Ch 16, Problem 38

$$a_m = \omega^2 x_m \Rightarrow \omega = \sqrt{\frac{a_m}{x_m}} = 2000 \text{ rad/s}$$

(a) $F = ma = m(-a_m \cos(\omega t + \phi))$

$$= -(80\text{ N})\cos\left(2000t - \frac{\pi}{3}\right)$$

(b) $T = \frac{2\pi}{\omega} = 3.1 \times 10^{-3}$ s

(c) $v_m = \omega x_m = 4.0$ m/s

(d) $E = \frac{1}{2} m v_m^2 = 0.080$ J

Ch 22, Problem 12

$$r_{12}^2 = \left[(x_2 - x_1)^2 + (y_2 - y_1)^2\right]$$

$$F_{21} = k\frac{|q_1 q_2|}{r_{12}^2} = \frac{(8.99\times10^9)(3.0\times10^{-6})(4.0\times10^{-6})}{\left[(-0.020 - 0.035)^2 + (0.015 - 0.005)^2\right]}$$

$$= 34.5\text{ N}$$

Ch 22, Problem 12 (continued)

$$\theta = \tan^{-1}\left(\frac{y_2 - y_1}{x_2 - x_1}\right) = \tan^{-1}\left(\frac{1.5 - 0.5}{-2.0 - 3.5}\right) = -123^\circ$$

Ch 23, Problem 20

$$\vec{E}_{net} = 2(-\vec{j})\frac{\lambda}{4\pi\varepsilon_0 R}\int_{-\pi/2}^{\pi/2} d\theta \cos\theta$$

$$= -\frac{q}{\varepsilon_0 \pi^2 R^2}\vec{j}, \text{ where } q = \lambda \pi R$$

Ch 24, Problem 10

$$\Phi = -(34)(3.0)^2 - (20)(3.0)^2 = -486 \text{ N}\cdot\text{m}^2/\text{C}$$

$$\Phi = q_{enc}/\varepsilon_0, \quad q_{enc} = \varepsilon_0 \Phi$$

$$\Rightarrow q_{enc} = (-486)(8.85 \times 10^{-12}) = -4.3 \times 10^{-9}\text{ C}$$