

1)  $m = 1.56 \text{ kg}$   $f = 95 \text{ s}^{-1}$   $v_0 = 50.6 \text{ m/s}$   $F_0 = ?$

$F_0 = m a_0 = m \omega v_0$ .  $\omega T = 2\pi \rightarrow \omega = \frac{2\pi}{T} = 2\pi f$

$F_0 = (1.56)(2\pi \cdot 95)(50.6) = \boxed{4.7 \text{ E } 3 \text{ N}} = F_0$

2)  $k = 5.5 \text{ E } 3 \left[ \frac{\text{N}}{\text{m}} \right]$   $m = 9.8 \text{ E } -3 \left[ \text{kg} \right]$   $a_0 = 3.4 \left[ \frac{\text{m}}{\text{s}^2} \right]$

$x_0 = ?$   $a_0 = \omega^2 x_0$

$\omega^2 = \frac{k}{m}$

solve for  $x_0 \Rightarrow x_0 = \frac{a_0}{\omega^2} = \frac{a_0 m}{k}$

$x_0 = \frac{(3.4)(9.8 \text{ E } -3)}{5.5 \text{ E } 3} = \boxed{6.06 \text{ E } -6 \text{ m}} = x_0$

3) ~~What is the mass~~  $k = 9.1 \text{ E } 3$   $T = 6.5 \text{ E } -3$   $x_0 = 8.1 \text{ E } -3 \rightarrow \text{SI units}$

$KE_{\max} = \frac{1}{2} m v_0^2$   $\omega = \left( \frac{2\pi}{T} \right)^2 = \frac{k}{m} \rightarrow m = \frac{k}{\omega^2} = \frac{k T^2}{4\pi^2}$

$= \frac{1}{2} \frac{k}{\omega^2} v_0^2 = \frac{1}{2} \frac{k}{\omega^2} (\omega^2 x_0^2)$  since  $v_0 = \omega x_0$

$= \frac{1}{2} k x_0^2$  {obvious statement!}  $KE_{\max} = PE_{\max}$

$= (.5)(9.1 \text{ E } 3)(8.1 \text{ E } -3)^2 = \boxed{.299 \text{ J}} = KE_{\max}$

4)  $k = 3.1 \text{ E } 3$   $f = 2.9 \text{ E } 3$   $F_0 = 2.3$   $E = ? \leftarrow \text{SI}$   
 $\text{N/m}$   $\text{s}^{-1}$   $\text{N}$   $\text{J} \leftarrow \text{units}$

$E = \frac{1}{2} m v^2 + \frac{1}{2} k x^2 = \frac{1}{2} m v_0^2 = \frac{1}{2} k x_0^2$

$F_0 = m a_0 = \frac{m v_0}{\omega} = \frac{m x_0}{\omega^2}$

~~What is the mass~~  $\omega = \frac{2\pi}{T} = 2\pi f = 1.82 \text{ E } 4 \text{ s}^{-1}$

$\omega^2 = \frac{k}{m} \Rightarrow m = \frac{\omega^2}{k} = \frac{(1.82 \text{ E } 4)^2}{3.1 \text{ E } 3}$

$F_0 = k x_0 \rightarrow x_0 = \frac{2.3}{3.1 \text{ E } 3} = 7.4 \text{ E } -4 \text{ m}$

$m = 9.34 \text{ E } -6 \text{ kg}$

$E = \frac{1}{2} k x_0^2 = \frac{1}{2} (3.1 \text{ E } 3)(7.4 \text{ E } -4)^2 = \boxed{8.53 \text{ E } -4 \text{ J}} = E$

Check:  $E = \frac{1}{2} k x_0^2 = \frac{1}{2} (k x_0)^2 k^{-1} = (.5)(F_0^2)/k = \text{same.}$