

Phys101 – Quiz # 10 (Ch.13) – Sec # 39

Name:

Key

ID #

- 1- A 1200 kg satellite orbits the Earth in an orbit of radius =  $2R_E$ . How much energy is needed to move the satellite from this orbit to another orbit of radius =  $3R_E$ ?

$$E_i = -\frac{GMm}{2(2R_E)} \quad , \quad E_f = -\frac{GMm}{2(3R_E)}$$

$$\begin{aligned} \text{required energy} = \Delta E = E_f - E_i &= +\frac{GMm}{2R_E} \left( -\frac{1}{3} + \frac{1}{2} \right) \\ &= \frac{GMm}{12R_E} \end{aligned}$$

$$\Delta E = \frac{6.67 \times 10^{-11} * 5.98 \times 10^{24} * 1200}{12 * 6.37 \times 10^6} = \boxed{6.25 \times 10^9 \text{ J}}$$

- 2- A 1000 kg satellite circles a planet every 2.8 h in an orbit of radius  $1.2 \times 10^7$  m. If the radius of the planet is  $5.0 \times 10^6$  m, what is the mass of the planet?

$$T = 2.8 \text{ h} = 10080 \text{ s}$$

$$r = 1.2 \times 10^7 \text{ m}$$

$$T^2 = \left( \frac{4\pi^2}{GM} \right) r^3$$

$$M = \frac{4\pi^2 r^3}{G T^2} = \frac{4\pi^2 (1.2 \times 10^7)^3}{6.67 \times 10^{-11} (10080)^2}$$

$$\boxed{M = 1.01 \times 10^{25} \text{ kg}}$$