Activity 8

Investigate Like a Scientist

Hands-On Investigation: Speed and Collisions

Now that you have reviewed your data from Racing Downhill, you know that objects traveling at a faster rate of speed have more kinetic energy. Now let's look a little closer at how force can affect both speed and kinetic energy. In this investigation, you will use a clay ball and a cardboard platform to investigate the speed and kinetic energy of objects.

Make a Prediction

How do you think the amount of force will affect the kinetic energy of an object?

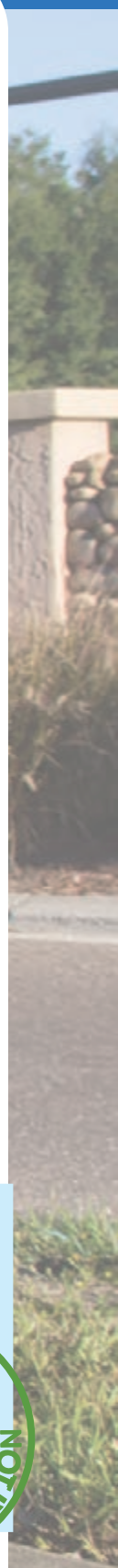
How are speed and kinetic energy related?

What materials do you need? (per group)

- Modeling clay or flour mixture
- Piece of cardboard
- Meterstick

HANDS-ON INVESTIGATION

Life Skills **I can think about how my team works together.**



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What Will You Do?

1. Roll a ball of clay in your hands, smoothing the sides of it. Sketch the ball of clay.
2. Use the cardboard to create a landing platform, attached to a hard surface on the ground. Position the clay ball 1 meter above the platform and lightly open your fingers to drop, not throw, the ball of clay onto the platform.
3. Sketch the dropped ball of clay in the table.
4. Smooth the clay ball over and repeat the experiment, this time putting force behind the clay ball and throwing it at the platform from 1 meter above. Sketch the result.
5. Repeat one more time and throw the clay ball a bit harder at the platform. Sketch the result.

Amount of Force Used	Sketch of Clay
Dropped	
Thrown Lightly	
Thrown Hard	

Think About the Activity

What can you conclude about the relationship between speed and kinetic energy based on this experiment?

How do the results from this experiment compare with the results from the tests you did in Racing Downhill? How are they different?

What does the damage to the clay tell you about what happens to vehicles in a real-world collision?

Activity 9

Analyze Like a Scientist

The Effect of Mass on Collisions

The amount of **mass** in the objects involved in a collision can also make a big difference in the outcome of the crash. **Look** at the image of the trucks. **Think** about which vehicle would probably cause more damage in a collision. **Read** the text, and then **choose** two conversation starters to help you **discuss** your ideas with classmates.

The Effect of Mass on Collisions

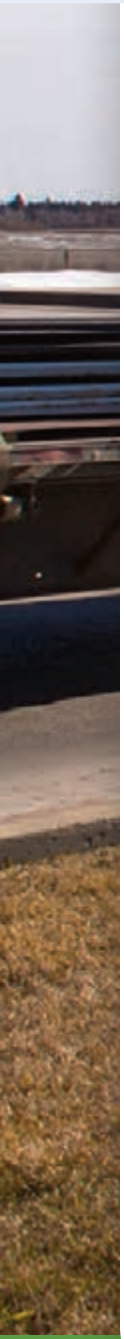
Why do big trucks need bigger engines than cars? The difference has to do with the mass of each vehicle. A large truck has a much greater mass than a car. As each vehicle moves faster, the energy from the fuel its engine uses is converted into kinetic energy.

Comparing Trucks

The bigger the mass of the vehicle, the more fuel it consumes, and the more kinetic energy it gains. A large truck traveling at the same speed as a car has more kinetic energy. If the mass of an object doubles, its kinetic energy at a certain speed also doubles. So, a 1-ton truck has half the kinetic energy of a 2-ton truck traveling at the same speed.

The Effect of Mass on Collisions, *continued*

This is why a large-mass vehicle causes more damage when it hits something than a small-mass vehicle traveling at the same speed. If a pedestrian hit by a bicycle with a speed of 50 kilometers per hour, he will most likely survive, and if a car hits him at that speed, it may endanger his life.



Now, **choose** two of the conversation starters from the table.
Discuss what you have read.

Question	Clarify	Connect
I don't get this part . . .	Let me explain . . .	This reminds me of . . .
What if . . .	No, I think it means . . .	The differences are . . .
Predict	**Comment**	**Explain**
I wonder if . . .	This is confusing because . . .	The basic idea is . . .
I think that . . .	This is hard because . . .	My understanding is . . .

Does Energy Disappear in a Collision?

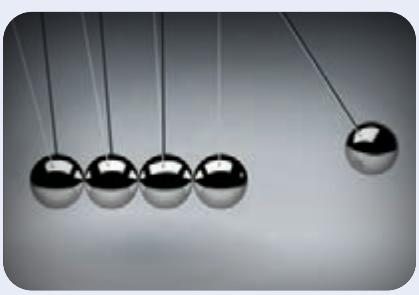
Activity 10

Analyze Like a Scientist

Energy Conversions during a Collision

You already know that when two objects collide there is a transfer of energy. When you play a game with marbles, kinetic energy is transferred from your arm to the marble. Then, there is a transfer of energy from your marble to the ones you hit to knock out of the triangle. Click! That sound you hear when the marbles collide is energy, too. Where did this sound energy come from? **Read** the text about Newton's cradle. As you read, **highlight** all the forms of energy to which kinetic energy is transformed.

Energy Conversions during a Collision



From what you have observed, you know that when objects collide, energy changes and transfers take place. The amount of energy depends on the kinetic energy of the objects and the direction in which they are traveling. Their kinetic energy is determined by both their speed and their mass. What happens to all this kinetic energy when objects collide?

None of the energy disappears. In a collision, energy in equals energy out. Energy is conserved in a collision. We can model collisions using a simple device called a Newton's cradle. In a Newton's cradle, most of the energy is transferred to other balls, which is why the same number of balls move on one side of the cradle as on the other.

You can hear that some energy is lost as sound. Some is lost as friction between the string and other parts, as the balls move. The balls lose a little energy as they pass through the air. If you leave the cradle long enough, after lots of collisions, the moving balls lose their kinetic energy and stop.

Talk Together If a moving car hits a stop sign, not all the energy transfers to the stop sign. Where else does the energy go?