrt{\frac{m}{k}} \Rightarrow k = \frac{4\pi^2 m}{T^2} = \frac{4\pi^2 \cdot 0{,}2}{0{,}25^2}$

$$\boxed{k = 126\,N/m}$$

b) $E = \frac{1}{2}kA^2 \Rightarrow A = \sqrt{\frac{2E}{k}} = \sqrt{\frac{2 \cdot 2}{126}} = \boxed{0{,}178\,m}$

(23) $k = 6.50\,N/m$
$A = 10.0\,cm$
$x = 5\,cm \Rightarrow v = 30.0\,cm/s$
a) $m = ?$
b) $T = ?$
c) $a_{max} = ?$

a) $E_0 = E_f$

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

$m = \frac{k(A^2 - x^2)}{v^2} = 6.5\left(\frac{0{,}1^2 - 0{,}05^2}{0.3^2}\right)$

$$\boxed{m = 0{,}542\,kg}$$

b) $T = 2\pi\sqrt{\frac{m}{k}}$
$= 2\pi\sqrt{\frac{0{,}542}{6.5}}$

$$\boxed{T = 1.81\,s}$$

c) $a_{max} = A\omega^2 = A\frac{k}{m}$
$= \frac{(0{,}1)(6.50)}{0542}$

$$\boxed{a_{max} = 1.20\,m/s^2}$$

(32) $m = 0.326\,kg$
$T = 0{,}250\,s$
$E = 5.83\,J$
a) $v_{max} = ?$
b) $k = ?$
c) $A = ?$

if $v_{max} \Rightarrow x = 0$

$E_0 = E_f$
$E_0 = 0 + \frac{1}{2}mv^2 \Rightarrow v = \sqrt{\frac{2E_0}{m}}$

$v = \sqrt{\frac{2 \cdot 5.83}{0{,}326}}$

$$\boxed{v = 5.98\,m/s}$$

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

$k = \frac{4\pi^2 m}{T^2} = \frac{4\pi^2\,0{,}326}{.250^2}$

$$\boxed{k = 206\,N/m}$$

$A = \sqrt{\frac{2E}{k}} = \sqrt{\frac{2(5.83)}{206}} = \boxed{0{,}238\,m}$

(35) 120 cycles in 3 min
$g = 9.80\,m/s^2$
$T = ?$ $\ell = ?$

$T = \frac{3 \times 60}{120} = 1{,}5\,s$ $\quad T = 2\pi\sqrt{\frac{\ell}{g}}$

$\ell = \frac{T^2 g}{4\pi^2} = \frac{1{,}5^2 \cdot 9.8}{4\pi^2}$

$$\boxed{\ell = 0{,}559\,m}$$

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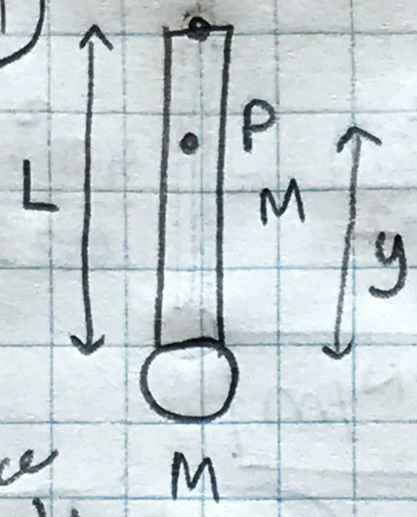

distance btw Pivot & CM

$x_{cm} = \frac{\Sigma x_i m_i}{\Sigma m_i}$

$d = \frac{\frac{ML}{2} + ML}{2M} = \frac{3L}{4}$

$I = I_{rod} + I_{ball}$

$\frac{1}{3}ML^2 + ML^2$

$I = \frac{4}{3}ML^2$

a) $T = 2mg$

from the pivot

From point P

fraction of rod → $\left(\frac{y}{L} \cdot M\right)g + Mg$ ← ball

$F = Mg\left(1 + \frac{y}{L}\right)$

c) $T = 2\pi\sqrt{\frac{I}{mgd}}$

$T = 2\pi\sqrt{\frac{4/3 ML^2}{2Mg\ 3L/4}}$

$= 2\pi\sqrt{\frac{16L}{18g}}$

$\boxed{T = \frac{4}{3}\pi\sqrt{\frac{2L}{g}}}$

c) $L = 2.00\,m \Rightarrow T = \frac{4}{3}\pi\sqrt{\frac{4}{9.8}} = \boxed{2.68\,s}$

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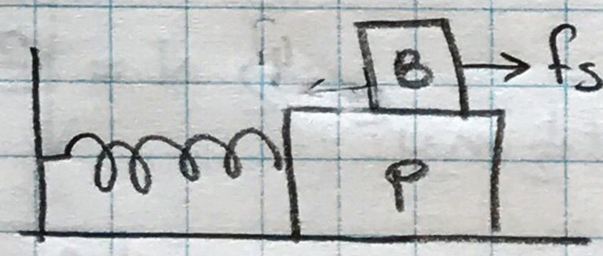

$f = 1.50\,Hz$

$\mu = 0.600$

$A = ?$

$\Sigma F_B = ma$

$f_s = ma$

$a_{max} = \frac{mg\mu}{m} = g\mu$

$f = \frac{\omega}{2\pi} \Rightarrow \omega = f2\pi$

$a_{max} = A\omega^2$

$g\mu = A\omega^2$

$A = \frac{g\mu}{f^2 4\pi^2} = \frac{(9.8)(0.6)}{(1.5^2)\,4\pi^2}$

$\boxed{A = 0.0662\,m}$