

Answer on Question #66038-Physics-Mechanics-Relativity

A satellite going around Earth in an elliptic orbit has a speed of 10 km s⁻¹ at the perigee which is at a distance of 227 km from the surface of the earth. Calculate the apogee distance and its speed at that point.

Solution

Perigee distance is

$$r_p = h + R_{Earth} = 227 + 6371 = 6598 \text{ km}$$

$$v_p = \sqrt{GM \left(\frac{2}{r_p} - \frac{1}{a} \right)}$$

The semi-major axis of orbit is

$$a = \frac{GM r_p}{2GM - r_p v_p^2} = 18724 \text{ km.}$$

Apogee distance is

$$r_a = 2a - r_p = 30850 \text{ km.}$$

The apogee speed is

$$v_a = \sqrt{GM \left(\frac{2}{r_a} - \frac{1}{a} \right)} = 2.14 \frac{\text{km}}{\text{s}}.$$

