Satellite and Chapter 6 Review

1.

A 900 kg satellite which is travelling at 8 600 m/s around a planet of mass 8.1×10^{25} kg has an orbital radius of 7.3×10^{7} m. What is the total orbital energy of this satellite relative to infinity? **(7 marks)**

$TME = \frac{1}{2}PE$

$= \frac{1}{2}\left(-\frac{Gm_1m_2}{r}\right)$

$= -\frac{1}{2}\frac{6.67\times10^{-11}\times900\times8.1\times10^{25}}{7.3\times10^{7}}$

$= -3.33\times10^{10}$ J.

2.

A satellite travels in a circular orbit at a height of one Earth radius above the surface of the Earth. What is the satellite's orbital period? **(7 marks)**

$\frac{Gm_1m_2}{r^2} = \frac{mv^2}{r}$

$\frac{Gm_2}{r} = v^2$

$\frac{Gm_2}{r} = \frac{4\pi^2r^2}{T^2}$

$T^2 = \frac{4\pi^2r^3}{Gm_2}$

$T = \sqrt{\frac{4\pi^2r^3}{Gm_2}}$

$= 2\pi\sqrt{\frac{r^3}{Gm_2}}$

$= 2\pi\sqrt{\frac{(2\times6.38\times10^{6})^3}{6.67\times10^{-11}\times5.98\times10^{24}}}$

$= 1.7\times10^{4}$ ~~1.7×10~~ 14339 s

$= 1.12\times10^{-3}$ ~~1.12×10⁻³ s~~

3.

A satellite is placed in circular orbit at an altitude of 4.8×10^5 m above Earth's surface. What is the satellite's orbital period? **(5 marks)**

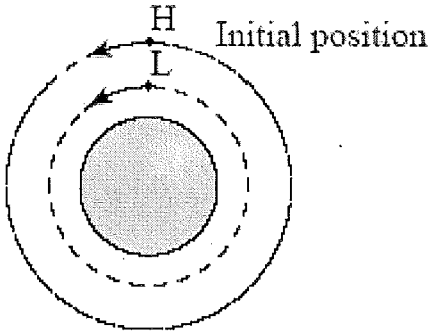
$$T = 2\pi \sqrt{\frac{r^3}{GM}}$$

$$= 2\pi \sqrt{\frac{(6.38\times10^6 + 4.8\times10^5)^3}{6.67\times10^{-11} \times 5.98\times10^{24}}}$$

$$= 5652.7 \text{ s.}$$

4.

As shown in the diagram below, two satellites pass over the same point on Earth's surface. Satellite H is in a higher orbit than satellite L.



Which satellite, H or L, completes one orbit first? (Circle one) **(1 mark)**

A. satellite H

(B.) satellite L

Using principles of physics, explain your answer. **(3 marks)**

Lower the orbit the faster the period

$$T = 2\pi \sqrt{\frac{r^3}{GM}}$$