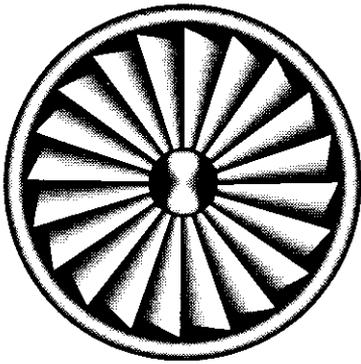


TURBINES

CONCEPT: *Turbines spin to generate electricity. We can use them to spin magnets near or through coils of wire to produce electricity.*



DIRECTIONS/LAB: Hand out the pinwheel cut out pages for students to make a pinwheel turbine in class. Their outside lab work (Home Lab, not Homework) will be to design other turbines that can spin in water, air, or steam that will be tested at school. All attempts should be recognized; students need to be encouraged and rewarded for their efforts, no matter what they come up with to solve a given problem.

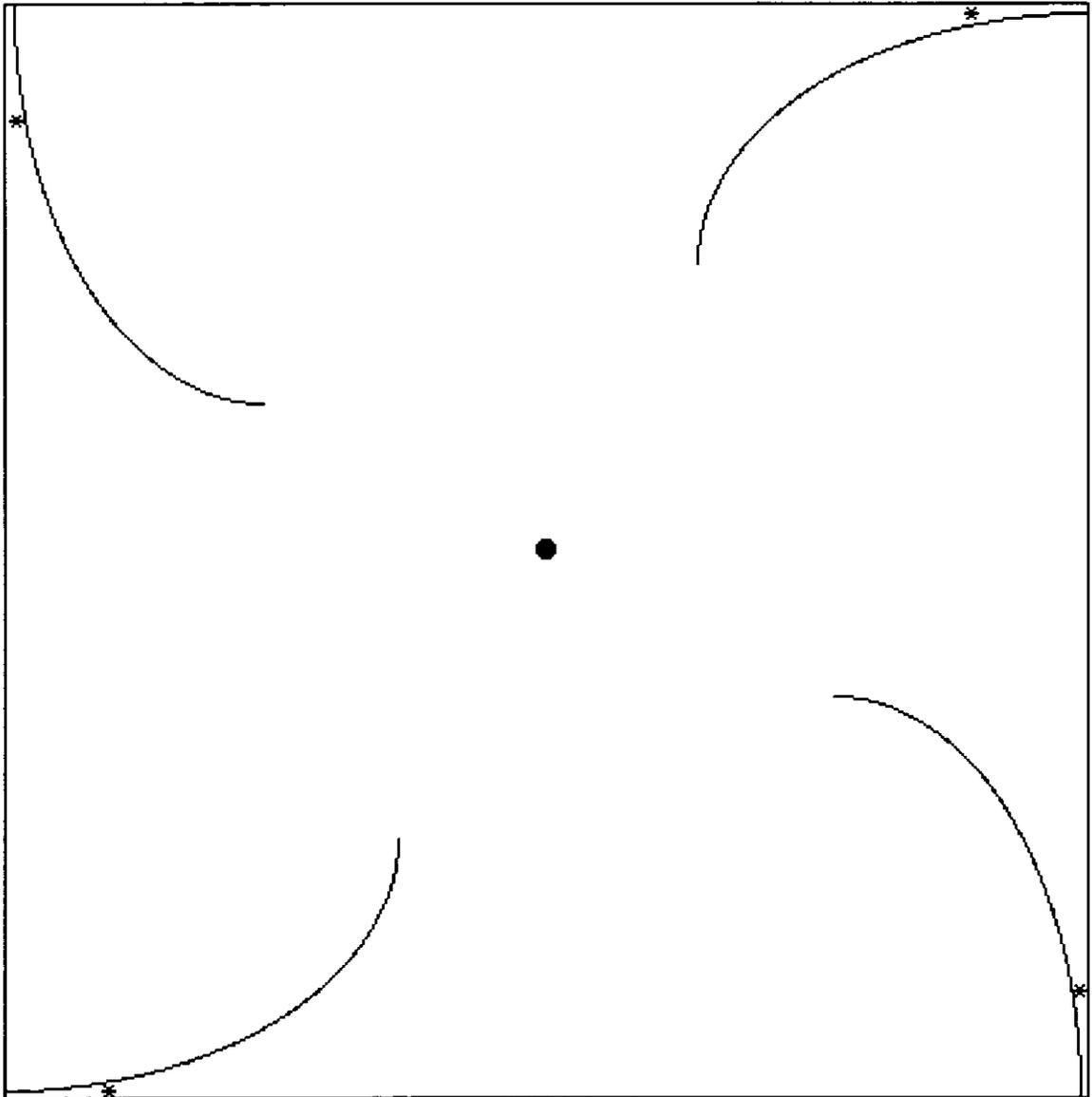
Can the students think of ways to connect their pinwheels to magnets? Can they draw a turbine/magnet/coil system for generating electricity? In the next lesson on turbine choices, the type of fuel used to spin the turbine will influence these designs. The collection of the evolving designs is a very important part of the demystification of electrical power generation.

DESIGN LABS: Students begin designing their conception of electric power plants in Lesson 10 and improve on their ideas in the following lessons. Encourage students to keep a record of ideas in their notebooks as they evolve. Students can make small models of their power plants (paper, recycled materials, clay, Legos, etc.). These models can be used to make presentations to the class. They can also be used when students turn “lobbyists” to promote their form of energy production during the Power Game. (Depending upon the teacher’s grading policy, this forms an excellent way to reward extra effort and excellence in science.)

Variations:

- 1) Materials (pinwheel/turbines will be used in water and steam)
- 2) Mounts (vary angles, materials, and look ahead to future lessons where drive shafts will turn magnets or coils)
- 3) Try different sizes and variations in the curves of the blades
- 4) Try different shapes (triangles, ovals, circles, etc.)

INQUIRY: In this lab, students spend time discussing the emotions involved in the experimental process. Why is it so hard to try something that might not be a success? Why do we want or need the first try to be successful to the point that if it appears that it won't be a success, we don't even attempt it? What models do students have of scientists, experimenters, or inventors and the process of *failure* as the best teacher toward the final success? What role does guessing have? Scientists call their educated guesses *hypotheses*. If they were called guesses, how would that change our opinion of the "scientific process"? When students are guessing, they should be rewarded (even graded) as they are truly engaged in the scientific process.



Cut along the solid lines. Tape the ends marked * to the center.
Pin the center to a pencil eraser.