Acceleration

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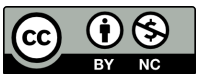

CHAPTER 1 Acceleration

- Define acceleration.
- Give examples of acceleration.
- Describe how it feels to accelerate.

Imagine the thrill of riding on a roller coaster like this one! The coaster slowly crawls to the top of the track and then flies down the other side. It also zooms around twists and turns at breakneck speeds. These changes in speed and direction are what make a roller coaster ride so exciting. Changes in speed or direction are called acceleration.

Defining Acceleration

Acceleration is a measure of the change in velocity of a moving object. It measures the rate at which velocity changes. Velocity, in turn, is a measure of the speed and direction of motion, so a change in velocity may reflect a change in speed, a change in direction, or both. Both velocity and acceleration are vectors. A vector is any measurement that has both size and direction. People commonly think of acceleration as in increase in speed, but a decrease in speed is also acceleration. In this case, acceleration is negative and called deceleration. A change in direction without a change in speed is acceleration as well.

Q: Can you think of an example of acceleration that doesn't involve a change in speed?

A: Driving at a constant speed around a bend in a road is one example. Use your imagination to think of others.

Examples of Acceleration

You can see several examples of acceleration in the pictures from the **Figure** 1.1. In each example, velocity is changing but in different ways. For example, direction may be changing but not speed, or vice versa. Figure out

what is moving and how it's moving in each of the photos.

FIGURE 1.1

Q: Describe how velocity is changing in each of the motions you identified from the **Figure** 1.1.

A: You should describe how both direction and speed are changing. For example, the boy on the carousel is moving up and down and around in a circle, so his direction is constantly changing, but his speed changes only at the beginning and end of the ride. The skydiver is falling straight down toward the ground so her direction isn't changing, but her speed keeps increasing as she falls until she opens her parachute. For a better understanding of the changing velocity of a skydiver, watch the animation at this URL:

http://www.waowen.screaming.net/revision/force%26motion/skydiver.htm

Feeling Acceleration

If you are accelerating, you may be able to feel the change in velocity. This is true whether the change is in speed, direction, or both. You often feel acceleration when you ride in a car. As the car speeds up, you feel as though you are being pressed against the seat. When the car slows down, you feel like you are being pushed forward, especially if the change in speed is sudden. If the car changes direction and turns right, you feel as though you are being pushed to the left. With a left turn, you feel a push to the right. The next time you ride in a car, notice how it feels as the car accelerates in each of these ways. You can also simulate acceleration at this URL: http://phet.colorado.edu/en/simulation/moving-man

Summary

- Acceleration is a measure of the change in velocity of a moving object. It measures the rate at which the change is occurring. It may reflect a change in speed, a change in direction, or both. Like velocity, acceleration is a

vector.
- Examples of acceleration include a person riding a carousel and a skydiver in free fall.
- When you experience acceleration, you may be able to feel the changes in speed and/or direction.

Explore More

Watch the acceleration animation at the following URL. Then answer the questions on the Web page and check to see if your answers are correct. http://www.physicsclassroom.com/mmedia/kinema/acceln.cfm

Review

1. Define acceleration.
2. Describe an example of acceleration and explain how velocity is changing.
3. The skydiver pictured in the **Figure** 1.1 will soon open her parachute. How will her velocity change when the parachute first opens?

References

1. Carousel: Jef Fisher; Skydiver: User:Degrer/Wikimedia Commons; Runner: Mike Spille; Basketball: Maurice Dayao/U.S. Navy. Examples of acceleration . Carousel: CC BY 2.0; Skydiver: Public Domain; Runner: CC BY 2.0; Basketball: Public Domain