Answer on Question#68667 – Physics – Mechanics – Relativity

A satellite of mass 3000 kg is orbiting the Earth in a circular path of radius $8.2 \cdot 10^6$ m. Given that the mass the Earth is $5.98 \cdot 10^{24}$ kg. Find centripetal force acting on the satellite.

Solution. If the satellite moves in circular motion, then the net centripetal force acting upon this orbiting satellite is given by the relationship

$$F_{net} = \frac{M_{sat} v^2}{R}$$

where M_{sat} – mass of the satellite, v – velocity of the satellite, R – radius of the orbit.

This net centripetal force is the result of the gravitational force that attracts the satellite towards the central body and can be represented as

$$F_{grav} = \frac{G M_{sat} M_{Earth}}{R^2}$$

where $G = 6.67 \cdot 10^{-11} \frac{N \cdot m^2}{kg^2}$, $M_{sat} = 3000kg$, $M_{Earth} = 5.98 \cdot 10^{24}$kg, $R = 8.2 \cdot 10^6$m.

Since $F_{net} = F_{grav}$, the above expressions for centripetal force and gravitational force can be set equal to each other.

$$F_{grav} = \frac{6.67 \cdot 10^{-11} \cdot 3000 \cdot 5.98 \cdot 10^{24}}{(8.2 \cdot 10^6)^2} \approx 17796N$$

Answer. $17796N$.