Defining Circular Motion

IB PHYSICS | CIRCULAR MOTION

Remember Newton's 1st?

A body will remain at rest or moving with constant velocity unless acted upon by an unbalanced force

"Law of Inertia"



Try This...



I'm usually running late for school and sometimes I forget my plate of pop tarts on the top of my car. What happens when I take a sharp turn to the right? Why?

Remember back...

There are 3 ways that an object can be experiencing acceleration?



You already know some of this...

If each blade in the wind farm animation is 30 meters long, estimate the speed (in m s⁻¹) of the tip of one turbine blade.



Think about the Circle...

If you walked around this circle once, what is your total distance?



What is a Radian??

We can define a circular distance in terms of a generic radius, r...

How many radians are there in one full revolution?





If a child on a merry-go-round rotates 3.5 times, what is their **angular distance** in radians?

If an ant on a record player spins for an angular displacement of 14 radians, how many revolutions has it experienced?

Timing Circular Motion





Angular Velocity

For Linear Motion:

$$v = \frac{distance}{time} = \frac{d}{t}$$

For Circular Motion: $\omega = \frac{angular \ distance}{time}$

If you have a single revolution:

 $\omega = \frac{angular \ distance}{time}$





A ferris wheel takes 40 seconds to make on full revolution, what is its angular velocity in rad/s?

A car tire rotates with an average angular velocity of 29 rad/s. In what time interval will the tire rotate 3.5 times?

Linear Velocity

At any given point, an object with circular motion will also have an instantaneous linear velocity.

This velocity will be in the direction to the curve





Calculating Linear Velocity



Calculating Linear Velocity

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

$$\omega = \frac{2\pi}{T}$$

IB Physics Data Booklet



Try this....



Time for 1 Rotation:

T = 10 s

If the carousel spins at 1 complete rotation every 10 seconds, what is the angular and linear velocity of each row?

Α	$\omega = \frac{2\pi}{T}$	$v = \omega r$
B	$\omega = \frac{2\pi}{T}$	$v = \omega r$



If you were sitting 4 m from the center of a carousel spinning at 12 rad s⁻¹ and threw a ball in the air, how fast would the ball continue in a straight line?

A woman passes through a revolving door with a tangential speed of 1.8 m s⁻¹. If she is 0.8 m from the center of the door, what is the door's angular velocity?

Lesson Takeaways

- □ I can convert between angular displacement in revolutions and radians
- □ I can define and measure the **period** of circular motion
- □ I can calculate angular velocity in rad/s
- I can describe and calculate tangential velocity based on the angular velocity and radius