Activity Title: An Introduction to Wind Energy

Recommended Grades

Kindergarten, Grade 1, Grade 2, Grade 3, Grade 4, Grade 5, Grade 6

Curriculum Connections

Matter

- K – properties of objects
- 1 – measurements (length)
- 2 – combine materials to create an object for a purpose
- 3 – states of matter
- 5 – density (air, liquids)
- 6 – particle model of matter, expansion/contraction when heating/cooling

Energy

- K – movement of objects
- 1 – direction, pathway, speed of moving objects
- 2 – sources of light (the Sun)
- 5 – thrust, drag, lift, buoyancy; renewable and non-renewable resources
- 6 – elasticity (balloon); energy resources (processed vs. unprocessed energy sources, connect to wind turbines, renewable energy)

Earth Systems

- K – changes in environments (weather)
- 2 – components of Earth include air, water
- 3 – global warming, human activities that change Earth's surface (connect to wind turbines, renewable energy)
- 4 – Earth's surface is warmed by the Sun
- 5 – climate (connect to climate change - wind turbines, renewable energy)
- 6 – climate change (connect to wind turbines, renewable energy)

Computer Science

- K – instructions to be followed, have steps
- 1 – instructions to be followed, have steps

Scientific Methods

- 1 – predict the answer to a question, make observations
- 6 – hypotheses

Time

10-20 minutes for each experiment

Skills Focused On

• Critical Thinking • Hypothesizing	• Observation

Materials Needed

Experiment 1: **Pressures and Temperatures**	**Experiment 2:** **Build a Sailboat**
• Kettle • Plastic bottle • Balloon • Bowl • Access to freezer	• Pool noodle • Scissors • Wood popsicle stick • Clear tape or glue • Cardstock • Ruler • Pencil • Large pan/tray • Water or access to sink

Background Information

Humans have been using wind for thousands of years! From sailing across the oceans to using it to grind flour, pumping water or even generating electricity – humans and the wind are connected. So let's explore wind energy!

Did you know that wind energy is a type of solar energy? The Sun creates wind. This happens because the Sun heats up the Earth and the air surrounding the Earth. But not all areas heat up the same. Some heat up more slowly, and others more quickly. For example, the ocean heats up more slowly during the day than the land surrounding it. But at night, the ocean cools more slowly than land.

The heating of the Earth causes molecules to start moving, becoming more active. This causes the air to rise as it becomes less dense, leaving behind an area of low pressure. Cooler, more dense air rushes in to fill the space left behind by the warm air rising. The air is moving from an area of high pressure into an area of low pressure. This generates wind!

Take a balloon for example. When you blow up a balloon and then release it, the air all rushes out! That's because the air is trying to move from the area of high pressure (inside the balloon) to an area of low pressure (outside of the balloon).

Uneven heating of the Earth can cause winds locally, like on-shore and off-shore winds that form at the coast, but it can also produce winds globally, like the prevailing winds. These global winds generally blow in the same direction throughout the year. This is really important when humans want to use wind, for example, for sailing around the world, or for generating electricity.

Let's explore the wind in a couple ways.

Experimental Steps

Experiment 1: Pressures and Temperatures

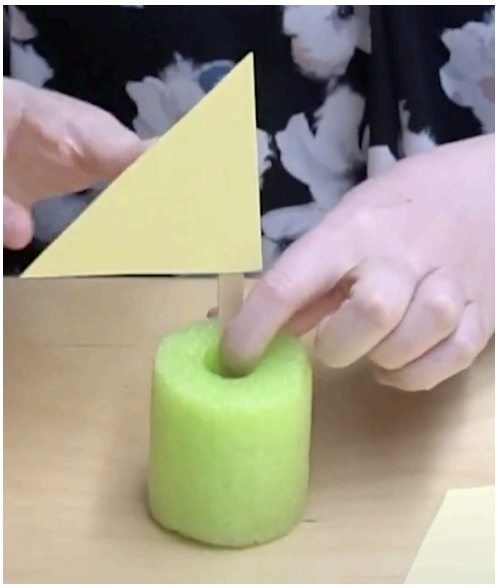
1. Stretch out your balloon and blow it up a few times.
2. Place the balloon over the end of the plastic bottle.

3. Place the bottle in the freezer (with the balloon still on it) for about 30 minutes.
4. Right before you take the bottle out of the freezer, heat up some water in your kettle. You will need a grown-up's help here.
5. Pour the hot water into the bowl.
6. Make a prediction (hypothesis)! What do you think will happen when you put the cold bottle into the hot water?
7. Carefully submerge the bottle about ⅔ to ¾ of the way.

8. Watch what happens! Did it match your prediction?

Experiment 2: Build a Sailboat

1. Have a grown-up cut a piece of the pool noodle, about 5 or 6 centimeters tall.
2. Cut a right triangle out of your cardstock, about 5 centimeters tall.
3. Glue or tape the sail to the wooden popsicle stick. If you used glue, let it dry.
4. Place the end of the popsicle stick inside your pool noodle. Tape it in place securely.



5. Pour a few centimeters of water into your pan or tray.
6. Using a fan, your breath, or the wind outside, see if you can move your boat!

Discussion/Experimental Extensions

Experiment 1: Pressures and Temperatures

The cold air inside the bottle is denser from being in the freezer – the molecules are held more tightly together. So when it is exposed to heat, those molecules start to warm up and move around more. This causes the balloon to start to inflate, because the molecules are further apart.

Possible discussion questions:

- Why do you think the balloon inflated?
- Would the balloon still inflate if we used cold water? What if we didn't put it in the freezer? Why or why not?
- Do you think the balloon would inflate more if we left the bottle inside the freezer for longer?

Possible extensions:

- Try different types of balloons. Which kind inflates the most? Why do you think that is? (Elasticity, thickness of material, etc.)
- What happens if we put some cold water or ice inside the plastic bottle before we put it in the freezer?

Experiment 2: Build a Sailboat

Possible discussion questions:

- Why does the boat move?
- Do you think the boat would still float if we replaced the pool noodle with something else? What other materials do you think might work?

Possible extensions:

- Build the best boat you can! Experiment with different sizes, shapes, and materials for your sail and the body of your boat.

Additional Resources

An Introduction to Wind Energy experimental video produced by Future Energy Systems - provides background information and instructions for experiment: https://youtu.be/NfjzORDySCY?feature=shared.

Learn more about Future Energy Systems (https://www.futureenergysystems.ca/) and access more learning content, including storytimes, lab tours, ask an experts and more (https://www.futureenergysystems.ca/engage/learning https://www.youtube.com/channel/UCJr8N9KyFJ6d-t36TPtUlwg).