

# The Shadow Knows

## Summary

In this activity students will discover the relationship between the angle which light strikes an object and the length of the shadow.

## Materials

### - [The Shadow Knows](#)

Straws  
Scissors  
Clay  
Protractors  
Flashlights  
Rulers

## Additional Resources

### Books

- *The Real Reasons for the Seasons*  
, by Alan Gould, Carolyn Willard, Stephen Pompea; ISBN0-924886-45-5

## Background for Teachers

In this activity students will discover the relationship between the angle which light strikes an object and the length of the shadow. When light strikes an object at a perpendicular angle to the surface where the shadow is cast, the shadow is almost nonexistent because the shadow is within the area covered by the object. As the angle of the light is changed the shadow falls in the opposite direction of the light source. The shadow length will increase with the decrease of the angle between the object and the surface where the shadow is observed. Before doing this activity it may be helpful to review terms: perpendicular, acute angle, right angle, obtuse angle, angle of incidence, angle of reflection. Students should also review the use of a protractor.

## Intended Learning Outcomes

1. Use Science Process and Thinking Skills.
4. Communicate Effectively Using Science Language and Reasoning.
6. Understand the Nature of Science.

## Instructional Procedures

### Invitation to Learn

Discuss Groundhog Day... Ask students to share comments about whether it is Scientific or Not.

### Instructional Procedures

#### The Shadow Knows

Cut a piece of the straw that is about six cm in length.

Use a small ball of clay and stick it to the table. Use the protractor to place the straw perpendicular to the surface.

Cut a slit in the remaining piece of the straw so it will fit over the protractor and be used as a guide to the angle of incidence.

Determine three acute angles that are relatively equal that will be used to gather shadow data (e.g., 90, 65, 45, 25).

Label the T-chart on the worksheet with the angles chosen.

Set the protractor and straw at 90 and use the flashlight to shine light. Measure and record the

length of the shadow.

Repeat steps for the remaining angles.

After completing the experiment, students will write a statement that describes the relationship between the angle of incidence and the shadow's length.

### Extensions

#### Curriculum Extensions/Adaptations/Integration

Students can use a variety of straw lengths to explore ratio of straw length to shadow length.

Sketch an object from multiple angles and predict shadow features.

#### Family Connections

Find a relatively permanent object in the yard. Take several shadow measurements at different times over several days. Organize a table that provides time measurements based upon shadow observations.

### Assessment Plan

- *Where's the Light*  
worksheet

Quick Question: Puxitony Phil comes out of his hole and sees a very long shadow, what information could Phil determine shadow.

### Bibliography

Bass, Kristin. M., Glaser, Robert.(2004) Developing Assessments to inform teaching and learning. *CSE Report 628*.

A key aspect of teaching has always been monitoring students' progress. Teachers traditionally do this by giving curriculum-based classroom tests and judging the number of correct responses. Unfortunately, this usual approach to assessment often does not provide the information that teachers could use in order to improve student proficiency.

Deboer,G. (1991). *A history of ideas in science education*. New York: Teachers College Press.

A key component of fostering learning is getting students to identify their ideas and then clarifying and challenging the validity of those ideas. This process enables students to redesign their thinking and create a stronger, more accurate structure of knowledge. New ideas and old ideas modify one another in a process of accommodation and assimilation.

### Authors

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