

① The planet Neptune travels in a nearly circular orbit of radius, $r = 4.5 \times 10^9$ km, about the sun. It takes Neptune 165y to complete trip around the sun. How fast (in km/h) does not Neptune travel in its orbit?

Ans. Radius = 4.5×10^9 km

$$= \frac{4.5}{10} \times 10000000000 = 45000000000 \text{ km}$$

$$\text{Time} = 165 \text{ y} = 165 \times 365 = 60225 \text{ days}$$

$$= 60225 \times 24$$

$$= 1445400 \text{ hrs}$$

$$\text{Angular velocity} = \omega = \frac{\theta}{t} = \frac{2\pi r}{1445400}$$

$$= 2 \times \frac{22}{7} \times 4500000000 \div 1445400$$

$$= 2 \times \frac{22}{7} \times 4500000000 \times \frac{1}{1445400}$$

$$657$$

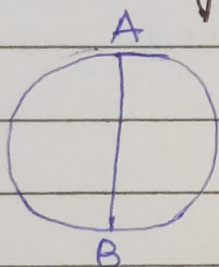
$$= 19569.47 \text{ km/h}$$

∴ It travels 19569.47 km/h fast.

② A circular cycle track has a circumference of 314m with AB as one of its diameter. A cyclist travels from A to B along the circular path with a velocity of constant magnitude 15.7 m/s

Find:

- the distance moved by the cyclist.
- the displacement of the cyclist if AB represents north-south direction.
- the average velocity of the cyclist.



Given,

circumference, $2\pi r = 314\text{m}$

\therefore radius, $r = \frac{314}{2\pi} = \frac{314}{2 \times 3.14} = 50\text{m}$

a) Distance moved, $S = \frac{1}{2} \times \text{circumference}$

$= \frac{1}{2} \times 314 = 157\text{m}$

b) Displacement = $\vec{AB} = 2r = 100\text{m}$

Displacement is in north-south direction

c) Time taken in going from A to B = $\frac{157}{15.7\text{m/s}} = 10\text{s}$

\therefore Average velocity = $\frac{\text{Displacement}}{\text{Time}} = \frac{100}{10} = 10\text{m/s}$ in north-south direction

Hw
7.7.21

Pg-85

③ Define circular motion.

An artificial satellite is moving in a circular orbit of radius 42,250 km. Calculate speed, if it takes 24 hours to revolve once around the earth.

Ans. Distance covered by the satellite in 24 hours

$$s = 2\pi r$$

$$= 2 \times 3.14 \times 42250$$

$$= 265464.58 \text{ km}$$

Therefore speed of satellite,

$$v = \frac{\text{distance travelled}}{\text{time taken}}$$

$$= \frac{265464.58}{24 \times 60 \times 60}$$

$$= 3.07 \text{ km s}^{-1}$$