Module 3: Angular Measurements and Motion

Objectives/Key Points

Students will be able to:
1. Define and use angular displacement and velocity variables in place of linear displacement and velocity variables in the equation of motion.

Unit Home

One dimensional kinematics.

Prerequisites

Linear motion equation d=vt.

Time

20 minutes

Materials

None.

Pre-Lesson

None.

Main Lesson

Teacher will define "linear" distance/velocity for students in contrast to angular quantities, as follows. To describe the rotation of objects, we sometimes talk about angles instead of linear distances. Just as we can say how far an object has moved along a straight line, we can refer to angular motion to describe how much an object has rotated. We typically use the symbol θ (theta) to represent this angle.

Concept Check: (If time, do as think-pair-share, otherwise as whole class discussion.)
In which clock has the big hand rotated through the largest distance (a.k.a. "linear" distance) since twelve midnight? In which clock has the big hand rotated through the largest angular distance since twelve midnight?
A) a wristwatch showing 12:10 AM
B) a wristwatch showing 12:15 AM
C) a wall clock showing 12:10 AM

The “angular velocity” or “angular speed” ω is how fast an object is rotating – that is, how many radians (or degrees) it turns every second. So just as $v = d/t$ for linear motion, $\omega = \theta/t$ for angular motion, with units of rad/sec (or ^{o}/sec).

Concept Check: (If time, do as think-pair-share, otherwise as whole class discussion.)
In which pair does the second item have greater speed (a.k.a. “linear” speed)?
In which pair does the second item have greater angular speed?
A) the big hand on a wristwatch and the big hand on a wall clock
B) the big wheel on a tricycle and the little wheels on a tricycle

If you want to convert angular distances and speeds into linear distances and speeds, the key is to remember that the arc length along a circle of radius r is just $r\theta$ if θ is measured in radians. So the linear speed is $v = r\theta/t$, assuming we have converted angles from degrees to radians using 2π rad = 360^{o}.

Concept Check: (Have students work independently first, then compare with a partner.)
What is the angular speed of the big hand of a clock in degrees per minute? In radians per minute (you may approximate $2\pi=6$)? If a wristwatch has a big hand 1 cm long, what is the linear speed of the big hand?

Enrichment

None.

Post-Lesson

None.