Phys101 – Quiz # 10 (Ch.13) – Sec # 37

Name: Key **ID #**

1- A satellite of 1000 kg mass circles a planet (mass M = 5.0×10^{24} kg) every 98 min. What is the radius of the orbit?

$T = 98 \text{ min} = 5880 \text{ s}$

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

$$r = \sqrt[3]{\frac{(5880)^2 \cdot (6.67\times10^{-11})(5\times10^{24})}{4\,(3.14)^2}}$$

$$\boxed{r = 6.6 \times 10^6 \text{ m}}$$

2- A 100-kg rock from outer space is heading directly toward Earth. When the rock is at a distance of ($9R_E$) from the Earth's surface, its speed is 12 km/s. Neglecting the effects of the Earth's atmosphere on the rock, find the speed of the rock just before it hits the surface of Earth.

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

$$\frac{1}{2}m(v_f^2 - v_i^2) + \left(-\frac{GmM_E}{R_E} + \frac{GmM_E}{10R_E}\right) = 0$$

$$\frac{1}{2}(v_f^2 - v_i^2) + \frac{GM_E}{R_E}\left(-1 + \frac{1}{10}\right) = 0$$

$$(v_f^2 - v_i^2) = 2\left(\frac{0.9\,GM_E}{R_E}\right)$$

$$v_f = \sqrt{\frac{1.8\,GM_E}{R_E} + v_i^2} = \boxed{16 \ \frac{\text{km}}{\text{s}}}$$