

Activity Duration: 5-10 minutes**Grade Level: 3-7**

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Wind Power From a Toaster



Hands-on

STAR[★]net

Tested & Approved STEM Activities

CAN A TOASTER MAKE WIND?

Activity Guide



Science-Technology Activities &
Resources For Libraries

A product of the Science-Technology Activities and Resources for Libraries (STAR_Net) program.
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CAN A TOASTER MAKE WIND?

Overview

Children investigate the source of wind. They use a toaster to heat air and observe the movement of a small aluminum foil kite — due to wind! They compare the appliance's heat source to Earth's warmed surface and discover that wind is a type of convection.

Activity Time

5-10 minutes

Intended Audience

School-aged children ages 8-9
Tweens up to about age 13

Type of Program

- Facilitated hands-on experience
- Station, presented in combination with related activities
- Passive program
- Demonstration by facilitator

What's the Point?

- Changes to distant oceans, air moving freely around our globe, and all living things have an influence on our regional environment. Our local weather is determined, in large part, by global patterns of atmospheric movement.
- A heated surface warms air, causing the air to rise.
- Earth's surface is warmed by the Sun.
- Wind is the horizontal movement of air, caused by warm air rising and cool air moving in to take its place.
- Models — such as the children are using here — can be tools for understanding the natural world.

Facility Needs

- 1 table
- Access to an electrical outlet

Materials

For the Facilitator

- Materials to construct one “kite:”
 - 1 (0.25” x 12”) dowel or chopstick
 - 1 (3.5” x 3.5”) piece of aluminum foil (not “heavy duty”)
 - 1 paperclip
- Brief Facilitation Outline* page (below)

For Each Group of 3-4 Children

- 1 toaster
- 1 aluminum foil “kite,” constructed beforehand using the materials listed above
- Wide tape or cord cover

Supporting Media

Books

The Everything Kids' Weather Book: From Tornadoes to Snowstorms, Puzzles, Games, and Facts that Make Weather for Kids Fun!

Joe Snedeker, Adams Media, 2012, ISBN: 978-1440550362

Games, investigations, and engaging text bring aspects of weather and Earth’s atmosphere — including air, water, clouds, the jet stream, weather stations, rainbows, and more — to life.

Appropriate for ages 7-12.

National Geographic Kids Everything Weather: Facts, Photos, and Fun that Will Blow You Away

Kathy Furgang, National Geographic Society, 2012, ISBN: 1426310587

This book about weather – including wild weather – is appropriate for ages 8-12.

Gases, Pressure, and Wind: The Science of the Atmosphere

Paul Fleisher, Lerner Publications Company, 2011, ISBN 9780822575375

This book offers a detailed look into the important role that air plays in shaping our planet.

Appropriate for children ages 9–12.

Handouts

Beaufort Wind Scale

Children can use a chart to estimate how fast the wind is blowing — without any instruments other than their own eyes — by observing the influence of the wind on smoke, trees, people, and other visible objects. Print the chart that best suits your needs: The National Weather

Service chart (www.spc.noaa.gov/faq/tornado/beaufort.html) lists the appearance of wind effects on both land and water, and the Mount Washington Observatory's worksheet give more information for students ages 10 and up. (https://www.mountwashington.org/uploads/pdf/Collecting_Wind_Data_on_Mount_Washington_Worksheet.pdf).

Science Notebooks for Ongoing Weather Observations

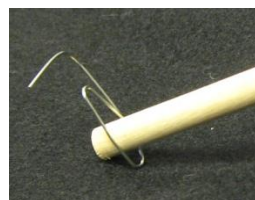
The Michigan Reach Out! "Keeping a Daily Weather Log" activity at www.reachoutmichigan.org/funexperiments/agesubject/lessons/caps/log1.html includes a printable chart to record temperature, wind speed and direction, relative humidity, and other data. Alternatively, professional-grade journals, such as those manufactured by www.riteintherain.com, may serve as a valuable memento for the children.

Preparation

Beginning six months before the activity

- Prepare and distribute publicity materials for programs based on this activity. If possible, build on the children's knowledge by offering multiple science, technology, engineering, art, and mathematics (STEAM) programs. See the STAR_Net resources listed at <https://www.starnetlibraries.org/resources/> for ideas.
- Arrange for an adult or teen to monitor the use of the toaster for this activity. Or, conduct the investigation as a demonstration by the facilitator. **The toaster used in this activity poses a fire hazard and the appliance will get hot; please use proper caution!**
- Construct an aluminum "kite:"

- Partially stretch out the paperclip.
- Hook the looped end of the paperclip onto one end of the dowel; it will be a tight fit!
- Puncture the aluminum foil with the straightened end of the paper clip to suspend it. The "kite" should be able to move freely to catch "wind" flowing from different angles up from the toaster.



The day before the activity

- Provide an appropriate space where the toaster can be safely plugged into the wall. It may be necessary to tape down the cord or install a cord cover to prevent tripping.
- Perform a test-run of the activity to ensure that it proceeds as planned.

Activity

1. Share ideas and knowledge.

- Introduce yourself and the library. Help the children learn each other's names (if they don't already).
- Frame the activity with the main message: Our local weather is determined, in large part, by global patterns of atmospheric movement.
- Invite the children to talk about what they already know about wind, their direct experiences with it, and their ideas about what causes wind. Use open-ended questions and invite the children to talk with you and each other.

The children may have a variety of ideas, including mechanical sources, like fans or moving in a car, and natural sources, like falling rain dragging air along. Allow the children to offer and confront possible erroneous ideas, such as that cold temperatures, the Moon, trees, or clouds cause wind.

- Explain that the children will model the natural source for winds on Earth using a toaster. They will use aluminum foil "kites" to detect the wind. Turn the toaster on so that it has time to heat up. Ask for predictions about whether or not a toaster can create wind.

Making predictions, and later reflecting on them, is a great skill for analytical thinking! Avoid giving the "answer;" instead, invite the children to respond to, and build upon, each other's predictions.

- ### 2. Invite the children to hold the dowel and suspend the "kite" over (10–15 inches) the top of the toaster.
- Take care to keep the "kite" from falling into the toaster! Discuss their observations and interpretations of what happened. Guide the discussion to the conclusion that air, warmed by the toaster, rose and pushed against the "kite."

Wind is simply air molecules in motion. The glowing coils in the toaster produced infrared radiation, heating the toaster. The heated metal then warmed the air in the toaster, making the air less dense and causing it to rise. Cooler air moved in to replace the rising air — creating wind.

- ### 3. Apply the small-scale toaster model to the much larger scale of Earth's atmosphere.
- Discuss how wind is formed. Encourage the sharing of evidence and conclusions with prompts such as:

- What is the heat source on the Earth?
- How is the Sun like the heating elements inside the toaster?
- How is movement of the warmed air like the movement of air around the globe?

The Sun's light heats Earth's surface, and that heat is passed to air touching the ground. The warm air becomes less dense and rises. As cold air moves in to replace the rising air, we feel wind.

- 4. Conclude.** Summarize that the movement of warm and cold air across the globe influences local weather. Whenever we feel wind, somewhere on the globe, air is rising!

Correlation to Standards

National Science Education Standards

Grades K–4

Earth and Space Science – Content Standard D

Changes in the Earth and Sky

- Weather changes from day to day and over the seasons. Weather can be described by measurable quantities, such as temperature, wind direction and speed, and precipitation.

Grades 5–8

Science as Inquiry – Content Standard A

Abilities Necessary to Do Scientific Inquiry

- Different kinds of questions suggest different kinds of scientific investigations. Some investigations making models.

Earth and Space Science – Content Standard D

Structure of the Earth System

- Global patterns of atmospheric movement influence local weather.
- The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle.

Extensions

It's Your Planet — Love It!

<https://www.girlscoutsp2p.org/en/members/for-girl-scouts/badges-journeys-awards/journeys.html>

Girl Scouts explore water, energy, and air quality through this program. There is a guide for Girls Scouts adult volunteers, as well as the following activity book:

Girl Scouts' Breathe

This book offers a path to leadership for children ages 11-13. The guide to asking questions of professionals in related careers, as well as information about wind, global warming, ozone, weird weather, trees, and air pollution, are especially relevant to *Discover Earth*.

Tornado In A Bottle

<http://celebrating200years.noaa.gov/edufun/book/TornadoBottle.pdf>

Using two 2-L bottles and water, children observe a vortex that is similar to the spiraling winds that create tornados.

Explore wind even further through projects such as:

- ***Wind Turbine Tech Challenge***, STAR_Net
<https://clearinghouse.starnetlibraries.org/engineering/37-wind-turbine-tech-challenge.html>
Participants build a model wind turbine, then explore and test common materials to identify a modification that would enable their model to better catch the wind.
- ***4-H Grab and Go: Kites***, University of Illinois
<http://howtosmile.org/record/3442>
This instruction sheet describes how to fold a kite and then modify the design to help the kite fly better. For younger children, provide pre-folded kites for them to decorate and fly.

References

Toasty Wind, JetStream — Online School for Weather, National Weather Service,
<https://www.noaa.gov/jetstream/global/learning-lesson-toasty-wind>

CAN A TOASTER MAKE WIND?

Brief Facilitation Outline

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- Frame the activity with the main message: Our local weather is determined, in large part, by global patterns of atmospheric movement.
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- Explain that the children will model the natural source for winds on Earth using a toaster. They will use aluminum foil "kites" to detect the wind. Turn the toaster on so that it has time to heat up. Ask for predictions about whether or not a toaster can create wind.

2. Invite the children to hold the dowel and suspend the "kite" over (10–15 inches) the top of the toaster. Take care to keep the "kite" from falling into the toaster! Discuss their observations and interpretations of what happened. Guide the discussion to the conclusion that air, warmed by the toaster, rose and pushed against the "kite."

3. Apply the small-scale toaster model to the much larger scale of Earth's atmosphere. Discuss how wind is formed. Encourage the sharing of evidence and conclusions with prompts such as:

- What is the heat source on the Earth?
- How is the Sun like the heating elements inside the toaster?
- How is movement of the warmed air like the movement of air around the globe?

4. Conclude. Summarize that the movement of warm and cold air across the globe influences local weather. Whenever we feel wind, somewhere on the globe, air is rising!