

Phy C8.1 HW 31, 33, 35, 38, 40, 42

31) $T^2 = \frac{4\pi^2 r^3}{Gm} = \frac{4\pi^2 (7.78 \times 10^{11} \text{ m})^3}{(6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2) (1.98 \times 10^{30} \text{ kg})}$
 $T = \frac{3.752 \times 10^8 \text{ s}}{(86400 \text{ s}) (365)} = 11.89 \text{ yrs} = 11.9 \text{ yrs}$

33) $F = \frac{G m_1 m_2}{r^2} = \frac{(6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2) (1.98 \times 10^{30} \text{ kg}) (1.90 \times 10^{27} \text{ kg})}{(7.78 \times 10^{11} \text{ m})^2}$
 $F = 4.15 \times 10^{23} \text{ N}$

34) $M_1 = 70.0 \text{ kg}$
 $M_2 = 50.0 \text{ kg}$
 $r = 20.0 \text{ m}$
 $F = \frac{m_1 m_2 G}{r^2} = \frac{(70.0 \text{ kg}) (50.0 \text{ kg}) (6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2)}{(20.0 \text{ m})^2}$
 $F = 5.84 \times 10^{-10} \text{ N}$

36) $F = \frac{G m_1 m_2}{r^2} = \frac{(6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2) (6.8 \text{ kg})^2}{(0.218 \text{ m})^2}$
 $F = 6.5 \times 10^{-9} \text{ N}$

38) $F = \frac{G m_1 m_2}{r^2}$
 $m = \sqrt{\frac{F r^2}{G}} = \sqrt{\frac{(5.47 \times 10^{-7} \text{ N}) (1.00 \text{ m})^2}{6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2}}$
 $m = 9.01 \times 10^{-3} \text{ kg}$

40) $r_e = 1.49 \times 10^{11} \text{ m}$
 $T_e = 3.16 \times 10^7 \text{ s}$
 $M_s = ?$

$$T^2 = \frac{4\pi^2 r^3}{GM} \quad M = \frac{4\pi^2 r^3}{GT^2}$$

$$M = \frac{4\pi^2 (1.49 \times 10^{11} \text{ m})^3}{(6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2 / \text{kg}^2) (3.16 \times 10^7 \text{ s})^2} = 1.96 \times 10^{30} \text{ kg}$$

48) $R_m = 1.87 \times 10^8 \text{ m}$
 $T_m = 23 \text{ h} = 82800 \text{ s}$
 $M = ?$

$$M = \frac{4\pi^2 r^3}{GT^2}$$

$$M = \frac{4\pi^2 (1.87 \times 10^8 \text{ m})^3}{(6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2 / \text{kg}^2) (82800 \text{ s})^2} = 5.6 \times 10^{26} \text{ kg}$$

PHY CE.2
#s 50, 51, 55, 56

50) $r_s = 4.23 \times 10^7 \text{ m}$
 $M_E = 5.98 \times 10^{24} \text{ kg}$
 $V = ?$
 $T = ?$

A) $V = \sqrt{\frac{GM}{r}} = \sqrt{\frac{(6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2)(5.98 \times 10^{24} \text{ kg})}{4.23 \times 10^7 \text{ m}}}$
 $V = 3070 \text{ m/s}$

B) $T = \frac{4\pi^2 r^3}{GM} = \frac{4\pi^2 (4.23 \times 10^7 \text{ m})^3}{(6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2)(5.98 \times 10^{24} \text{ kg})}$
 $T = 86600 \text{ s}$

51) $M_c = 7 \times 10^{20} \text{ kg}$
 $r_c = 500000 \text{ m}$
 $g = ?$
 $W_T = ?$
 $M_A = 85 \text{ kg}$

$g = \frac{GM_c}{r^2} = \frac{(6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2)(7 \times 10^{20} \text{ kg})}{(500000 \text{ m})^2}$
 $g = .19 \text{ m/s}^2$

$W_T = F = mg = (85 \text{ kg})(.19 \text{ m/s}^2) = 16 \text{ N}$

55) $A = 111000 \text{ m}$
 $r_m = 1785000 \text{ m}$
 $M_m = 7.3 \times 10^{22} \text{ kg}$
 $T_{min} = ?$
 $V_m = ?$

$T = \sqrt{\frac{4\pi^2 r^3}{GM}} = \sqrt{\frac{4\pi^2 (111000 \text{ m} + 1785000 \text{ m})^3}{(6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2)(7.3 \times 10^{22} \text{ kg})}}$
 $T = 7433 \text{ s} \div 60 = 120 \text{ min}$

$V = \sqrt{\frac{GM}{r}} = \sqrt{\frac{(6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2)(7.3 \times 10^{22} \text{ kg})}{(111000 \text{ m} + 1785000 \text{ m})}}$
 $V = 1600 \text{ m/s}$

$M_E = 5.98 \times 10^{24} \text{ kg}$ $F = mg$ $m = \frac{F}{g}$ $F = \frac{GM_1 M_2}{r^2}$

56) $r_c = 6.38 \times 10^6 \text{ m}$ $M_s = \frac{7.20 \times 10^3 \text{ N}}{9.80 \text{ m/s}^2} = 734.7 \text{ kg}$

$W_{T1} = 7.20 \times 10^3 \text{ N}$

$H_{T1} = 6.38 \times 10^6 \text{ m}$ $W_{T1} = \frac{(6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2)(734.7 \text{ kg})(5.98 \times 10^{24} \text{ kg})}{(6.38 \times 10^6 \text{ m})^2} = 1.80 \times 10^3 \text{ N}$

$H_{T2} = 1.28 \times 10^7 \text{ m}$ $(6.38 \times 10^6 \text{ m} + 6.38 \times 10^6 \text{ m})^2$

$W_{T1} = ?$

$W_{T2} = ?$ $W_{T2} = \frac{(6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2)(734.7 \text{ kg})(5.98 \times 10^{24} \text{ kg})}{(6.38 \times 10^6 \text{ m} + 1.28 \times 10^7 \text{ m})^2} = 797 \text{ N}$

