PHYS 2C HW#5 Ch 15

#9, 30, 31 14, 35, 106

9. a) $x = 6.0\cos(3\pi(2.0) + \frac{\pi}{3}) = 3.0\,cm$

b) $v = \frac{dx}{dt} = -3\pi(6.0)\sin(3\pi(2.0) + \frac{\pi}{3}) = -49\,m/s$

c) $a = \frac{dv}{dt} = -3\pi^2(6.0)\cos(3\pi(2.0) + \frac{\pi}{3}) = -2.7\cdot10^2\,m^2$

d) $3\pi(2.0) + \pi/3 = 20\,rad$

e) $\omega = 3\pi\,rad/s \quad f = \omega/2\pi = 1.5\,Hz$

30. a) $E = \frac{1}{2}kx_m^2 \quad E = 1.00J \quad x_m = 0.100m$

$k = \frac{2E}{x_m^2} = 200\,N/m$

b) $E = \frac{1}{2}mv_m^2 \Rightarrow m = \frac{2E}{v_m^2} = 1.39\,kg$

c) $\omega = \sqrt{\frac{k}{m}} \quad f = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = 1.21\,Hz$

31. a) $\omega = \sqrt{\frac{k}{m}} \quad f = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{1000\,N/m}{5.0\,kg}} = 2.25\,Hz$

b) $x_0 = 0.300m, \quad U_0 = \frac{1}{2}kx_0^2 = 125J$

c) $v_0 = 10.0\,m/s, \quad K_0 = \frac{1}{2}mv_0^2 = 250J$

d) $E = K_0 + U_0 = 375J$

$E = \frac{1}{2}kx_m^2 \quad x_m = \sqrt{\frac{2E}{k}} = 0.866\,m$

19. a) $\frac{v}{x} = -\omega \tan(\omega t + \phi)$

$\tan^{-1}\left(\frac{-3.415\ m/s}{(7.07\ rad/s)(0.120\ m)}\right)$ $x_m = 0.500\ m$

b) $x_0 = x_m \cos\phi = -0.251\ m$

c) $v_0 = -x_m \omega \sin\phi = 3.06\ m/s$

35. a) $\omega = \frac{2\pi}{T}$ $T = \frac{2\pi}{\omega} = 3.1 \times 10^{-3}\ s$

b) $v_m = \omega x_m$

$\frac{1}{2}kx_m^2 = \frac{1}{2}mv_m^2$ $v_m = x_m\sqrt{\frac{k}{m}} = 4.0\ m/s$

c) $\frac{1}{2}kx_m^2 = \frac{1}{2}mv_m^2 = 0.080\ J$

d) $F = kx = (4.0 \times 10^4\ N/m)(2.0 \times 10^{-3}\ m) = 80\ N$

e) $F = kx = (4.0 \times 10^4\ N/m)(1.0 \times 10^{-3}\ m) = 40\ N$

106. a) $T = 0.20\ s$

b) $T = 2\pi\sqrt{\frac{m}{k}}$ $k = 200\ N/m$

$m = 0.203 \approx 0.20\ kg$

c) $x_m = 0.20$ $v_0 = -0.20\ m$

d) $v = 0$ $t = 0.10\ s$ $\omega^2 = k/m$

$a = -\omega^2 x \approx -2.0 \times 10^2\ m/s^2$

e) $v_m = 6.28\ m/s$ $K_m = \frac{1}{2}mv_m^2 = 4.0\ J$