

HomeworkCircular motion

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

$$\text{Radius of Neptune} = 4.5 \times 10^9 \text{ km.}$$

Time taken by Neptune to complete one revolution around sun

Time taken by Neptune to complete one revolution around sun in hours =

$$= 165 \text{ years}$$

$$= 165 \times 364 \times 24 \text{ hrs.}$$

$$\text{Then, Velocity of Neptune} = \frac{2\pi r}{t} = v$$

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

$$= \frac{2 \times 3.14 \times 4.5 \times 10^9}{165 \times 364 \times 24}$$

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

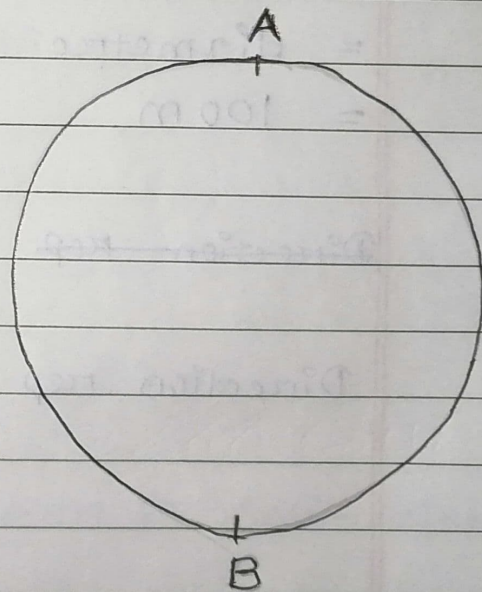
∴ Velocity of Neptune is 2×10^4 km/h.

2) A circular track has circumference of 314 m and AB as one of diameter. A cyclist travels from A - B along the circular path with a velocity of 15.7 m/s. Find

- a) distance moved by cyclist
- b) displacement of cyclist if AB represents N-S direction.
- c) average velocity

a) Distance moved by cyclist =

As the cyclist moved from A to B in a circular path and AB is a diameter, so we can say that the body moved in a semicircle path.



$$\text{distance moved by cyclist} = \frac{2\pi r}{2} = \frac{314}{2}$$

$$= \pi r = 157 \text{ m.}$$

Hence distance travelled by body is 157.m.

2) Direction of A and B = North and South respectively

As the body travelled from A to B in circular path and AB is a diameter so the displacement of the body would be from A to B, means North to South and because the body didn't change direction, its displacement is in South direction.

Now, let radius of circle be $= r$

Then, circumference $= 2\pi r = 314$

$$= 2\pi r = 314$$

$$= 2 \times 3.14 \times r = 314$$

$$r = \frac{314}{2 \times 3.14} = 50 \text{ m}$$

$$\text{So diameter} = 2(r) = 2(50) = 100 \text{ m}$$

Hence displacement of body is 100m in South direction

3) Average velocity of body is 15.7 m/s

3>a) Define circular motion

b) An artificial satellite is moving in a circular orbit of radius 42,250 km. Calculate its linear velocity, if it takes 24 hrs to revolve around Earth.

a) The motion of a particle / body along a circle is called circular motion.

b) Time taken to revolve around Earth = 24 hrs.
Distance travelled by satellite = $r = 42,250$ km.

$$\text{Linear velocity of satellite} = \frac{l}{t} = \frac{42,250 \text{ km}}{24 \text{ hr}}$$

$$= \left(\frac{42,250 \times 1000}{24 \times 3600} \right) \text{ m/s}$$

$$= \frac{42 \times 25 \times 10^2}{24 \times 36} = \frac{21 \times 25 \times 100}{24 \times 18}$$

$$= \frac{21 \times 25 \times 25}{6 \times 18} = \frac{7 \times 625}{36} = 121.5 \text{ m/s.}$$