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$$\begin{aligned} \textcircled{3} \quad T &= 2\pi \sqrt{\frac{m}{k}} \\ &= 2\pi \sqrt{\frac{1568 \text{ kg}}{133416 \text{ Nm}^{-1}}} \\ &= 0.6812 \text{ s} \end{aligned}$$

$$\begin{aligned} F &= -kx \\ mg &= -kx \\ k &= \frac{-mg}{x} = \frac{-(68 \text{ kg})(-9.81 \text{ m/s}^2)}{5 \times 10^{-3} \text{ m}} \\ &= 133416 \text{ Nm}^{-1} \end{aligned}$$

$$f = \frac{1}{T} = \frac{1}{0.6812 \text{ s}} = \underline{1.5 \text{ Hz}}$$

$$\begin{aligned} \textcircled{7} \text{ (a)} \quad T &= \frac{1}{f} = 2\pi \sqrt{\frac{m}{k}} \\ k &= (2\pi f)^2 m = (2\pi (4 \text{ Hz}))^2 (0.25 \times 10^{-3} \text{ kg}) = \underline{0.16 \text{ Nm}^{-1}} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \frac{1}{f} &= 2\pi \sqrt{\frac{m}{k}} \\ f &= \left(2\pi \sqrt{\frac{m}{k}}\right)^{-1} = \left(2\pi \sqrt{\frac{0.5 \times 10^{-3} \text{ kg}}{0.16 \text{ Nm}^{-1}}}\right)^{-1} = \underline{2.8 \text{ Hz}} \end{aligned}$$

$$\begin{aligned} \textcircled{11} \quad a &= -\omega^2 x \\ a_{\text{max}} &= -\omega^2 x_0 \end{aligned}$$

$$\begin{aligned} \frac{-\omega^2 x_0}{2} &= \frac{-\omega^2 x}{2} \\ x &= \frac{x_0}{2} \end{aligned}$$

(22)	A	B
(a)	2.5 m	3.5 m
(b)	0.25 Hz	0.5 Hz
(c)	4.0 s	2.0 s
(d)	$\omega = 2\pi f = 1.57$ $x = 2.5 \sin 1.57t$	$\omega = 2\pi f = 3.14$ $x = 3.5 \cos 3.14t$

$$(29) \quad T = 2\pi \sqrt{\frac{l}{g}}$$

$$l = \left(\frac{T}{2\pi}\right)^2 g = \left(\frac{2s}{2\pi}\right)^2 (9.81 \text{ ms}^{-2}) = \underline{0.99 \text{ m}}$$

$$(33) \quad T = 2\pi \sqrt{\frac{l}{g}} = 2\pi \sqrt{\frac{0.9930 \text{ m}}{9.81 \text{ ms}^{-2}}} = 1.999 \text{ s}$$

seconds per day = 24(3600) 86400 s
 time is slow by 30 s so period needs to
 be adjusted by

$$T' = \frac{86400}{86400 + 30} T$$

$$T_{\text{new}} = \frac{86400}{86400 + 30} (1.999) = 1.9983 \text{ s}$$

$$l = \left(\frac{T}{2\pi}\right)^2 g = \left(\frac{1.9983 \text{ s}}{2\pi}\right)^2 (9.81 \text{ ms}^{-2}) = 0.9923 \text{ m}$$

∴ length should be shortened by $0.9930 \text{ m} - 0.9923 \text{ m} = \underline{7 \times 10^{-4} \text{ m}}$