Phys101 – Quiz # 10 (Ch.13) – Sec # 38

Name: Key **ID #**

$= 10^7$ m $\qquad 4 \times 10^6$

1- A satellite of mass 500 kg orbits a planet of radius 10^4 km, At a height of 4000 km from the surface of the planet. The mass of the planet is 10^{24} kg. Find the period of the satellite.

$$T = \sqrt{\frac{4\pi^2}{GM} r^3} = \sqrt{\frac{4\pi^2 (4\times10^6 + 1\times10^7)^3}{6.67\times10^{-11} * (1\times10^{24})}}$$

$$= 4\times10^4 \text{ S} \simeq 11.2 \text{ hr.}$$

2- An object is fired vertically upward from the surface of the Earth with an initial speed of $(V_{esc})/2$, where (V_{esc} = escape speed). Neglecting air resistance, how far above the surface of Earth will it reach?

$$v_f = 0$$

$$v_i = \frac{v_{esc}}{2} = \frac{1}{2}\sqrt{\frac{2GM_E}{R_E}}$$

$$\Delta K + \Delta U = 0$$

$$\frac{1}{2}m\left(\cancel{v_f^2}^{0} - v_i^2\right) + \left(-\frac{GM_E m}{(R_E+h)} + \frac{GM_E m}{R_E}\right) = 0$$

$$-\frac{1}{2}\cdot\frac{1}{4}\cdot\frac{2GM_E}{R_E} + GM_E\left(\frac{-1}{(R_E+h)} + \frac{1}{R_E}\right) = 0$$

$$-\frac{1}{4R_E} - \frac{1}{R_E+h} + \frac{1}{R_E} = 0$$

$$\frac{3}{4R_E} = \frac{1}{R_E+h} \Rightarrow R_E + h = \frac{4}{3}R_E$$

$$\Rightarrow \boxed{h = \frac{R_E}{3}} = \frac{6.37\times10^6}{3} \simeq \boxed{2.1\times10^6 \text{ m}}$$