Motion

How do you decide if an object is moving? You are probably sitting in a chair as you read this. Are you moving? Your eyes blink and your chest moves up and down. But you would probably say that you are not moving. An object is in motion if the distance from another object is changing. Because your distance to your chair is not changing, you conclude you are not in motion.

Reference Point

To decide if you are moving, you use your chair as a reference point. A reference point is a place or object used for comparison to determine if something is in motion. An object is in motion if it changes position relative to a reference point.

Objects that we call stationary- such as a tree, a flagpole, or a building- make good reference points. From the point of view of a train passenger, those 3 objects are not in motion. If the passenger is moving relative to a tree, he can conclude the train is in motion.

Once you have selected your reference point, you can indicate change of position by using a plus (+) or minus (-) sign. The signs stand for any pair of opposing directions from the reference point, such as to the right or left, up and down, away from and toward, or in front of or behind. If you make the passenger on the train your reference point, then three seats in front of him could be shown as +3. A distance of -5 would mean 5 seats behind him.

Relative motion

Are you moving as you read this? The answer depends on your reference point. When your chair is your reference point, you are not moving. But if you choose another reference point, you may be moving. Suppose you choose the sun as a reference point instead of the chair. If you compare yourself to the sun, you are moving quite rapidly. This is because you and the chair are on Earth, which moves around the sun about 30 kilometers every second. So, you, the chair, the classroom and everything else on Earth move that quickly as well. Going that fast, you could travel from New York City to L.A. in about 2 minutes. Relative to the sun, you are in motion. But, because you are moving with the Earth, you do not seem to be moving.

Distance and Displacement

When you move, the distance between you and a reference point changes. Distance is the length of a path between two points. Suppose you trace the route you take to school each morning. From your starting point at home, you walk one block, turn left, and continue for another block. Then you turn right and walk two more blocks. At the intersection, you turn left and walk 3 more blocks to your end point at school.

How many blocks did you walk in all? The lengths of the segments of your walk are 1 block, 1 block, 2 blocks, and 3 blocks. Therefore, your walk from home to school is a total of 7 blocks.

Displacement is the length and direction that an object has moved from its starting point. Distance is the total length of the actual path between two points. Displacement is the length and direction of a straight line between starting and ending points. According to these 2 directions, you walked a distance of 7 blocks, but your displacement was 5 blocks northeast.

As you learn about motion, you will find other measurements that also have a magnitude (size) and a direction. A quantity that consists of both magnitude and direction is called a vector. Displacement is a vector but distance is not. Other examples of vectors include velocity, acceleration and force. You will learn about vectors later on in this unit. Vectors are shown graphically by using an arrow. The length of an arrow represents the vector's magnitude (size). The direction of the arrow indicates the direction of the vector.
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