Class 16 Solutions

1. $v_f = v_i + at \rightarrow a = 9/8 \ m/s^2$
$a = R\alpha \rightarrow R = 0.4 \ m$

2. $I = \frac{1}{3}ML^2 = 27 kg \cdot m^2$
$\tau_1 = \frac{1}{2}L(22)\cos(20°) = 18.6 \ N \cdot m$ clockwise
$\tau_2 = L(15)\cos(15°) = 19.1 \ N \cdot m$ counterclockwise
$\rightarrow \tau_{total} = 0.5 \ N \cdot m$ counterclockwise
$\rightarrow \alpha = 0.5/27 = 0.019 \ rad/s^2$

3. $C = 2\pi(1.2 \times 10^7) = 7.54 \times 10^7 \ m$
2.8 h = 10,080 s
$v = C/T = 7.54 \times 10^7/1.01 \times 10^4 = 7.47 \times 10^3 \ m/s$
circular orbit $\rightarrow v^2 = GM/r \rightarrow M = 1 \times 10^{24} \ kg$
$a_g = GM/R^2 = 26.8 \ m/s^2$

4. $I = (13)(0.7)^2 + (10)(0.9)^2 + (22)(0.4)^2$
$\tau = RT = I\alpha$
$Mg - T = Ma$
$a = R\alpha$
$\alpha = 6.4 \ rad/s^2$

5. $T = 7/3 \ s$
$\omega = \sqrt{k/m}$
$T = 2\pi/\omega = 2\pi\sqrt{m/k}$
$k = \frac{4\pi^2 m}{T^2}$

6. (a) 4.13 cm
(b) 10.4 cm
(c) $\frac{1}{18} \ s$
(d) $v = \lambda/T = 10.4 \ cm/\frac{1}{18} \ s$