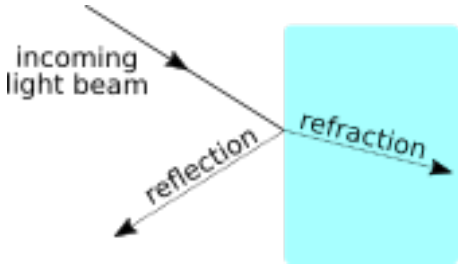
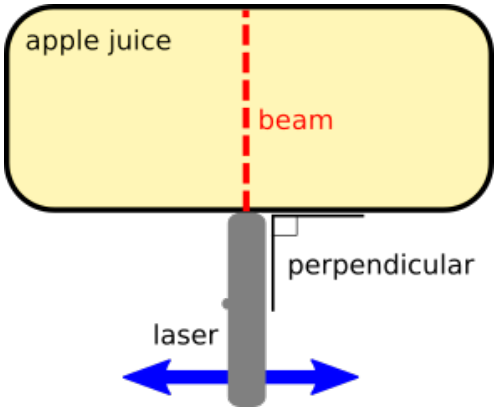
Light Beams and Reflection

- Light always travels in straight lines (beams) until it interacts with something that makes it bend.
- **Reflection**: bouncing a light beam off a surface
- Light beams that come together or spread out produce an **image** that our eyes see.
- Curved mirrors can make an image that is a different size or upside down, compared to the original object.



Part 1: Reflecting Light Rays

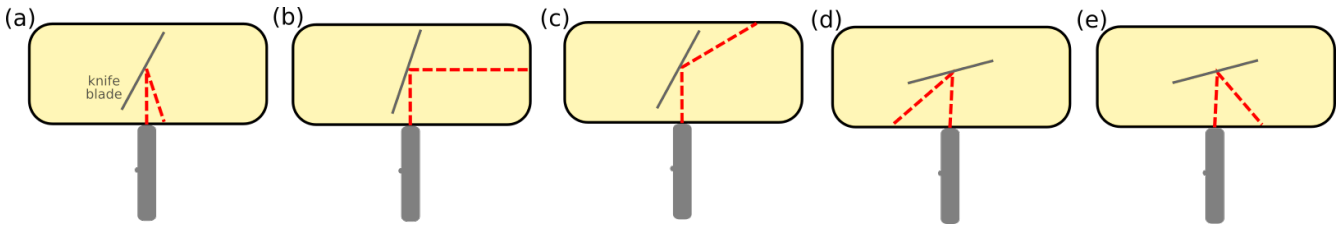
1. Pour apple juice into a clear container.
2. Place the laser perpendicular to the flat side so that the beam goes into the juice. Slide the laser back and forth along the flat side and watch the beam move.



2. Dip a mirror vertically into the juice, in the path of the laser beam. Tilt the mirror a little downward so the light does not hit your eyes!

Discuss: what happens to the beam when it hits the mirror?

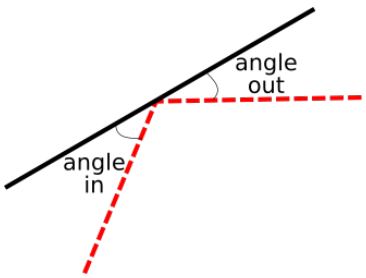
Try tilting the mirror so that the beam hits it at different angles.



Circle: which of the pictures above can you reproduce?

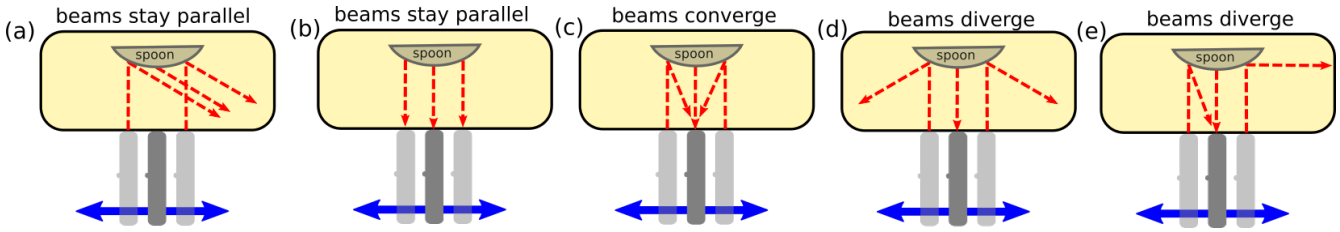
Based on your observations fill in the "**Law of Reflection**":

When a light beam hits a surface, it **reflects** so that:
angle coming in is _____ angle going out.
(greater than? less than? equal to?)



3. Place a spoon in the apple juice, so that its back surface is facing the laser beam. The surface should curve away from the beam. Keeping the laser perpendicular to the container side, slide it side-to-side and look at the reflected beams that bounce off the spoon.

Circle the picture that best shows how the mirror reflects the laser beams:



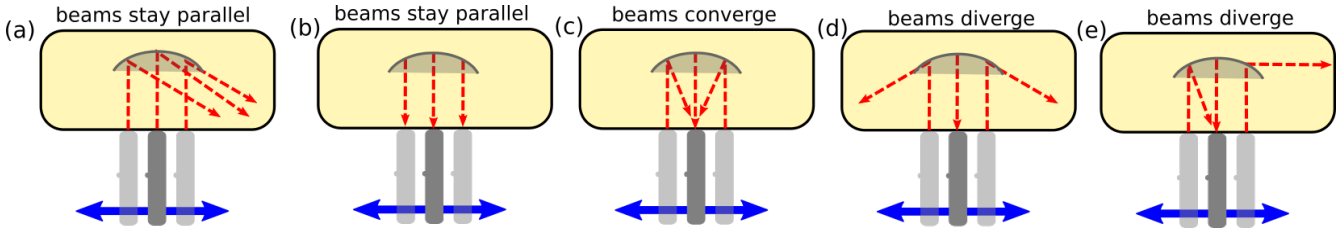
4. What do you think will happen if you reflect the laser off the inner surface of the spoon? Write down your hypothesis.

Hypothesis: the surface curving inward will make the beams _____

stay parallel? converge ? (come together) Diverge? (split apart)

5. Try the experiment.

Which of the pictures below looks most like what you see?

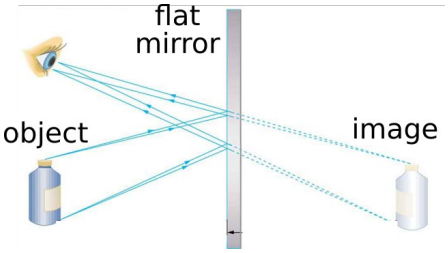


Observation: the surface curving inward made the beams _____

stay parallel? Converge? Diverge?

Part 2: Images in Mirrors

Curved mirrors change the path of incoming light beams. A **convex** mirror (curving outward) diverges the beams and a **concave** mirror (curving inward) converges the beams. When an object is reflected in the mirror, each point in the object sends off many light beams. By changing where these beams go, the mirror makes an "image" of the object --- the reflection that we see.



5. Hold a Lego minifigure next to **convex mirror** (back of spoon) and look at its reflection.

Fill in your observations:
A convex mirror makes a _____ (right-side-up / upside down) reflection that is _____ (bigger / smaller) than the object.

6. Hold the minifigure a few inches from the **concave mirror** (inner surface of spoon) and look at the reflection.

Fill in your observations:
An object far from a concave mirror makes a _____ (right-side-up / upside down) reflection that is _____ (bigger / smaller) than the object.

7. Now bring the minifigure very close to (touching) the inner surface of the spoon.

An object very close to a concave mirror makes a _____ (right-side-up / upside down) reflection that is _____ (bigger / smaller) than the object.

8. Try the same experiment by looking at your own reflection in a gently curving a strip of mirror paper.

Discuss: what kind of images do you see when the paper is flat? When it is curved inward (concave)? When it is curved outward (convex)?

Part 3: Multiple Mirrors
(if you have time)

1. Hold 2 flat mirrors at an obtuse angle (eg: 120°) to each other. Put the Lego figure in front of the junction between the mirrors.

How many images do you see? _____

Discuss: where do the two images come from?

2. Now hold the mirrors at exactly a right angle (90°) to each other.

How many images of the figure do you see? _____

3. Now hold the mirrors at an acute angle (eg: 70°) to each other.

How many images do you see now? _____

Discuss: why do you see multiple images? What happens as you move the mirrors to a smaller and smaller angle?

4. Fold a piece of mirror paper into thirds, with the reflective side facing inward. Tape the seam to make a triangle. Insert into the paper towel tube.

You've made a kaleidoscope! Look around the room with it to see many images.