

3. Suppose there existed a planet that went around the sun twice as fast as the earth. What would be its orbital size as compared to that of the earth?

Sol. Suppose, T_P and T_E denote the time periods of the planet and the earth, respectively. If R_P and R_E denote the corresponding orbital size

$$\Rightarrow \frac{T_P^2}{T_E^2} = \frac{R_P^3}{R_E^3}$$

$$\left(\frac{R_P}{R_E}\right)^3 = \left(\frac{T_P}{T_E}\right)^2 \Rightarrow \frac{R_P}{R_E} = \left(\frac{T_P}{T_E}\right)^{2/3}$$

$$\text{Since } T_P = \frac{1}{2}T_E, \frac{T_P}{T_E} = \frac{1}{2}$$

$$\therefore \frac{R_P}{R_E} = \left(\frac{1}{2}\right)^{2/3} = 0.63$$