SPH3U
UNIVERSITY PHYSICS

KINEMATICS

- Motion in Our Lives
  (P.6-7)

Motion

Everything in our universe is in a state of motion. Our solar system moves through space. Earth revolves around the Sun while rotating about its own axis. People, animals, air, and countless other objects move about on Earth's surface. The elementary particles that make up all matter, too, are constantly in motion. Scientists call the study of motion ***kinematics****.*

Motion

NOTE!

To understand the motion of objects, we must first be able to describe motion. Physicists use a number of specific terms and units to describe motion. You are likely already familiar with many of these terms and units – distance, speed, velocity, acceleration, ...

KINEMATICS

- the study of motion

Motion

Motion *is defined as the movement of an object from one place to another, as measured by an observer. But what is the observer measuring? Consider two objects connected by a straight line segment. If the straight line segment between them changes in length, direction, or both, one or both of the objects is moving.*

Motion

MOTION

- movement of an object from one place to another, as measured by an observer
- two objects are in motion wrt each other if the straight-line segment between them changes in:
  - length
  - direction
  - or both

Motion

PRACTICE

1. How can you tell if one object is in motion with reference to another?

   if the straight line segment between the object and the observer changes in length, direction, or both

Motion

PRACTICE

2. Two golf carts are travelling at the same speed in the same direction along a straight level path. Are the carts in motion with reference to each other? Explain.

no – the straight line segment between the two golf carts does not change in length or direction

Motion

PRACTICE

3. The engine of a freight train is pulling five cars around a gradual curve. Is the engine in motion with reference to the last car? Explain.

yes - the straight line segment between the engine and the last car changes in direction (the length stays relatively constant though)

Motion

Uniform motion *is a movement at a constant speed in a straight line. However, most motion in our lives are classified as* ***non-uniform****, which means the movement involves changes in speed or direction or both. A roller coaster is an obvious example of such motion – it speeds up, slows down, falls, and travels around corners.*

UNIFORM MOTION

- movement at a constant speed in a constant direction

NON-UNIFORM MOTION

- movement that involves changes in speed or direction or both

Motion

PRACTICE

4. Are the motions described below uniform or non-uniform? Explain.
   (a) A rubber stopper is dropped from your raised hand to the floor.
   (b) A car is travelling at a steady rate of 85 km/h due west.
   (c) A motorcycle rider applies the brakes to come to a stop.
   (d) A race car travels around a circular track at a constant speed.

   (a) non-uniform – speed is changing
   (b) uniform – speed and direction are constant
   (c) non-uniform – speed is changing
   (d) non-uniform – direction is changing