

Answer on Question #51081, Physics, Mechanics | Kinematics | Dynamics

Question:

A 2000 kg satellite orbits the earth at a height of 300 km. What is the speed of the satellite and its period? Take $G = 6.67 \times 10^{-11} \text{Nm}^2/\text{kg}^2$, Mass of the earth is $5.98 \times 10^{24} \text{kg}$.

Answer:

Newton's second law of motion:

$$\frac{mv^2}{R+h} = \frac{GMm}{(R+h)^2}$$

where $\frac{v^2}{R+h}$ is centripetal acceleration, R is radius of Earth

Therefore, speed of motion equals:

$$v = \sqrt{\frac{GM}{R+h}} = 7730 \frac{m}{s} = 7.73 \frac{km}{s}$$

Period equals:

$$T = \frac{2\pi(R+h)}{v} = 2\pi \sqrt{\frac{(R+h)^3}{GM}} \cong 5420 \text{ s}$$