Chapter 8 Oscillations Notes Answers

Errata

Pg13 bottom:

$$PE = TE - KE = \frac{1}{2}mv_0^{\,2}(1-\cos^2\omega t) = \frac{1}{2}mv_0^{\,2}\sin\omega t$$

should be $$PE = TE - KE = \frac{1}{2}mv_0^{\,2}(1-\cos^2\omega t) = \frac{1}{2}mv_0^{\,2}\sin^2\omega t$$

Page 15 middle:

$$\frac{1}{2}k(x-e)^2 + \frac{1}{2}k(x+e)^2 = ke^2 + kx^2$$

should be $$\frac{1}{2}k(e-x)^2 + \frac{1}{2}k(x+e)^2 = ke^2 + kx^2$$

Check Your Understanding 1

1. Ans
   Based on information given,
   $x_0 = 50$ mm , $x = 675 - 650 = 25$ mm
   since oscillation starts from equilibrium,
   solving for $x = x_0\sin\omega t \rightarrow 25 = 50\sin\left(\frac{2\pi}{2}t\right)$
   $t = \frac{1}{6}$ s

2. (a) 0.12 m
   (b) 2s
   (c) $f = \frac{1}{2} = 0.5$ Hz
   (d) $\omega = 2\pi f = \pi$ rads^{-1}
   (e) $a = -\omega^2 x$
   (i) 0
   (ii) $a = -\pi^2(0.12) = 0.12\,\pi^2$ ms^{-2}
   (f) $v_0 = \omega x_0 = 0.12\ \pi$ m s^{-1}

3. Ans
   (a) $v_0 = \omega x_0 = 6.28\times10^{-2}$ m s^{-1}
   (b) $x = x_0\sin\omega t = 4.76\times10^{-3}$ m
   (c) $v = \omega\sqrt{x_0^{\,2} - x^2} = 1.9\times10^{-2}$ m s^{-1}
   $a = -\omega^2 x = -0.75$ m s^{-2}

4. Ans

(a) 1.0 s = half a period, x = - 3.0 cm.

Thus, total distance = 6.0 cm.

(b) $x = x_0 \cos\omega t \rightarrow x = 3.0\cos\left(\frac{2\pi}{2}0.75\right) = -2.1$ cm

total distance = $3.0 + 2.1 = 5.1$ cm