ÇANKAYA UNIVERSITY
PHYS 131 – PHYSICS I

CHAPTER XV

OSCILLATIONS

PROBLEM SET

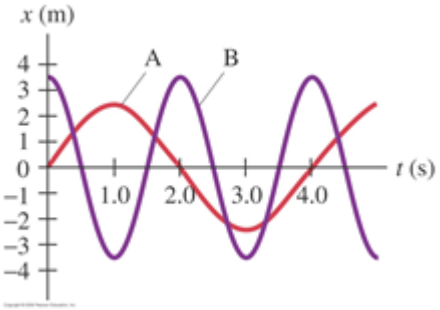
1) *** (*a*) What is the equation describing the motion of a mass on the end of a spring which is stretched 8.8 cm from equilibrium and then released from rest, and whose period is 0.66 s? (*b*) What will be its displacement after 1.8 s? **[Answer: a)** $(\mathbf{8.8\ cm})\cos(\mathbf{9.5t})$**, b)** $\mathbf{-1.3\ cm}$**]**

2) *** Figure 14–29 shows two examples of SHM, labeled A and B. For each, what is (*a*) the amplitude, (*b*) the frequency, and (*c*) the period? (*d*) Write the equations for both A and B in the form of a sine or cosine.

[Answer: a) $\boldsymbol{A_A = 2.5\ cm}$**,** $\boldsymbol{A_B = 3.5\ cm}$**, b)** $\boldsymbol{f_A = 0.25}$ **Hz,** $\boldsymbol{f_B = 0.50\ Hz}$**,**

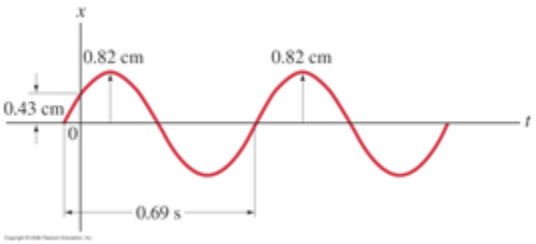
c) $\boldsymbol{T_A = 4.0\ s}$**,** $\boldsymbol{T_B = 2.0\ s}$**, d)**

$$x_A = (2.5\,\text{m})\sin\left(\tfrac{1}{2}\pi t\right)\quad x_B = (3.5\,\text{m})\cos(\pi t)$$ **]**



3) The graph of displacement vs. time for a small mass *m* at the end of a spring is shown in Fig. 14–30. At $t = 0$, $x = 0.43$ cm. (*a*) If $m = 9.5$ g, find the spring constant, *k*. (*b*) Write the equation for displacement *x* as a function of time. **[Answer: a)** $\mathbf{0.79\ N/m}$**, b)**

$$(0.82\,\text{cm})\cos\left(\frac{2\pi}{0.69}t - 1.0\right)$$ **]**



4) The position of a SHO as a function of time is given by $x = 3.8\cos(5\pi t/4 + \pi/6)$ where t is in seconds and x in meters. Find (*a*) the period and frequency, (*b*) the position and velocity at $t = 0$, and (*c*) the velocity and acceleration at $t = 2.0$ s.

[Answer: a) f $= \frac{5}{8}$ Hz, T=1.6 s, b) x=3.3 m, v= -7.5 m/s, c) v= -13 m/s, a=29 m/s^2]

5) *** A 1.15-kg mass oscillates according to the equation $x = 0.650\cos 7.40t$ where x is in meters and t in seconds. Determine (*a*) the amplitude, (*b*) the frequency, (*c*) the total energy, and (*d*) the kinetic energy and potential energy when $x = 0.260$ m.

[Answer: a) 0.650 m, b) 1.18 Hz, c) 13.3 J, d) K=11.2 J, U=2.1 J]