Chapter 13 - Universal Gravitation

Physics 206

Group 1 Problems:
Problem 1:

$$v_2 = \frac{r_1}{r_2} v_1$$

Problem 2:

(a) $\Delta E = 3.27 \times 10^7$ J $= 9.07$ kW $\cdot$ hr

(b) Cost $= \$544$

Problem 3:

$a = 1.45 \times 10^{14}$ m

$= 1.45 \times 10^{11}$ km 100 times larger than Pluto's distance

$= 0.0153$ light years

Problem 4:

$$W = \frac{GMm}{4r_0}$$

Problem 5:

$$g = 2.027 \times 10^{-4} \text{ m/s}^2$$

Group 2 Problems:
Problem 6:

(a) $F_g = \dfrac{16\pi^2 m \left(\frac{D}{2} + h\right)^3}{D^2 T^2}$

(b) $F_g = \dfrac{16\pi^2 m \left(\frac{D}{2} + h\right)^3}{D^2 T^2} - \dfrac{2m\pi^2 D}{T_D^2}$

Problem 7:

$$v_f = \sqrt{GM_M \frac{R_M + H}{R_M(R_M + H)}}$$

Problem 8:

(a) $F = \dfrac{GM_1 m_3}{x^2} - \dfrac{GM_2 m_3}{(d-x)^2}$

(b) $x = \dfrac{M_1(1 - \sqrt{M_2/M_1})}{M_1 - M_2} d$

Problem 9:

$$r_A = 4.60 \times 10^7 \text{ m}$$

Problem 10:

(a) $a_X = 12$ AU

(b) $F_{G,X} = 400$ lbs

Group 3 Problems:
Problem 11:

(a) $\vec{F} = Gm_1 \sqrt{\dfrac{m_3^2}{a^4} + \dfrac{m_2^2}{b^4}}$

(b) $U = -\dfrac{Gm_1 m_2}{b} - \dfrac{Gm_1 m_3}{a} - \dfrac{Gm_2 m_3}{\sqrt{a^2 + b^2}}$

(c) $W_{ext} = \dfrac{Gm_1 m_2}{b} + \dfrac{Gm_2 m_3}{\sqrt{a^2 + b^2}}$

(d) $L = m_3 \sqrt{Gam_1}$

Problem 12:

$$\vec{F} = -\frac{GM_1 m_3(x - x_1)}{(x - x_1)^{3/2}} \hat{x} - \frac{GM_2 m_3(x - x_2)}{(x - x_2)^{3/2}} \hat{x}$$

Problem 13:

$$\theta = 70.9 \text{ degrees}$$