

Answer on Question#39911, Physics, Mechanics

Question:

Obtain an expression for the time period of a satellite orbiting the earth. A space shuttle is in a circular orbit at a height of 250km from the earth's surface, where the acceleration due to earth's gravity is 0.93g. calculate the period of its orbit. Take $g=9.8\text{m/s}^2$ and the radius of the earth $R=6370000\text{m}$.

Answer:

Newton's second law of motion:

$$\frac{mv^2}{R+h} = 0.93mg$$

where $\frac{v^2}{R+h}$ is centripetal acceleration, $0.93mg$ is gravitational force.

Therefore, speed of motion equals:

$$v = \sqrt{0.93g(R+h)}$$

Period equals:

$$T = \frac{2\pi(R+h)}{v} = 2\pi \sqrt{\frac{R+h}{0.93g}} \cong 5400 \text{ s}$$

Answer: 5400 s