


Oscillations

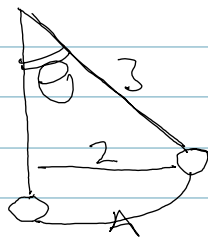
① 

a) $|F| = -kx \Rightarrow k = \frac{F}{x} = \frac{10}{0.05} = \underline{200 \text{ N/m}}$

b) $T = \frac{2\pi}{\omega} = 2\pi \sqrt{\frac{m}{k}} = 2\pi \sqrt{\frac{2}{200}} = \frac{2\pi}{10} = 0.2\pi \text{ s}$
 $= \underline{0.63 \text{ s}}$

c) $v_{\text{max}} = A\omega = 0.05 \frac{2\pi}{0.2\pi} = \underline{0.5 \text{ m/s}}$

②

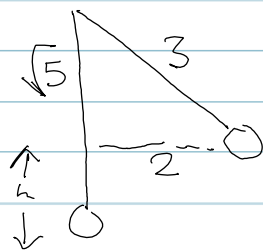


$\sin \theta = \frac{2}{3} \quad \theta = \underline{0.73 \text{ rad.}}$

$\omega = \sqrt{\frac{g}{l}} \quad \leftarrow$

$v_{\text{max}} = A\omega = 20 \sqrt{\frac{g}{l}} = \sqrt{gl} \theta$
 $= \underline{3.96 \text{ m/s}} \quad \parallel$

Cons. of energy



$h = 3 - \sqrt{5} = 0.76 \text{ m}$

$mgh = \frac{1}{2}mv^2$

$\Rightarrow v = \sqrt{2gh} = \underline{3.87 \text{ m/s}}$

3) Read off $T = 20s$ so $\omega = \frac{2\pi}{T} = \frac{\pi}{10} \text{ rad s}^{-1}$.

$$x_{\max}(t) = A e^{-bt/2m}$$

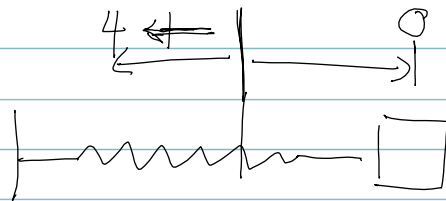
At $t=170$ $x_{\max} = 5 \text{ cm}$.

$$5 = 10 e^{-\left(\frac{b \times 170}{2}\right)}$$

$$-\ln 0.5 \times \frac{2}{170} = b$$

$$b = 8 \times 10^{-3} \text{ kg s}^{-1}$$

4) Incomplete data



$$\left. \begin{array}{l} t=0, \text{ max } x, v=0 \\ t=4 \text{ max } -x, v=0 \end{array} \right\} T=8s \quad \omega = \frac{2\pi}{T} = \frac{\pi}{4} \text{ rad s}^{-1}$$

$$x(t) = 4 \cos\left(\frac{\pi}{4} t\right)$$

$$v(t=2) = -\pi \text{ cm/s}$$

$$v(t) = -\frac{\pi}{4} \times 8 \sin\left(\frac{\pi}{4} t\right)$$

$$v(t=3) = -\frac{\pi}{\sqrt{2}} \text{ cm/s}$$

$$x(t=3) = -2.8 \text{ cm}$$