

Catch the Wind

Teacher Background

Wind has been used as a energy source for centuries. Inventions from sailing ships to wind will harness the energy in moving air and turn it into power to do work. In this model activity, you will guide your students in a discussion and activity to design and build a wind turbine, and use it to capture the moving air from a box fan to lift as many pennies as you can 10 centimeters straight up.

Problem/Question

Begin by putting the students in cooperative learning teams of 3 to 4 students. Hand out a copy the “Catch the Wind” paper project board to each student. Ask, “*How can we capture the wind from a box-fan and use it to lift some pennies?*” Tell them to write this problem under the **Problem/Question** label on their paper project board. Write on the white board, “**Can we capture the power of the wind and use it to lift some pennies?**”

Explore/Hypothesis

Next, ask the students to “*Imagine the types of inventions or technologies you already know about that can capture the wind?*” (Probe for answers like a kite, pin wheel, or the sail of ship.) Show them a Pin Wheel (either one you bought or make with the turbine template). Ask, “*How does it capture the wind?*” “*Could we use a pin wheel like this to lift something?*”

Under the Explore/Hypothesis label on their paper project board tell the students to write, “**How many pennies can I lift with a wind mill made out of paper and string?**”

Design/Plan

Have the students look at the drawing of the Wind Mill on their paper Project Board under the label *PLANS*. Help them label the parts of the drawing and write a title for the drawing (wind turbine blades are already labeled).

Materials

Help the students write the list of materials they will need to build their wind mills. Make sure they list the quantity for each item on their list. Once they have their list done, have them come and get the materials they need to make one (1) wind mill per team. You may want to also provide a large gallon size plastic baggie to keep their materials (wind mill) together if you need two days to build and test their models. They can write their names on the baggies using a sharpie marker.

Create/Procedure

Next, have the students write the procedure they will follow to create (build) their wind mills. Since all the wind mills are the same design, you can have the students copy the steps (found on the Answer Key) in order. Once they have their procedure written they can start making their wind mills. Make sure that the string from the pencil to the small cup is exactly 10cm long (the distance that the pennies need to be lifted for each trial). You can use blue painters tape to secure the cotton string to the pencil at exactly 10cm from the small cup. Help the students cut and fold the wind turbine correctly, turning numbers 1 through 4 to the center and securing the blade to the eraser of the pencil (like a wheel and axle) so that when the turbine blade catches the wind it turns the pencil. The string should wrap around the pencil lifting the pennies in the small cup up. When the small cup reaches the bottom of the large cup, record the time in seconds. Give the teams time to run their trials and record their data in their tables.

Catch the Wind

Improve/Test

Students will explain how their wind mill design has changed from the initial design/plan phase. This will include information about how your tests have informed your design changes, and other important information about changes made to the product, experiment, or procedures. Students should give examples of what they did to improve (help) their wind mills to work properly in each trial until it lifted the pennies.

Data

Before testing their wind mills, have the students predict how many pennies each turbine blade will lift. "Yes" means they think it will lift that many pennies, "No" means they think it won't lift them. (indicated in red in the Answer Key) Once they have their prediction recorded, they can begin their trials. After each test they need to record the "results" - Yes if it lifted all the way or No if it did not. Also record the time in seconds it took to lift the pennies all the way up to the bottom of the large cup.

Share/Conclusions

Using the data they have collected for each trial, have the students write true statements about "How well their wind mill worked." Have them explain their results (green Yes or No in the Answer Key) and time in seconds (blue Yes or No on the Answer Key) to support their claims.

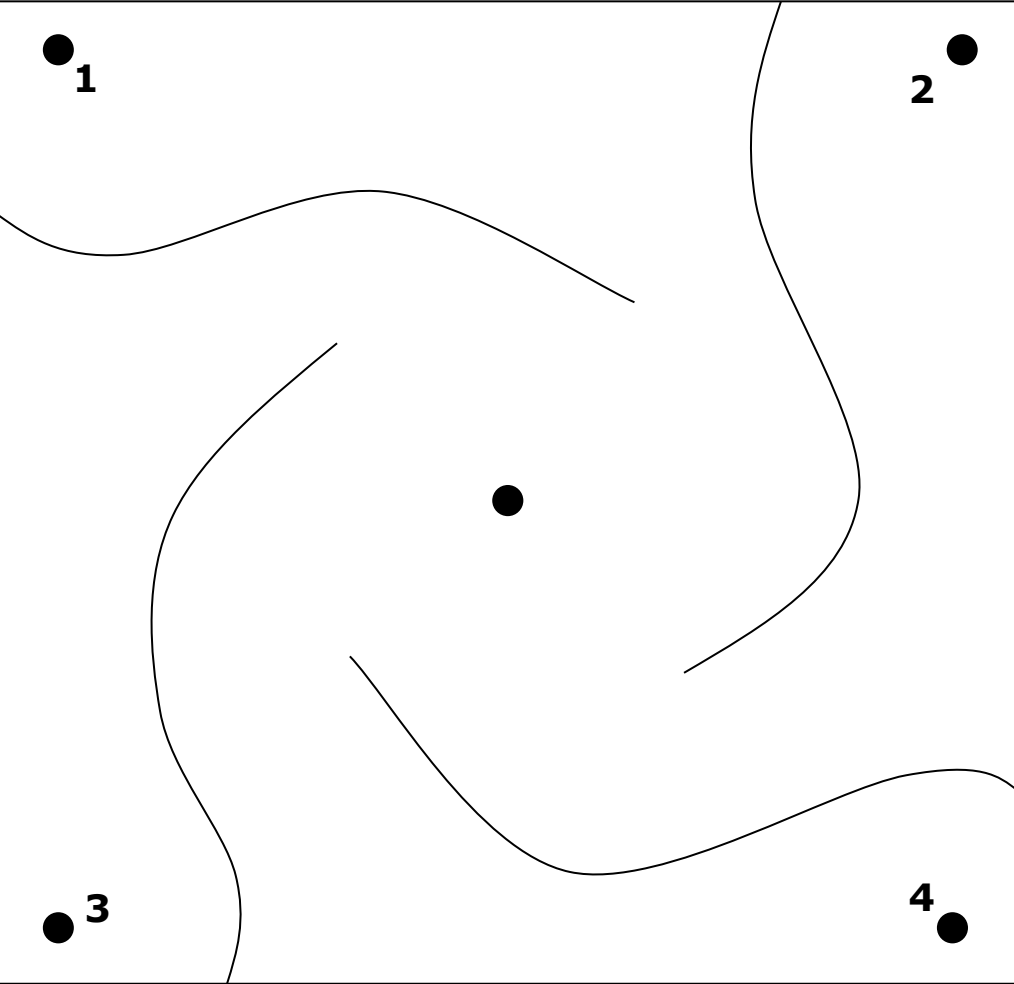
Real World Connections

Identify the science, technology, engineering, and mathematical concepts used in your investigation. Explain how your investigation related to the real-world and/or career.

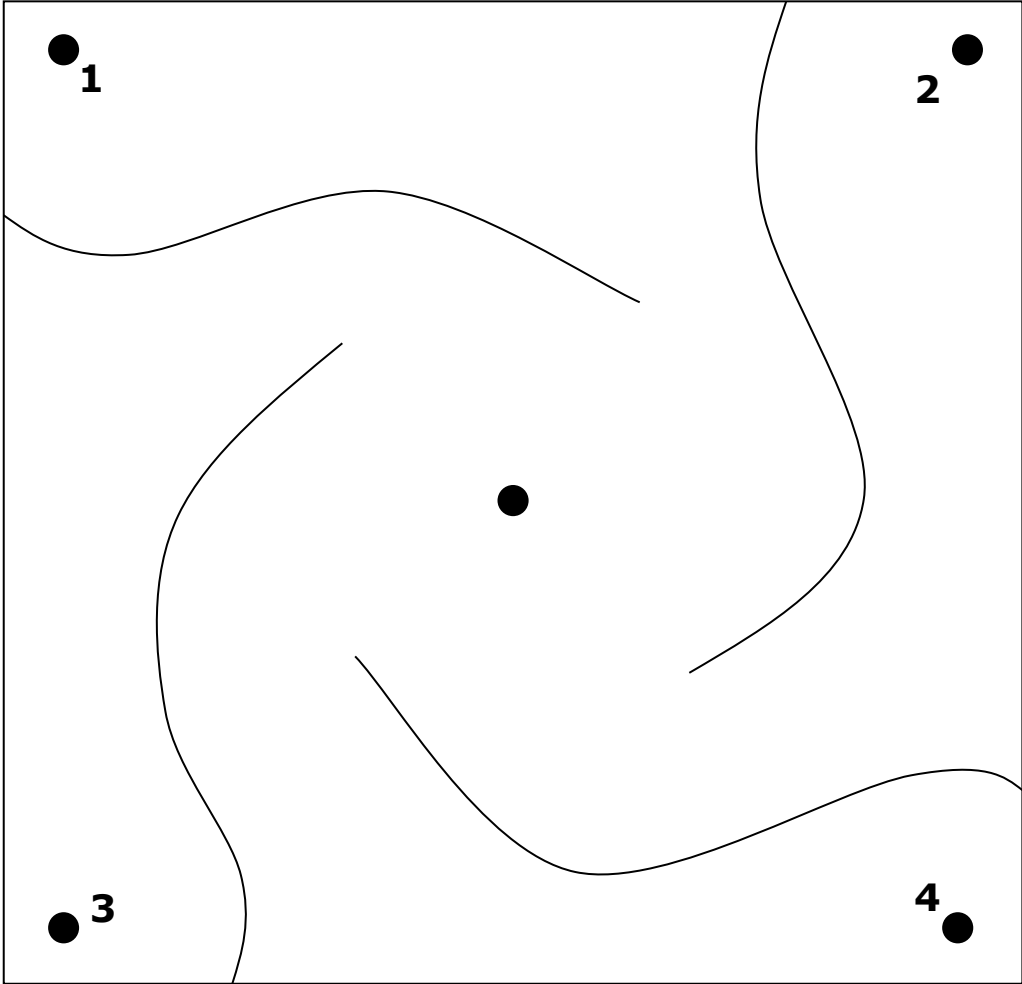
Modeling this activity may take two (2) days. Use card stock to copy the small and large wind templates. Thumb tacks may be substituted for the push pins in needed. Like wise foam or plastic cup may be substituted for paper.

When the students have completed their paper project boards, they have a sample of how to put together a STEM project. Remind them that they can enter a Math, Science, or STEM project in the Fair. They can work in TEAMS or INDIVIDUALLY. If they do a project based on a STEM theme, they have more chances to win more awards (especially if they move on to the District Fair competition).

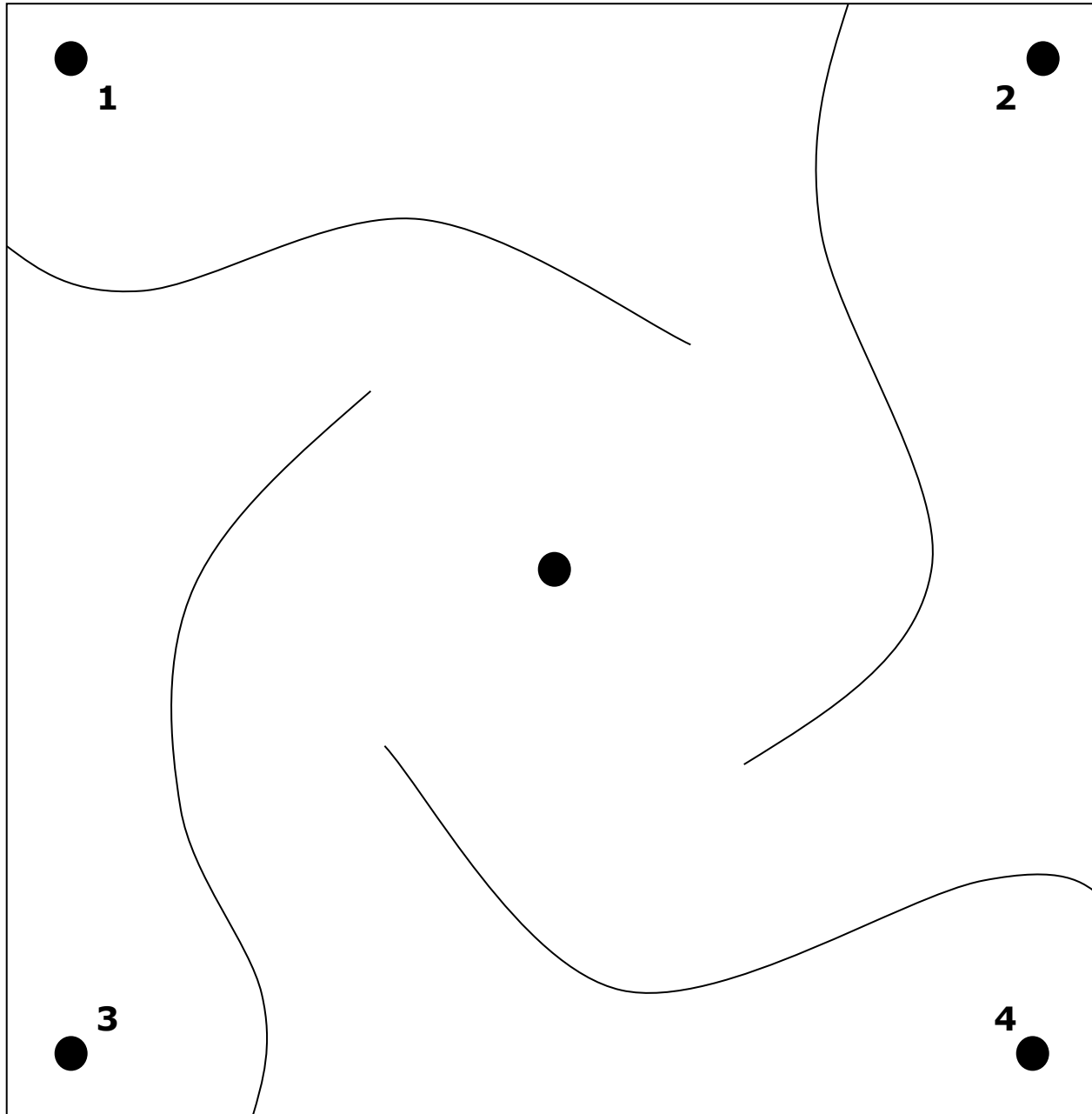
Small Wind Turbine Blade



Small Wind Turbine Blade



Large Wind Turbine Blade



Catch the Wind

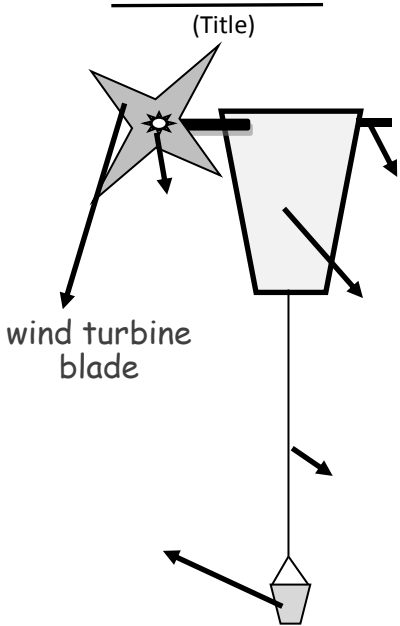
Problem/Question

Can we capture-

Explore/Hypothesis

How many pennies-

Design/Plan



Materials

1 wind small & large turbine template

Create/Procedure

1. Get your materials from the teacher.

Improve/Test

Data

TYPE OF TURBINE	TRIALS	LIFT? YES OR NO		LIFT TIME
Small Wind Turbine Blades	1 penny			
	2 pennies			
	3 pennies			
Large Wind Turbine Blades	3 pennies			
	4 pennies			
	5 pennies			

Share/Conclusion

We were able to-

Real World Connections

Answer Key

Catch the Wind

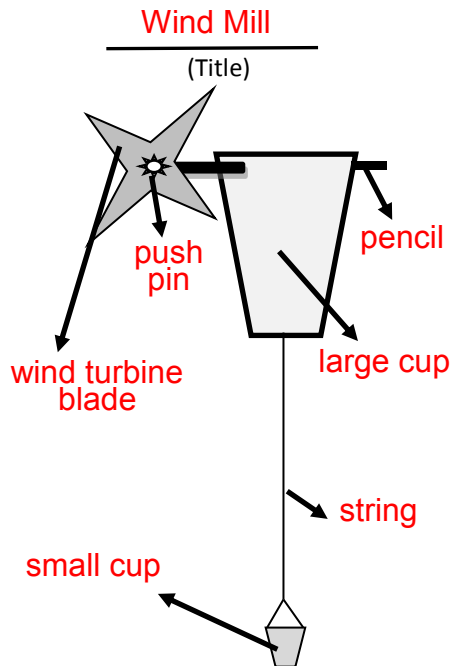
Problem/Question

Can we capture the power of the wind and use it to lift some pennies?

Explore/Hypothesis

How many pennies can I lift with a wind mill made out of paper and string?

Design/Plan



Materials

1 wind small & large turbine template
1 pencil
3oz. paper cup
10oz. paper cup
25cm of cotton string, scissors, tape
5 pennies
1 electric box fan, and a clock

Create/Procedure

1. Get materials from the teacher.
2. Build the Wind Mill like the PLANS.
3. Predict what you think each turbine will lift.
4. Test the small turbine wind mill with the fan on high speed. Then test the large turbine blade.
5. Record the result and lift times for trials of 1, 2, and 3 pennies using the small turbine blade.
6. Record the result and lift times for trials of 3, 4, and 5 pennies using the large turbine blade.
7. Looking at your data table, write as many true statements about how well each turbine worked under conclusions. Site your evidence for each claim.
8. Explain how you improved your test results with each test trial.

Improve/Test

Data

TYPE OF TURBINE	TRIALS	LIFT? YES OR NO		LIFT TIME
Small Wind Turbine Blades	1 penny	yes	yes	5 sec.
	2 pennies	yes	yes	8 sec.
	3 pennies	no	yes	13 sec.
Large Wind Turbine Blades	3 pennies	yes	yes	2 sec.
	4 pennies	yes	yes	7 sec.
	5 pennies	yes	yes	15 sec.

(Real test data may vary by team!)

Share/Conclusions

We were able to lift pennies using the wind mill. The small turbine blade lifted up to 3 pennies and the large turbine up to 5 pennies. The more pennies added to each trial the more seconds it took the turbine to lift the pennies up 10cm. One improvement we made was holding the pencil still and another was staying the same distance away from the fan for each trial.

Real World Connections