BOUNCING BEAMS

BENCHMARK and TASKS

SC.B.1.2.2 The student recognizes various forms of energy (e.g., heat, light, and electricity).

- The student recognizes that energy comes in many different forms: (e.g., **mechanical**, energy of position and motion; **electrical**, energy of moving electrons; **chemical**, energy stored in chemical bonds; **thermal,** heat energy - the energy of moving and vibrating molecules; **nuclear**, energy contained in the nuclei of atoms; and **radiant,** energy that travels in waves like sunlight).
- The student demonstrates that light travels very rapidly in straight lines. When it strikes an object, light is reflected, absorbed, or it passes through, causing it to be refracted.

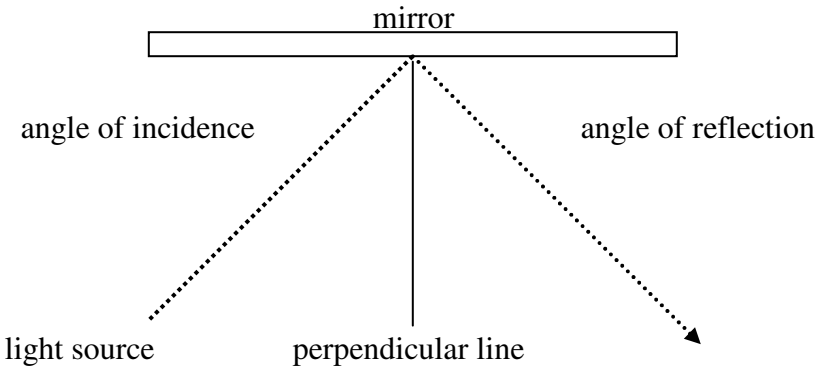
KEY QUESTION

What will happen to a ray of light when it hits a mirror?

BACKGROUND INFORMATION

Light energy travels in a straight path. When light is reflected from a shiny, smooth surface, it behaves very much like a bouncing ball. A ball will bounce off a wall at the same angle at which it is thrown. Light will bounce off a mirror at the same angle at which it hits the mirror.

Law of Reflection: The law states that the angle of **reflection** is equal to the angle of incidence. This means that the angle at which light bounces off a surface (angle of reflection) will be the same as the angle at which it strikes the surface (angle of incidence). The angles will be equal, but in the opposite direction. The angle of incidence is the angle formed by the incoming ray of light and a line perpendicular to the mirror. The angle of reflection is the angle formed by the reflected ray of light and a line perpendicular to the mirror.



The law of reflection applies even when light strikes rough surfaces, but when light shines on a rough surface, the light rays get reflected at many different angles. That is why you cannot use a rough surface as a mirror.

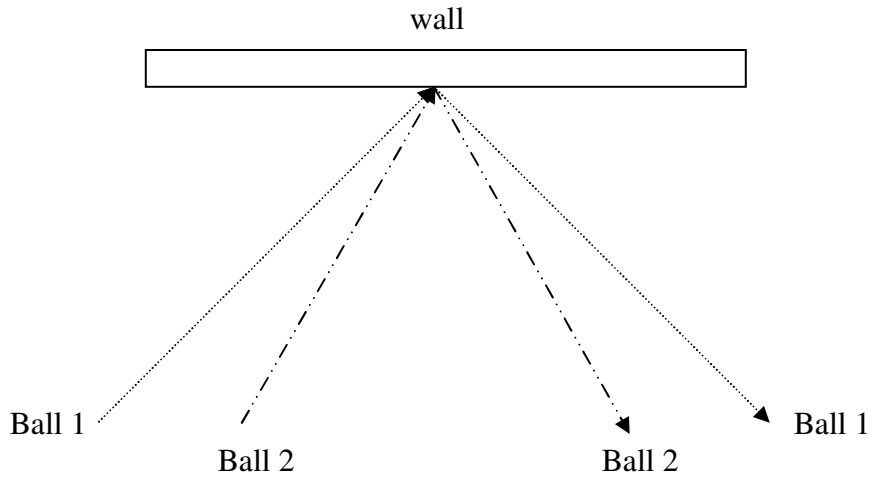
MATERIALS

Per class

1 ball
several small mirrors
several flashlights

ENGAGE

1. Have one student roll a ball against a wall while the class observes. *Where did the ball travel after it hit the wall?*
2. Ask students to predict where the ball will travel when it is rolled so that it hits the wall head on. (The ball will roll directly back to the student.)
3. Ask students to predict where the ball will travel when it is rolled so that it hits the wall at an angle. (The ball will strike the wall at an angle and roll back at the same angle but away from the student.)
4. Have students line up and then sit down parallel to the wall and a few feet from it. Place a mark on the wall at which students should aim.
5. Hand the ball to one student. Ask students to predict which one of them will catch the ball when it is rolled to the mark by that student. Have the student roll the ball.
6. Repeat this process several times from different angles.



EXPLORE

1. Place a mirror on the wall where the marker was located. (Students should still be seated parallel to the wall and a few feet from it.)
2. Hand a flashlight to someone in the group. Ask the students to predict where the light will be reflected when that student shines the flashlight on the mirror.
3. Ask the student to shine the flashlight on the mirror so the other students can see where the light is reflected. Continue by having students pass the flashlight to different people and allow each one to predict on whom the light will shine.
4. Vary the activity by:
    - having students predict who should hold the flashlight in order to have it reflect on a certain person.
    - distributing more than one flashlight to the group.
    - placing more than one mirror on the wall.

EXPLAIN

Is the light going through the mirror? How can you tell?
If the light is not going through the mirror, where is it going? (The mirror blocks the light and prevents it from passing through. The light hits the mirror, bounces off, and is thrown to another place. When light is "thrown" by an object, like a mirror, the light is said to be reflected.)
How is rolling the ball against the wall similar to a light beam hitting a mirror? (Light behaves like a bouncing ball, because it reflects off a surface to another place. It travels in a straight line, just as the ball does.)
How could you predict accurately where the ball would bounce or where the light would be reflected?

EXTEND/APPLY

Ask students to think of other things that cause mirror-like reflections. (Examples may include chrome on cars, shiny surfaces, and water.)

EXTENSIONS

1. Let students experiment with mirror writing (writing that can be read correctly only when held in front of a mirror).
2. Have students shine a beam of light on a concave and/or a convex lens and observe. Discuss their observations.