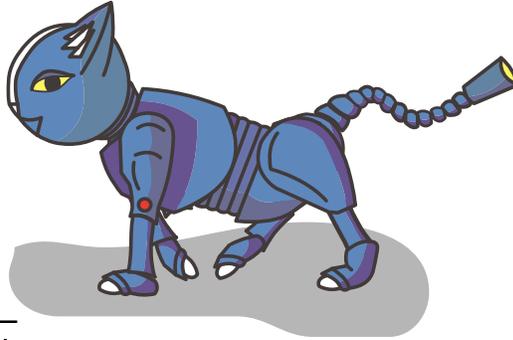


LIGHT ACTIVITY

SCIENCE: Light
MATHEMATICS: Angles
LANGUAGE ARTS: Writing conclusions

AIM: Students discover the properties of light and reflection.



BACKGROUND: Light is a form of energy—without it, we cannot see. Traveling through space at approximately 186,000 miles per second, sunbeams and rays from lamps strike objects and bounce off of them. When an object reflects light rays toward our eyes, we see the object. Nearly all objects reflect light rays.

Although most objects are reflective, rays bounce most effectively off of smooth, shiny surfaces—such as mirrors. When light reflects off of mirrors, the angle of incidence equals the angle of reflection. In other words, the angle between the incoming ray and the mirror and the angle between the outgoing ray and the mirror are equal.

Light, a form of electromagnetic radiation, spreads out as it travels away from its source. Lenses—such as a magnifying glass—bend light rays so they come back together, intensifying the rays that hit a specific location.

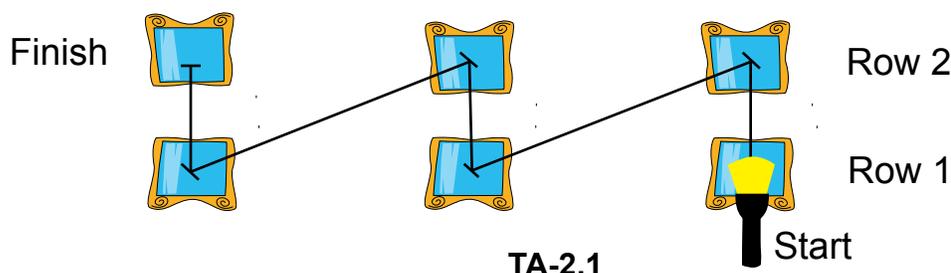
BEFORE PLAYING

Activity: Have your students discover for themselves that a bouncing ball's incoming angle equals its outgoing angle.

Ask your students to pair up, giving a ball to each pair. Have them bounce the ball back and forth (make sure the floor or pavement is smooth!) to each other. Ask them to share observations about how the ball bounces. (Observations will vary.) If no one observed the angle at which a ball bounces, prompt the desired observation by asking students to throw the ball to each other from different angles. For instance, if they throw the ball straight down, will it bounce toward their partner? (No, it will bounce straight up.) If they push it down and away, they will create a gentler angle and the ball will reach their partner. Explain to them that light reflects off objects in a similar way.

AFTER PLAYING

Challenge: Ask each student to bring in a small mirror from home (women's compacts work well). Arrange your students' desks in rows and create teams: rows 1 and 2 are a team, 3 and 4 are a team, and so on. Make sure that each student has a mirror. Give a flashlight to the students sitting in the first desk of rows 1, 3, 5, and so on. (If any students forgot to bring in a mirror, have them be the flashlight holder.) Turn off the lights. Challenge the teams to adjust their mirrors so that the light from the flashlight reflects off everyone's mirror on the team and reaches the last person in the row, as shown.



TA-2.1

LIGHT ACTIVITY

ASSESSMENT: Assess students' answers on the After Playing Worksheet.

RESOURCES

<http://www.brainpop.com/science/light/light/index.weml>

At this site from BrainPOP, your students watch an animated movie about light, perform an experiment on mirrors and reflection, and then take a quiz. Interested in other science topics? BrainPOP's award-winning site has loads of animated movies that will hold kids' interest!

<http://www.miamisci.org/af/sln/index.html>

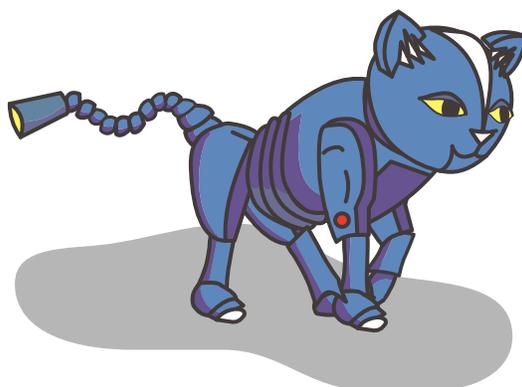
Visit the Atoms Family and tour Dracula's Library to learn more about the properties of light, waves, and particles. Or have your students check out places like Frankenstein's Lightning Laboratory to explore different forms of electricity and electrical safety—all by Miami's Museum of Science.

ANSWERS

Light Catcher, Worksheet: (Conclusions: Answers will vary. The angle between the incoming ray and the mirror and the angle between the outgoing ray and the mirror were equal.)

Before Playing, Worksheet: (1. With respect to the mirror, the angles made by the incoming and outgoing beams are equal. **2.** 45. **3.** 19. **4.** 80. **5.** 35.)

After Playing, Worksheet: (Across, row 1: 22, 78, 76, 15. **Across, row 2:** 2, 126, 12, 26. **Across, row 3:** 10, 19, 70, 21. **Across, row 4:** 42, 7, 86, 63. Angle of the incoming beam: 86. Angle between the mirror and the outgoing light beam is 86. We know this because the angle between the mirror and the incoming beam equals the angle between the mirror and the outgoing beam.)



LIGHT ACTIVITY

CONNECT TO YOUR CURRICULUM

This activity can help you meet these National Standards:

Mathematics:

- Understand meanings of operations and how they relate to one another
- Compute fluently and make reasonable estimates
- Develop and evaluate inferences and predictions that are based on data
- Understand measurable attributes of objects and the units, systems, and processes of measurement

Science:

- Evidence, models, and explanation
- Change, constancy, and measurement
- Transfer of energy

CURRICULUM AREAS

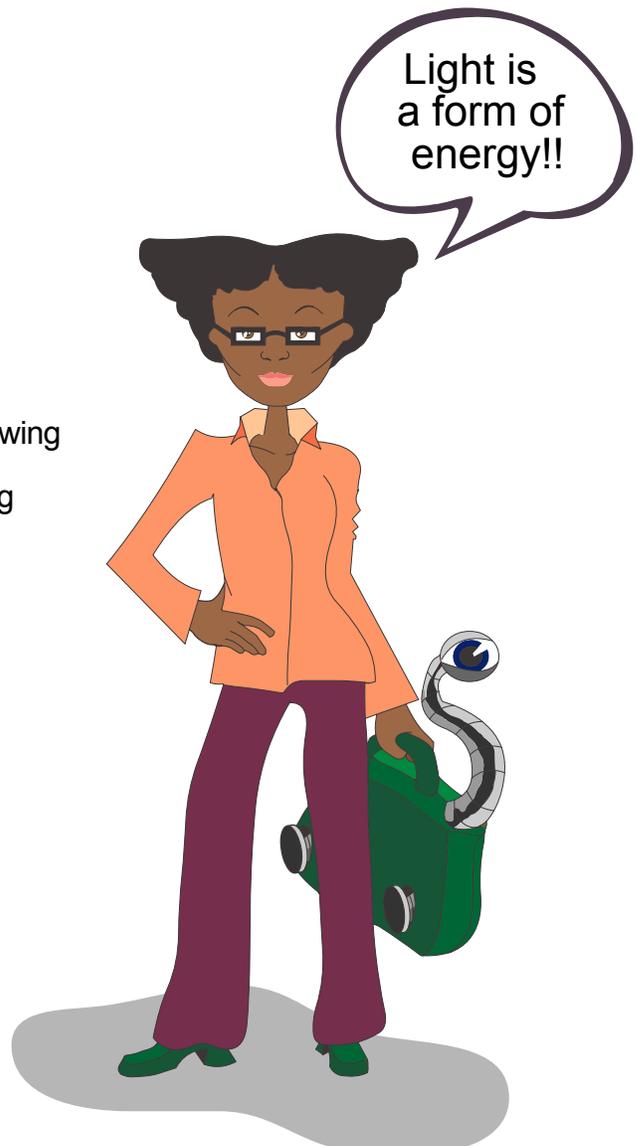
Science: light; energy.

Scientific Inquiry: testing variables; experimenting; observing; gathering data; drawing conclusions; interpreting results.

Language Arts: following directions; writing conclusions.

Technology: computer science.

Math: angles; finding patterns; addition; subtraction; multiplication; division.



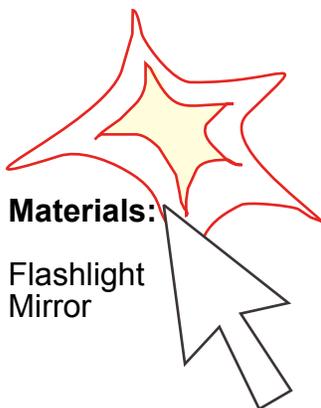
TA-2.3

LIGHT ACTIVITY

(Student Hands-On Activity)

Name: _____

Date: _____



Materials:

Flashlight
Mirror

Think: Have you ever caught a glimpse of someone in a mirror and wondered if the person could see you too? What did you conclude: Could they see you or not?

Predict: Can you use a mirror to reflect light from a partner's flashlight onto another partner? How?

Procedure:

1. Break into groups of three.
2. Have one partner hold the flashlight and turn it on.
3. Have your other partner stand 3 m (10 ft) away from Partner #1.
4. Turn off the lights.
5. Use a mirror to reflect light from the flashlight onto your second partner: Adjust your location and the angle at which you hold the mirror.
6. Now have your partners increase their distance apart to 6 m (20 ft).
7. Again, try to reflect the flashlight's rays onto Partner #2 by adjusting your position and the angle at which you hold the mirror.



Conclusions:

In the space below, use words and pictures to explain how you had to hold your mirror in order to reflect light onto your partner. Think about the angle between the incoming ray and the mirror and the angle between the outgoing ray and the mirror. What do you notice?

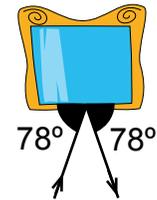
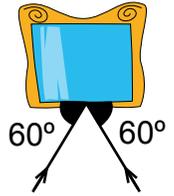
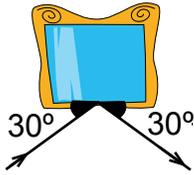


LIGHT ACTIVITY (Before Playing)

Name: _____

Date: _____

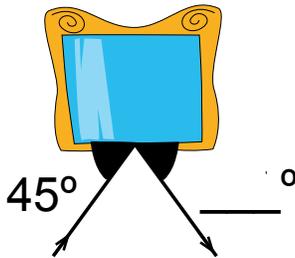
Look at the following pictures showing an incoming flashlight beam bouncing off a mirror. Find the pattern between the angles of the incoming and outgoing beams and the mirror.



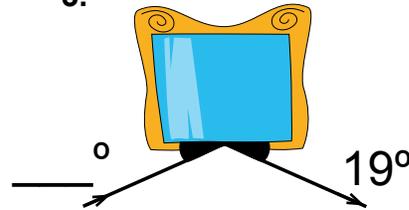
1. What is the pattern? _____

Using the pattern you found above, complete the following:

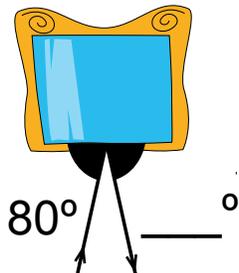
2.



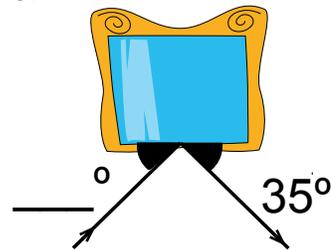
3.



4.



5.



LIGHT ACTIVITY

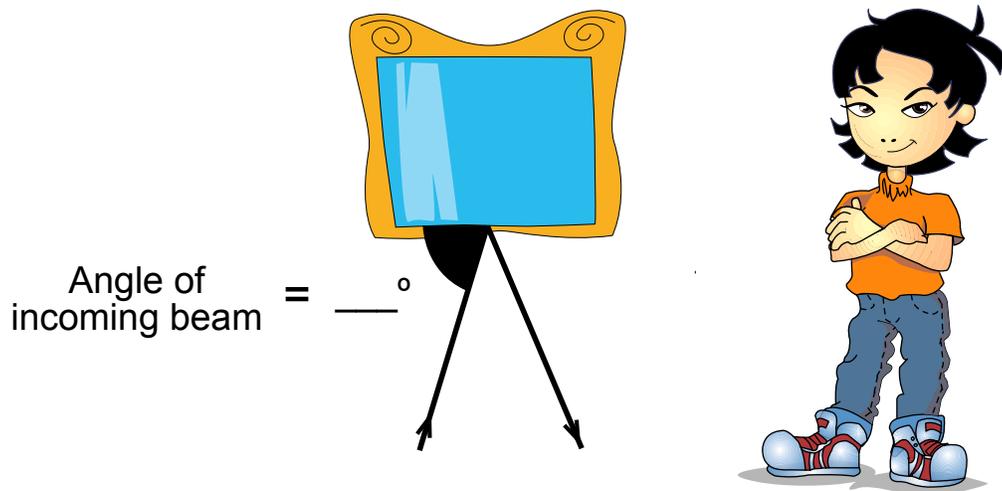
(After Playing)

Name: _____

Date: _____

Below is a diagram of an incoming and outgoing light ray. To figure out what angle each ray makes with the mirror, you need to solve some math questions. Begin with the highlighted box. Once you've found the answer, look for the box that starts with that answer and then solve the math question in that box. Continue solving questions like this until you've finished the chart. We did the first one for you. Your final answer will tell you the angle between the mirror and the incoming light beam.

45 - 23 = 22	26 x 3 =	2 + 74 =	19 - 4 =
10 - 8 =	63 x 2 =	22 - 10 =	76 - 50 =
21 - 11 =	12 + 7 =	78 - 8 =	15 + 6 =
126 / 3 =	70 / 10 =	42 + 44 =	7 x 9 =



What is the angle between the mirror and the outgoing light beam? How do you know? _____
