

# Read About Collisions

## COLLISION DEFINITION

A *collision* happens when one object runs into another. When objects collide, the energy transfers from one object to the other. *Energy* is the ability to do work (or in more simple terms: energy makes things happen). The amount of energy transferred during a collision depends on the weight and speed of the moving object.

**To better understand how energy transfer and collisions work...**

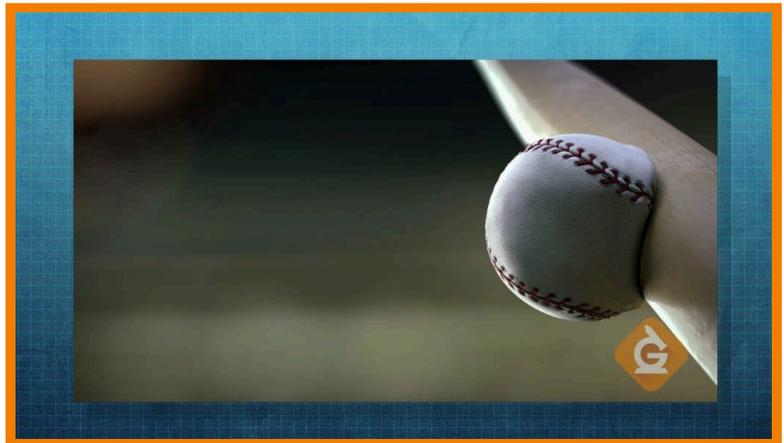
## LET'S BREAK IT DOWN!

### Collisions happen all around us.

Every day, we see and experience hundreds of collisions. A collision could be as gentle as a puppy licking your face, or as dramatic as a wrecking ball smashing into a building.

Collisions are part of our everyday lives. People drop things which collide with the ground. Drumsticks collide with drums to make sounds.

Sports involve numerous collisions. Think about baseball. The batter tries to collide the bat with the ball. At the instant of impact, the energy **transfers** from the swinging bat to the ball, which makes it fly.



## Energy transfers when two objects collide.

Do you enjoy going bowling? When you bowl, you are transferring the energy from the moving ball to the bowling pins.



Bumper cars are another great example. In this case, all the cars are usually in motion. When one bumper car hits another car, the energy is

transferred and the passengers in the cars feel a change in their motion. The cars may stop or change direction due to the impact of the collision.

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## The faster an object is moving, the more energy it can transfer.

The amount of energy transferred between moving objects depends on the object's speed. Objects that are moving faster have a bigger impact because they transfer more energy.

In the video, Dr. Jeff's mom was able to knock Izzy farther when she ran

**faster**. That's because she had more energy to transfer. That energy was transferred to Izzy when they collided.



This has an important real-world application for car safety. When cars are traveling fast and they have an accident, the crash is typically much worse than if the car was traveling slowly. Speed limit signs are posted to keep drivers safe for this reason.

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## The heavier an object, the more energy it can transfer.

Heavier objects carry more energy. This explains why car accidents involving trucks are so damaging to cars. During a collision, the energy carried by the heavy truck is transferred to the lighter car.

Have you ever noticed that the biggest football players have the most stopping power? If a 300-pound lineman tackles a 100-pound quarterback, the quarterback doesn't have a chance.

Animals sometimes fight over territory. The larger animal is usually more successful in these fights, because it has more weight and can transfer more energy during a collision.



## EXAMPLES OF COLLISIONS



**Engineers build cars with special crumple zones.** The crumple zone absorbs the impact. This reduces the amount of energy transferred to passengers during a crash.



**Newton's cradle uses a series of swinging balls that collide.** This is a common toy seen on people's desks. As the balls continue to collide, energy is transferred from one ball to the next. Over time the balls stop because some of the energy in each collision becomes sound and heat.



**Rube Goldberg machines show energy transfers.** This ice dispensing machine from our video transfers energy through a series of collisions. It may not be very useful, but it sure is fun!

## COLLISIONS VOCABULARY

### Energy

It makes things happen! (Or more formally: the ability to do work)

### Rube Goldberg Machine

A complex contraption that performs a simple task, such as pouring a glass of lemonade.

### Energy Transfer

When one object runs into another, energy is transferred.

### Collision

When one object runs into another.

### Contact

When two objects touch each other.

### Stationary Object

An object that is not moving.

## **ENERGY TRANSFER DISCUSSION QUESTIONS**

### **True or false: Only humans use energy.**

False. People use energy to make things happen, such as lifting weight, but it's not just people that use energy. Water uses energy to turn a water wheel, wind use energy to spin wind turbines and animals use energy when running or butting heads.

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### **Explain how energy is transferred to make the Rube Goldberg Machine work.**

The weight drops the top ramp, which collides with the metal ball. The metal ball rolls down a series of ramps and collides with a rod that releases the spinning circle. The spinning circle travels down as it spins, which eventually pulls the large hanging metal ball loose. The ball drops slowly as it unwinds, turning the windmill. That eventually pulls a pin holding the ice. The ice slides down the tube and drops into the pitcher. During each collision energy is transferred between objects.

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### **Explain how energy is transferred from a baseball bat to a baseball.**

At the moment the bat touches the ball, energy from the moving bat is transferred to the ball, setting it in motion.

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### **What evidence did you see in the video that suggests energy is transferred by a moving object?**

In the video we observe a baseball flying after the bat hits it, the chain reaction of motion during the Rube Goldberg machine demonstration and Izzy flying back after Dr. Jeff's Mom collides with him.

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### **Does Izzy fly back further when Dr. Jeff's mom runs faster or slower? Why?**

When hit with more speed, Izzy flies back farther.

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### **Explain how the energy transfers when the drum stick hits the gong.**

The energy of motion from the swinging drum stick is transferred to the gong, which then vibrates producing sound.

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