# ASTR 201 - Homework #2 Solutions

Ch. 3: 9). A - $P^2/A^3 = 1.0$

Kepler's 3rd Law: $P^2 = A^3 \rightarrow \frac{P^2}{A^3} = 1$

Ch 3: 33). $A = 50\,AU$ ; $P = ?$

$P^2 = A^3 \rightarrow P = A^{3/2}$

$P = (50)^{3/2} \approx \boxed{354\ years}$

Ch 4: 6) $M_V = 0.8 M_E$ ; $R_V = 0.95 R_E$

$F_V = ?$ ; $m$ = your mass

$$F_V = mg_V = \frac{GM_V m}{R_V^2} = \frac{G(0.8M_E)}{(0.95R_E)^2}$$

$$g_V \approx \frac{G(0.8M_E)}{0.9R_E^2} \approx 0.9\frac{GM_E}{R_E^2}$$

$$= 0.9 g_E$$

Ex.: $m = 50\,kg$, $g_E = 10\ m/s^2$

$Weight = mg_E = 500\,N$

$g_V = 9\ m/s^2$

$Weight(Venus) = (50)(9) = 450\,N$

→ D - 10 percent less than on Earth

Ch 4: 31) $M_M = 0.1 M_E$ ; $R_M = 0.5 R_E$ ; $g_M = ?$

$$F = \frac{GMm}{R^2} = mg$$

$$g_M = \frac{GM_M}{R_M^2} = \frac{G(0.1M_E)}{(0.5R_E)^2} = \frac{G(0.1M_E)}{0.25R_E^2}$$

$$g_M = 0.4\, GM_E/R_E^2 = \boxed{0.4 g_E}$$

$m = 50\,kg$ ; $g_E = 10\,m/s^2$ ; $g_M = 4\,m/s^2$

Weight (Earth) $= mg_E = (50)(10) = 500N$

Weight (Mars) $= mg_M = (50)(4) = 200N$

Hollywood movies

Ch 4: 37 (E.C)). Galilean Moons: Io, Europa, Ganymede, & Castillo

$P^2 = A^3 \rightarrow \frac{P^2}{A^3}$ should be the same for each moon

Io: $P = 1.77d$ ; $A = 421.8 \times 10^3\,km = 421,800\,km$

$P^2/A^3 = (1.77)^2/(421,800)^3 \approx 4.2 \times 10^{-17}\, d^2/km^3$

Europa: $P = 3.55d$ ; $A = 671,100\,km$

$P^2/A^3 \approx 4.2 \times 10^{-17}\, d^2/km^2$

Ganymede: $P = 7.15d$ ; $A = 1,070,000\,km$

$P^2/A^3 \approx 4.2 \times 10^{-17}\, d^2/km^3$

Castillo: $P = 16.69d$ ; $A = 1,883,000\,km$

$P^2/A^3 \approx 4.2 \times 10^{-17}\, d^2/km^3$

$P^2/A^3$ is consistent for each moon; Kepler's 3rd law applies