

Equilibrium Arrow

Critical Thinking and Problem Solving

Introduction

Keep your students guessing with this device!

Concept

- Scientific method

Materials

- Lamination film
- Laminator
- Paper, card stock, 8 × 8-inches (20 × 20 cm)
- Paper, colored, to make the arrows

Safety Precautions

Although the materials in this demonstration are considered nonhazardous, always follow laboratory safety guidelines.

Preparation

1. Make two large versions of the arrow shown above. They should be approximately 8 inches long.
2. Use a 10 × 10-inch (25 × 25 cm) card stock center.
3. Glue an arrow on each side so that they are perpendicular to each other as shown at right.
4. Laminate together.

Procedure

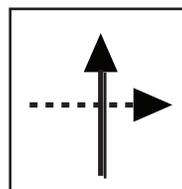
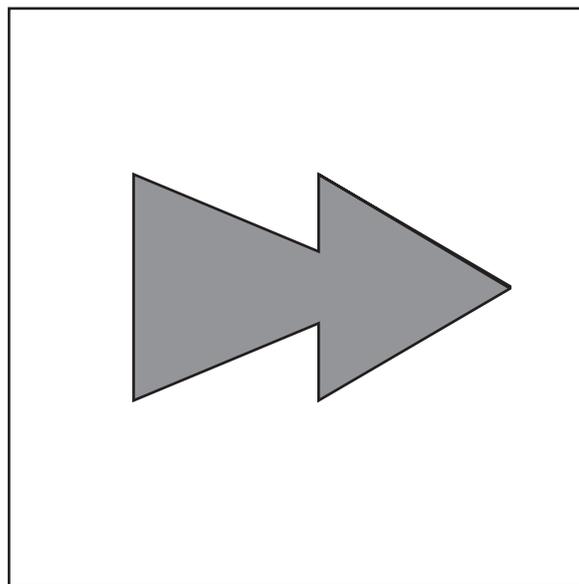
1. While holding on opposite corners of the card with your fingertips, rotate the card diagonally—corner for corner.
2. First, use the two corners that result in no change in the arrow direction.
3. Then use the other two corners, which will result in a direction change when rotated corner for corner.

Disposal

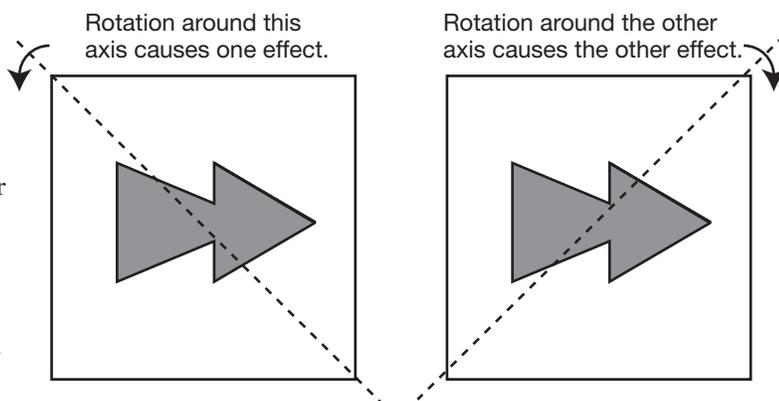
None. Save materials for future use.

Tips

- You want to practice this so that the arrows stop for viewing at just the right time—the rotation should be fast but the motion must stop when the arrows are in viewing position.



Dashed arrow
on backside



- Another problem is that it is difficult to hold the corners so that the card is horizontal—there is a tendency to shift fingers so that the corners are vertical or horizontal. Practice! Practice! Practice!

Discussion

A card with arrows on both sides is held by its corners and rotated. Holding certain corners will leave the arrow direction unchanged through the rotation event. Holding the opposite corners results in the arrow shifting directions during card rotation. The magic effect can be used as an entertaining introduction to equilibrium and/or to present a problem-solving situation.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation

Content Standards: Grades 9–12

Content Standard A: Science as Inquiry

Content Standard B: Physical Science, structure and properties of matter

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Equilibrium Arrow* activity, presented by Jeff Hepburn, is available in *Critical Thinking and Problem Solving* and in *Momentary Diversions*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.