

## Home assignment

1. The planet Neptune travels in a nearly circular orbit of radius,  $r = 4.5 \times 10^9 \text{ km}$ , about the sun. It takes Neptune 165 years to make a complete trip around the sun. How fast (in km/h) does Neptune travel in its orbit?

Given,

$$r = 4.5 \times 10^9 \text{ km}$$

$$t = 165 \text{ years}$$

$$= (165 \times 365 \times 24) \text{ hours}$$

$$= 8760 \text{ hours} \times 165$$

$$= 1445400 \text{ hours}$$

$$v = \frac{2\pi r}{t}$$

$$= \frac{2 \times 22 \times 4.5 \times 10^9}{7 \times 1.44 \times 10^6}$$

$$= \frac{1980 \times 10^9}{1008 \times 10^6} = \frac{198 \times 10^9}{10.08 \times 10^6}$$

$$= \frac{198 \times 10^2}{1.08} = 19800 \times 10^2$$

$$= 193.3 \times 10^2 = 1.93 \times 10^4 \text{ km/h}$$

2. A circular cycle track has a circumference of 314 m with AB as one of its diameters. A cyclist travels from A to B along the circular path with a velocity of constant magnitude  $15.7 \text{ ms}^{-1}$ . Find :-

- The distance moved by the cyclist.
- The displacement of the cyclist is AB represents North-South direction.
- The average velocity of the cyclist.

(a) Circumference = 314 m  
 Distance covered =  $\frac{314}{2} = 157 \text{ m}$

(b) Displacement =  $2r$

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

$$\Rightarrow \frac{314 \times 7}{2 \times 22} = r$$

$$\Rightarrow r = 49.95 \text{ m}$$

$$\text{Displacement} = 2r$$

$$= 2 \times 49.95$$

$$= 99.9 \text{ m}$$

$$\begin{aligned}
 (c) \quad v_{avg} &= \frac{u+v}{2} \\
 &= \frac{0+15.7}{2} \\
 &= 7.85 \text{ ms}^{-1}
 \end{aligned}$$

3. (a) Define Circular motion.

The motion of a body along a circular path is called circular motion.

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

$$r = 42,250 \text{ km}$$

$$t = 24 \text{ hours}$$

$$\begin{aligned}
 \text{Circumference} &= 2\pi r \\
 &= \frac{2 \times 22}{7} \times 42,250 \\
 &= \underline{18,59,000} \\
 &\quad 7
 \end{aligned}$$

$$= 2,65,571.42$$

$$\text{Speed} = \frac{2\pi r}{t}$$

$$= \frac{2,65,571 \cdot 42}{24}$$

$$= \underline{\underline{\text{11,065} \cdot 47 \text{ km/hr}}}$$

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