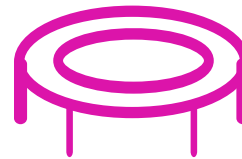


Family Activity | Grades 6–8

# Cushion It!



## OVERVIEW

Collisions are a part of everyday life. Some are wanted (baseball and bat), some are unwanted (car crash), while others are unavoidable (stubbing one's toe). There is a great deal of basic science involved with collisions. Recently, your student investigated some of this science in class. They also practiced and developed their inquiry skills by creating their own cushioning devices to protect an impact against a sugar cube.

These skills will be reinforced at home as you and your young scientist continue to explore collisions through various conversations, investigations, research, and an activity.

## OBJECTIVES

Students will be able to:

- explain the protection that cushion (bubble) wrap offers.
- investigate the “give” of different surfaces.
- explain the science of collisions.

## BACKGROUND INFORMATION

The study of collisions is a fundamental topic in science. Collisions are part of broader physics: domain of mechanics → conservation laws → conservation of momentum → collisions. A baseball moving through the air has a given amount of momentum associated with it; the more massive the ball, the more momentum it has. The faster the ball is traveling, the more momentum it has, as well. Momentum also has a direction of travel associated with it. Momentum in one direction is different from momentum in another direction. When the batter hits the ball with a bat, the ball suddenly changes speed and direction, hence the momentum of the ball suddenly changes. This sudden change in momentum is referred to as an impulse. Another common example of an impulse is a car crash. The mass of the car and its occupants traveling at a given speed is suddenly brought to a stop.

One way to reduce the damaging effects of a large impulse is to either reduce the impact force (not swing the bat as hard) or to extend the time or distance of the collision. In a car crash with the momentum at a given value, the way to reduce the effect of the collision is to extend the time of the collision by increasing the distance over which the object suddenly comes to rest. This is how an airbag in a car cushions the effect of a sudden collision. The use of an airbag extends the time it takes to stop a person's body from its initial speed by increasing the distance over which the collision occurs. A secondary safety feature airbags provide is

to distribute the large force of the impact over a larger surface area, reducing the maximum pressure on the body.

The generic term for any item or material that reduces the damaging effect of a sudden impulse is ‘cushioning material.’ Padding is a common material found in sports equipment, shipping supplies, and vehicle interiors. A popular type of cushioning material used to protect delicate items during shipping is cushioning wrap, or bubble wrap.

## MATERIALS

- Ball (hard rubber ball or tennis ball)
- Various surfaces (tile, carpet, asphalt, grass, wood, countertop etc.)
- Device with internet
- Bubble wrap
- Item to ship
- Box to ship

## HOME ACTIVITIES

1. **Share Activity:** Your child could share the results and findings of the cushioning investigation he or she did at school for this lesson.
2. **Short Investigation Activity:** The “give” of a surface has an effect on the response of an object colliding with that surface. Use a ball (hard rubber or tennis work well) to test the “give” of various surfaces around the house: wood floor, different types of rugs, concrete, etc.
3. **Research Activity:** You and child could use the Internet to research the science of collisions with these Websites:
  - Seatbelts: <http://hyperphysics.phy-astr.gsu.edu/hbase/seatb.html#cc1>
  - Truck Collisions: <http://hyperphysics.phy-astr.gsu.edu/hbase/truckc.html#c1>
  - Airbags and Seatbelts: <http://hyperphysics.phy-astr.gsu.edu/hbase/seatb2.html#cc2>
  - The Effect of Collision Time: <http://www.physicsclassroom.com/class/momentum/U4l1c.cfm#rebound>
4. **Hands-On Activity:** Use bubble wrap to pad and protect an item you plan to ship using a package delivery system.

## VOCABULARY

- **Collision:** when two or more objects hit each other.
- **Impact:** to hit with a great force.
- **Momentum:** a measurement of mass in motion.

## THOUGHT/CONVERSATION STARTERS

- Tell me what you did to protect the sugar cube from **impact**.
- Does the weight of the ball affect its **momentum**?
- What kinds of surfaces do you think will cause the biggest/smallest **collisions**?
- How can we use **cushion** (bubble) wrap to protect an item we want to ship?

## DOCUMENT THE LEARNING IDEA

- Allow your young scientist to document their learning at home by reflecting in their science journal.
- Take photos using a smartphone or tablet of the various surfaces you used in your investigation activity as well as how you used the bubble wrap to protect the item you were shipping. Use text and/or stickers to tell what happened.
- Record a video to inform the class about what was learned after researching.

If your young scientist documents the learning, encourage them to bring their creations to class and share with the teacher.

## CONTINUE MAKING CONNECTIONS

Almost every item in your home was shipped at one point or another. Extend your young scientist's thinking about shipping items by discussing how items are shipped to you from local stores, across the country, and from different countries (mail trucks, semis, airplanes, ships, etc.). Which way most likely causes the most damage to boxes/shipments and why? How do companies protect their shipments?

