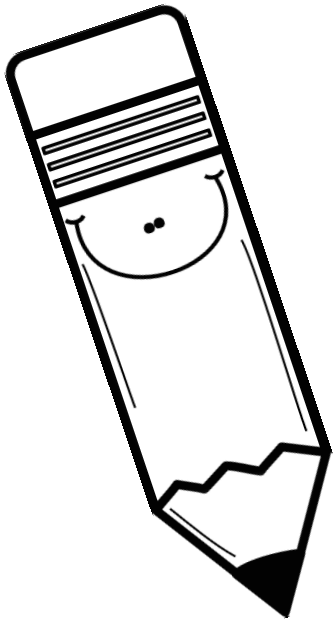
Balancing Pencil STEM CHALLENGE



Objective: Balance a pencil vertically on a craft stick

Materials:

- #2 pencils
- Clothespins
- Pipe cleaners
- Craft sticks
- Tape

Procedure:

1. Tape your craft stick so that it's half on a flat surface and half off.
2. Challenge the students to balance a pencil on the stick.
3. Challenge them to do it with a sharpened pencil and with an unsharpened pencil.
4. After trying for a while, let the students experiment with the clothespins and pipe cleaners. Each student will need 2 clothespins and 1 pipe cleaner.
5. Attach the center of the pipe cleaner around the pencil and attach a clothespin to each loose end of the pipe cleaner. The balanced weight will hold the pencil up, both sharpened and unsharpened.

Balancing Pencil STEM CHALLENGE

Name: _____ **Date:** _____

1. Describe what happened when you tried to balance the pencils without the assistance of the pipe cleaner and clothespins.

2. What impact did the pipe cleaner and clothespins have on the ability to balance the pencil? Explain how that impact was possible.

3. What other materials could we use that would have a similar impact? Explain.

Pencil Tower STEM CHALLENGE

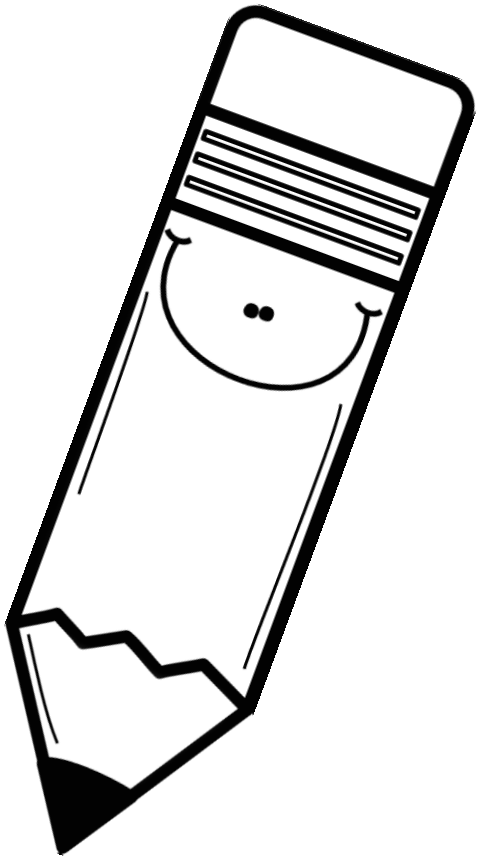
Objective: Build a tower using only pencils

Materials:

- #2 pencils

Procedure:

1. Create a set of rules that the students must follow, such as:
    - Limit the number of pencils
    - Don't allow any binding agents
    - Tower must be XX high



Pencil Tower STEM CHALLENGE

Name: _____ **Date:** _____

1. What rules do I need to remember to follow while I am constructing my pencil tower?

2. Sketch or write a plan for how you will build your pencil tower. Label or list the materials you plan to use.

Pencil Tower STEM CHALLENGE

Name: _____ **Date:** _____

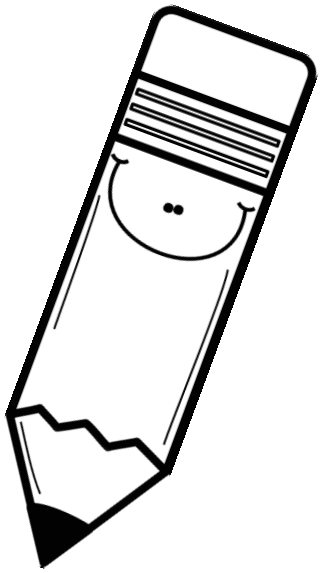
1. Using a ruler, determine the measure of your tower.

2. What one tool, supply, or material had the biggest impact on your tower construction? Explain.

3. If you could have used any tool, supply, or material to help you make your pencil tower taller, what would you use? Explain the reason for your choice.

Light Refraction Pencil SCIENCE

Objective: "Break" a pencil using water



Materials:

- #2 pencils
- Water
- Clear Jar

Procedure:

1. Fill a jar halfway with water.
2. Ask the students, "Can you break a pencil without touching it?"
3. Let the students experiment with trying to break their pencils using the jar, water, and pencils. Some of the students might find the answer without help, but others won't.
4. If the students can't figure it out, show them how to place the pencil in the water and tilt the pencil and jar so that the pencil appears broken when you look at it from the side.
5. Explain that the pencil looks broken due to light refraction. Light refraction happens when something causes the light waves to bend. Usethe reading text on the next page to help explain the concept.

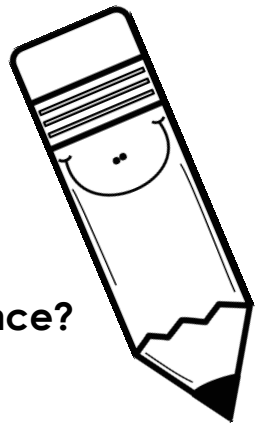
Light Refraction Pencil SCIENCE

You might have heard the phrase "the speed of light." You might have even learned that the speed of light is *constant*. *Constant* means it's never changing. However, the speed of light is only constant in a vacuum. A *vacuum* means empty space where there are no other materials present- not even air! In a vacuum, light travels at a constant speed and in a straight line.

The speed of light is *not* constant, though, when it passes through transparent materials such as air, water, or glass. These are called *mediums*. It's not just speed that's affected. Direction is affected, too. Light passing through a medium no longer travels in a straight line. The result of a medium's influence on light is called *refraction*.

Different mediums have different qualities. They make light bend or turn in different ways. Consider jumping through the air. Now, consider jumping while standing shoulder-deep in a lake. The second medium – water – has a greater impact on speed and motion than the first – air. The same goes for the motion and speed of a ray of light.

This is why a pencil sticking out of a glass of water will appear broken. You're seeing the pencil through two different mediums. The part sticking out of the glass is seen through air. The part submerged is seen through a combined medium of glass and water. Each medium has a separate influence on the way we perceive the pencil. Each changes the direction and speed of light in a different way. Scientists have used these same principles of refraction to make lenses for eyeglasses, microscopes, and telescopes. They've learned to shape mediums like glass in a precise way that enables them to use refraction as a helpful tool.



1. **Using the information in the text, explain how the pencil placed in the water appeared broken.**

2. **How does knowing about refraction benefit the world of science?**

Light Refraction Pencil SCIENCE ANSWERS

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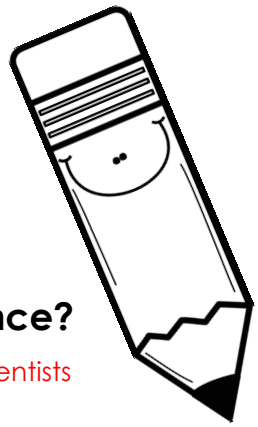

1. Using the information in the text, explain how the pencil placed in the water appeared broken.

The pencil appeared broken because the pencil was being seen through two different mediums. The part not in the water was seen through air. The part in the water was seen through both glass and water, making it look different.

2. How does knowing about refraction benefit the world of science?

Understanding the concept of refraction benefits science because it has allowed scientists to use that knowledge to make lenses for eyeglass, microscopes, and telescopes.

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