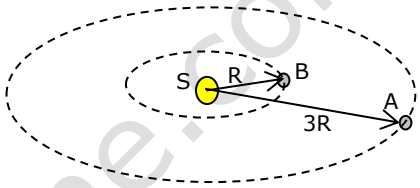
Q- A Star S have two planets A and B. Planet A has average orbital radius three times as big as planet B. If planet A orbits S in 2 earth years,
(a) How long is a year for the resident of planet B
(b) What is linear orbital speed of planet B

(a) According to the Kepler's laws of planetary motion the square of time-period of the planets are directly proportional to the cube of the average distance from the stars hence

$$\frac{T_1^2}{T_2^2} = \frac{R_1^3}{R_2^3} \qquad \text{---------- (1)}$$



Here period of revolution of B T_1 =?
Radius of orbit of B R_1 = R
Period of rev. of A T_2 = 2 earth years
Radius of orbit of A R_2 = 3R

Substituting in equation 1 we have

$$\frac{T_1^2}{2^2} = \frac{R^3}{(3R)^3}$$

Or $$T_1^2 = \frac{4}{27}$$

Or $T_1 = \frac{2}{3\sqrt{3}} = 0.385$ Earth years

The year of the residents of B is 0.385 earth years
= 0.385*365 =140.5 days
= 140.53*86400 = $1.214*10^7$ s

(b) The average orbital velocity of B is given by

$v_o = \omega * R = 2\pi R/T_1$

Here ω is the angular velocity, R is the orbital radius and T_1 is its time-period.

Hence the orbital velocity of B will be

$v_o = 2*3.14*(1*10^{11}m)/(1.214*10^7s) = 5.173*10^4$ m/s