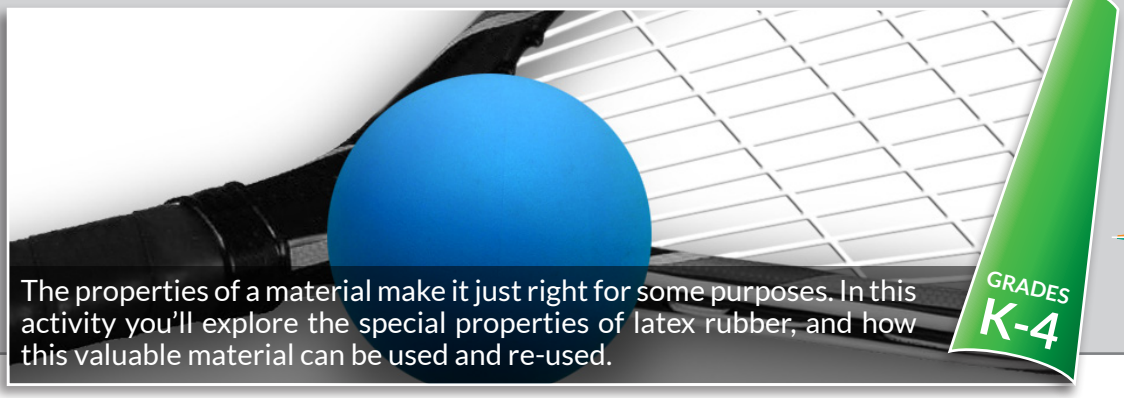
Bounce



The properties of a material make it just right for some purposes. In this activity you'll explore the special properties of latex rubber, and how this valuable material can be used and re-used.

GRADES K-4

ISRI Voice of the Recycling Industry

JASON Learning

PREPARE:

Time Required: 1-2 class periods (45-90 minutes) without extensions

- Gather materials (see activity pages).
- Replicate student activity sheet (one per student).
- Prepare to project the photo of the recycled-tire Merry-Go-Round.
- Cut one racquetball open to show students the hollow core. Use part of this ball to cut some smaller pieces for teams to make observations with and test density. For making observations, a whole ball can also be used, but pieces are necessary for testing density.
- Verify that latex is permitted in your classroom (check for latex allergies and with administration).

MOTIVATE:

- Hold up a racquetball and have students discuss what it is. Optional: show students a video of kids learning how to play racquetball.
- Have students discuss some characteristics of a racquetball (very bouncy)!
- Ask students what material they think a racquetball is made out of. Where does it come from? Can this material be recycled? Have students share ideas.
- Racquetballs are made out of rubber, the same material used to make tires. Why would a racquetball or tire be made of latex rubber rather than something hard like wood or metal?
- Every substance has characteristic properties. The special properties of latex rubber make it ideal for many purposes! Natural rubber (latex) comes from the sap of tropical trees. Humans have figured out ways to make a synthetic rubber. About 21 percent of today's passenger tires are made from natural rubber (synthetic rubber represents 27 percent and carbon black 28 percent).
- Can tires be re-used or recycled? Each year, Americans generate approximately 100 million scrap tires, with more than 90 percent recycled and reused annually.
- Show students the image of a Merry-Go-Round that is made of recycled tires. What might be other uses?
- Explain that students will learn more about the properties of rubber by using the racquetballs in an experiment.

TEACH

- Divide teams into groups of 3-4 students. Pass out a piece of a racquetball. Have students make observations and list at least 5 traits (have them consider texture, smell, weight or mass, color, size, and what happens when pulled or twisted?)
- Discuss the word elasticity (the ability of an object or material to resume its normal shape after being stretched or compressed; stretchiness).

- Have students conduct activity.
- Depending on grade level and abilities, you may include a more extensive exploration of density, and have students actually calculate it (using displacement method in water to calculate volume, and a scale for mass, where d=m/v). At the most basic level, floating vs. sinking in water is a good way to get a general idea of density (objects more dense than water will sink; objects less dense than water will float). This portion of the activity is a quick and good way of getting kids into "observation mode" and measuring qualities of a material that a scientist might also do if he/she were learning more about its behavior and properties.
- The warm-up portion of the activity should have students thinking about procedure and methods. This is a good time to challenge them to think about how many times (trials) they should do their test and why. How can they repeat it the same way each time? This is also a good time to discuss with students the importance of dropping balls from a certain height, same height each time. Throwing the balls down will: lead to safety issues (hitting someone or something); be hard to measure (because it will go too high or off at a different angle); and make it difficult to control the force with which they throw the ball down every time which could lead to errors. This gives students a chance to think about experimental design and science practices. Discuss and review as a whole class. Eventually, students will follow the guidelines provided in the lab as one example of how to control the variables and plan a safe experiment. Depending on age and ability, you might also allow students to follow their own procedures as long as they are safe and workable.
- Provide guidance as needed during the experiment. Review how to calculate an average as necessary. For younger audiences, you may need to skip this.

REFLECT/ASSESS

Students should be able to:

1. Explain how temperature affects the elasticity (bounciness) of rubber using their data (warmer molecules have more energy and more elasticity. A cold ball will not bounce as high as a warmer ball).
2. List other items that are made of rubber and explain why rubber is good for that use.
3. Examine the physical properties of a school track that has been constructed from recycled automobile tires. Students should predict what might happen to the track when the weather changes, and how might that affect the people running on it (in colder weather, it may be less springy, so there may be less bounce/more impact to the person running).

EXTEND

Have students use the internet to find out where rubber trees are grown and where natural latex is obtained. Have them use the map provided to mark the locations.

The special properties of rubber make it a valuable material. It can be re-used for many purposes. Have students think of the properties of good rubber tires and good running tracks. Have them use the Venn diagram to compare and contrast the properties of tires and running tracks. How are they alike? How are they different? How is rubber an ideal material for both?

JOURNAL QUESTION

Have students imagine a world without rubber! Challenge them to construct a new kind of tire – this could be made from materials that already exist, or could be made from imaginary materials. Have them explain the properties their new creation would have and why. Optional: Invite them to include a drawing!

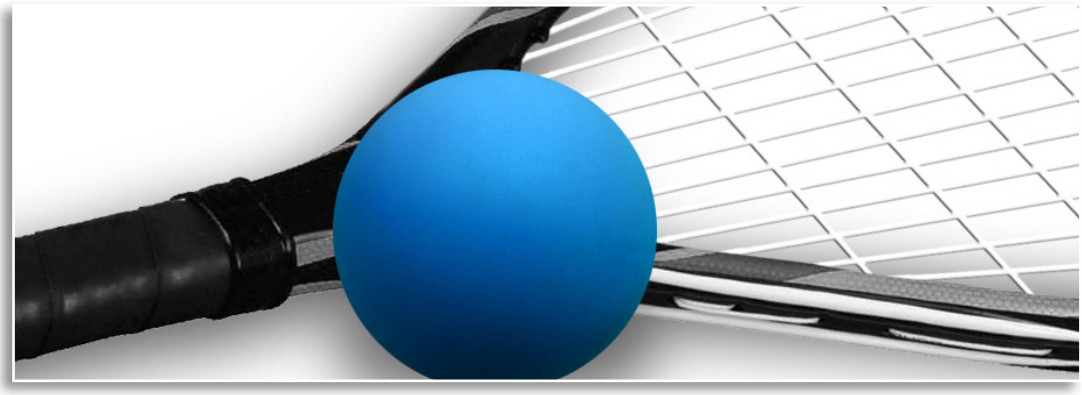
WEBLINKS

Video of kids playing racquetball https://www.youtube.com/watch?v=9TyEVXoASC0

Bounce

National, state, and local standards ask students to develop an understanding of the properties of matter. The unique properties of organic polymers make them essential for many products. One valuable polymer is rubber. In chemical terms it is an elastomer (an elastic hydrocarbon polymer) and a thermoplastic (changing its flexibility depending on the temperature.) Natural latex rubber is extracted from rubber trees grown in tropical zones. The tree lives for about 32 years, using a great deal of water and nutrients. To make natural rubber more durable and less sensitive to temperature changes, it is vulcanized—a process invented by Charles Goodyear in 1839, which changes the sulfur bonds between its long molecules and improves its resistance and elasticity in lower temperatures. Carbon black is often added to improve its strength in tires. (See “Bag It” for how carbon black can be extracted from recycling grocery bags).

Rubber is also an ideal material for sports balls like racquetballs. The standard ball has a diameter of 2.25 inches. Rubber is almost always the material of choice. In the activity, students discover that the elasticity of a racquetball changes with temperature. They examine the requirements of a good running track (resilience and elasticity) and compare them to those of a good automobile tire to develop an understanding that chemical engineers design materials with the ideal properties for certain purposes.



Bounce

Grab a ball and let's play scientist! Each material has special traits or properties. The properties make it ideal for making certain items and purposes. In this activity, you'll examine the elasticity (ee-la-stis-itee) of a racquetball. You will explore how temperature affects how high the ball bounces, and think about the many uses for rubber.

Materials

- Three racquet balls
- Three large paper cups
- Ice cube
- Thermometer
- Markers for labeling cups
- Meter stick
- A large graduated cylinder
- Water (warm and room temperature)

Part 1: Make Observations

1. Your teacher will give you a piece of a racquetball. Make observations and list at least 5 traits. What materials is the racquetball made of?
2. Share observations with the class. What happens when you pull the piece from different ends? When you twist it?
3. Fill a cup or graduated cylinder about 2/3rds of the way up with room temperature water.
4. Make a hypothesis about what might happen when the piece of racquetball is placed into the water. Will it sink or float and why?
5. Place your piece of racquetball into the water – what happens? What does this tell you about the ball?

Part 2: Warm-up

- How high do you think a racquetball can bounce? Can you figure out a way to measure this? With your teammates, discuss how you could find this out.
- Discuss your plan with your teacher to get approval. Then test it out! How high did the ball bounce? Record your measurement.
- How do you think temperature might affect the ball's bounce height (rebound)? Make a prediction. Discuss how you would test this.
- Discuss ideas with the class.

Part 3: Test the Bounce!

- Fill 3 cups halfway with water: warm, room and cold. Make the cold water by putting an ice cube in the last cup.
- Measure the temperature in each cup and record it.
- Place one racquetball in each cup. Leave it there for five minutes.
- One member of your group should hold a meter stick upright. One member will be the observer, and one the recorder.
- Remove each ball from the water, dry it quickly and drop it from a height of one meter (don't throw it; just let it fall). Record the height of the ball's first bounce. Repeat two times.
- Calculate the average height (how would you do this?) Which ball bounced the highest? The lowest?

Reflect and Apply:

1. Elasticity is a trait or property of rubber. The more elastic a material is, the more "bounce" it will have. How did the temperature affect the elasticity (bounciness) of rubber?
2. Can you think of other things that are made of rubber? Make a list and explain why rubber is good for that use.
3. Rubber can be reused and recycled. Look at this photo of a running track at a Michigan middle school. It is made of tiny cubes cut from recycled tires! Discuss the traits or properties that might make rubber a great material to use in a running track! What do you think might happen to the track when the weather changes, and how would it affect the people running on it? Discuss with your class.

Extensions

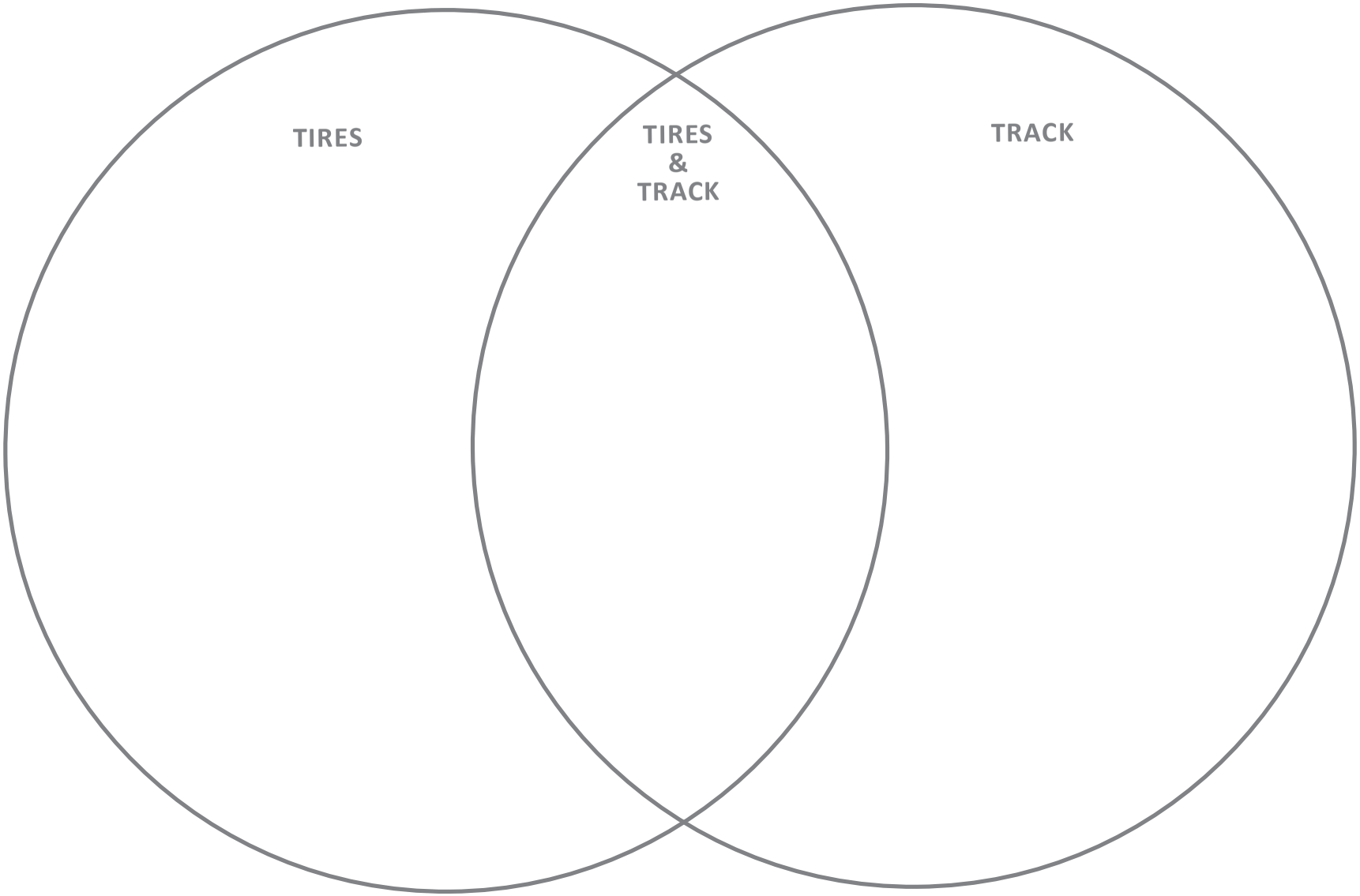
Use the internet to find out where rubber trees are grown and where natural latex is obtained. Use the map provided to mark the locations.

The special properties of rubber make it a valuable material. It can be re-used for many purposes. Think of the properties of good rubber tires and good running tracks. Use the venn diagram provided to compare and contrast the properties of tires and running tracks. How are they alike? How are they different? How is rubber an ideal material for both?

JOURNAL QUESTION

Imagine a world without rubber! If you could make a new kind of tire, what would it be made out of and why? Your new tire can be made from other materials that exist or from imaginary materials. Include a drawing if you wish!

Tires and Tracks



Student Name: Period:

1. Racquetball material observations:

2. Warm-up: How high did your ball bounce in cm? _____

3. Collect your data:

Ball	Temperature	Height of Bounce #1 (cm)	Height of Bounce #2 (cm)	Height of Bounce #3 (cm)	Average Height (cm)
A (cold water)					
B (room temp water)					
C (warm water)					

Which ball bounced the highest? What was its average height?

Which ball bounced the lowest? What was its average height?

Reflect and Apply

1. How did the temperature affect the elasticity (bounciness) of rubber?

2. Can you think of other things that are made of rubber? Make a list and explain why rubber is good for that use.

3. Discuss the traits or properties that might make rubber a great material to use in a running track. What do you think might happen to the track when the weather changes, and how would it affect the people running on it?