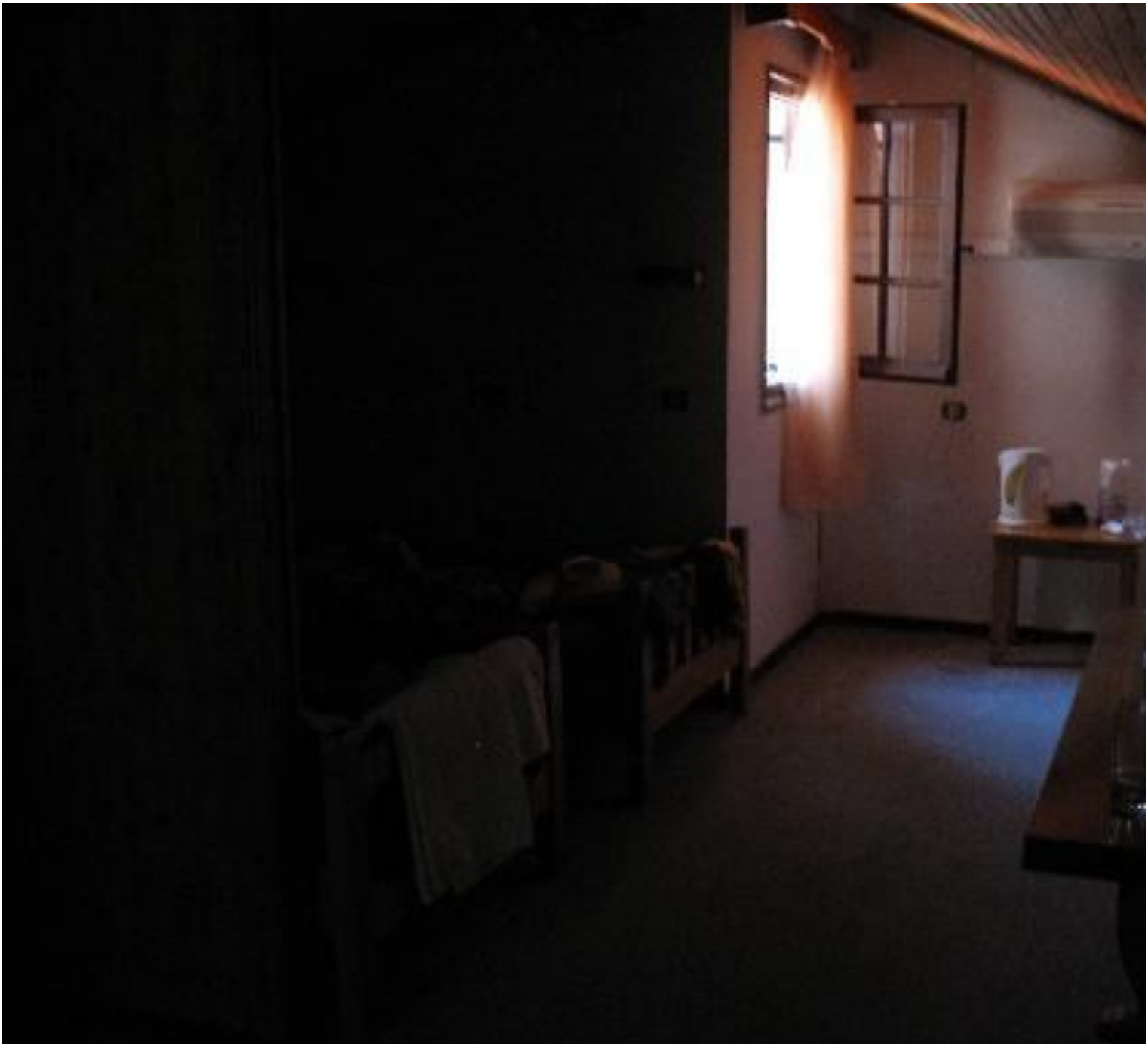
Light and Shadow

A Family Inventors' Lab Original

Look around you. Can you see things in the room?

What if you turn off the lights?
Now can you see everything?



No, you need light to see.

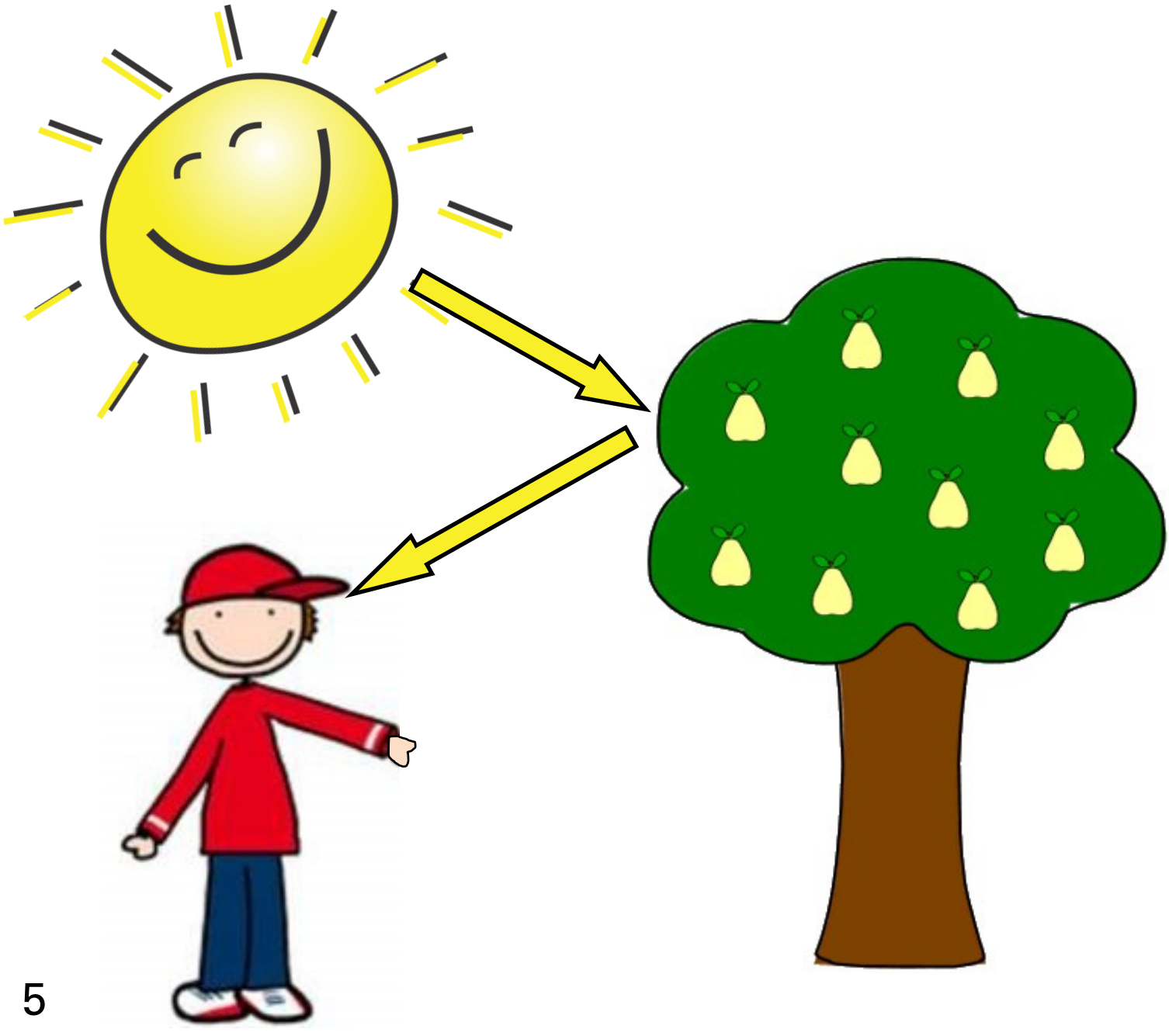
Where does light come from?

From the sun, from stars, from flame, and from inventions like lightbulbs and flashlights.


OPEN

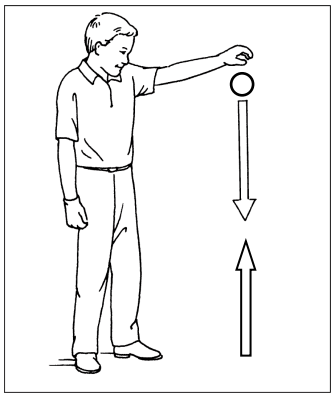
Reflected Light

Rays of light move in straight lines. When a ray hits something, it bounces off again. Light is reflected back to you, helping you see the object.

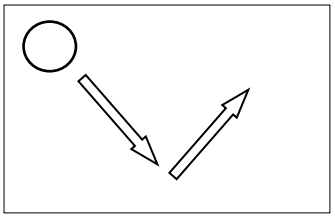


Try these experiments

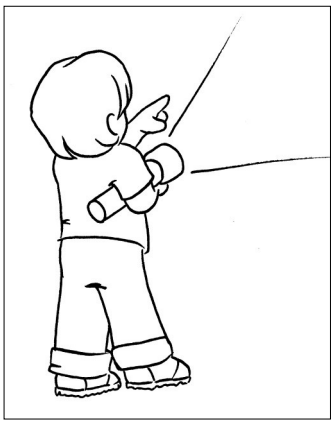
1. Drop a ball straight down. The ball bounces straight back up.



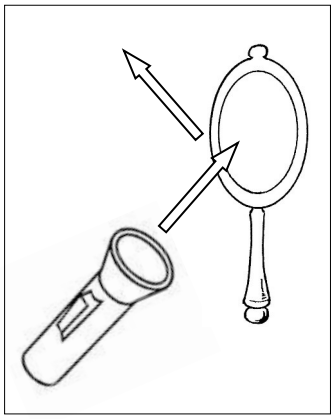
2. Throw a ball down at an angle. It bounces up at an angle. (deflects)



3. Turn off the light. Shine a flashlight around—when you point the light at an object, the light bounces back (reflects) and you see the object.



4. Shine a flashlight toward a mirror, but at an angle. The light bounces off at an angle. (deflects)



5. Play with mirrors and flashlights in a dark room. Where can you bounce the light to?

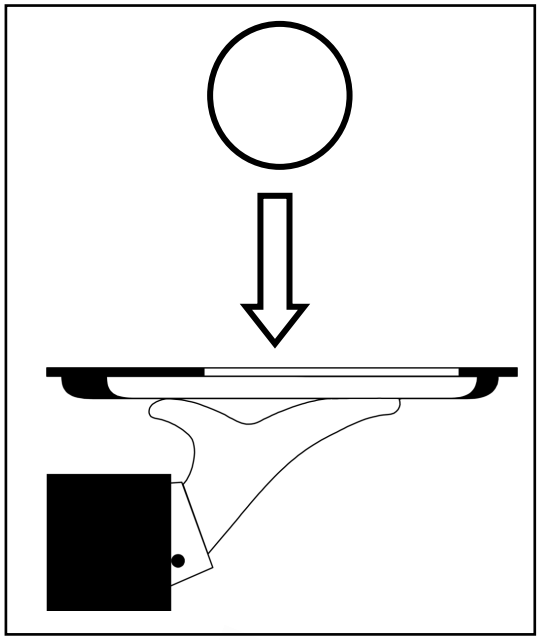
Shadows

Light only travels in straight lines. If light hits a solid object, it can't turn to go around it.

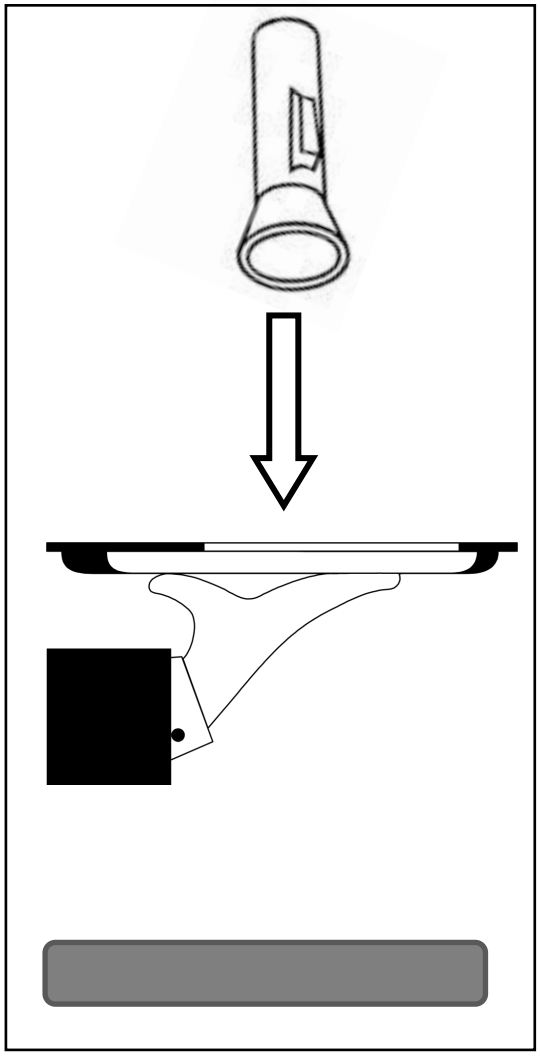
If you shined a light toward a wall, all the light would fall on the wall. But, if there's an object (like this cat) between the light and the wall, the cat blocks some light. There is a dark patch on the wall—a shadow—that is shaped like the cat.

Try these experiments

Hold a tray in one hand. Drop a ball onto it. Does the ball go through the tray?
No, the tray blocks its path.



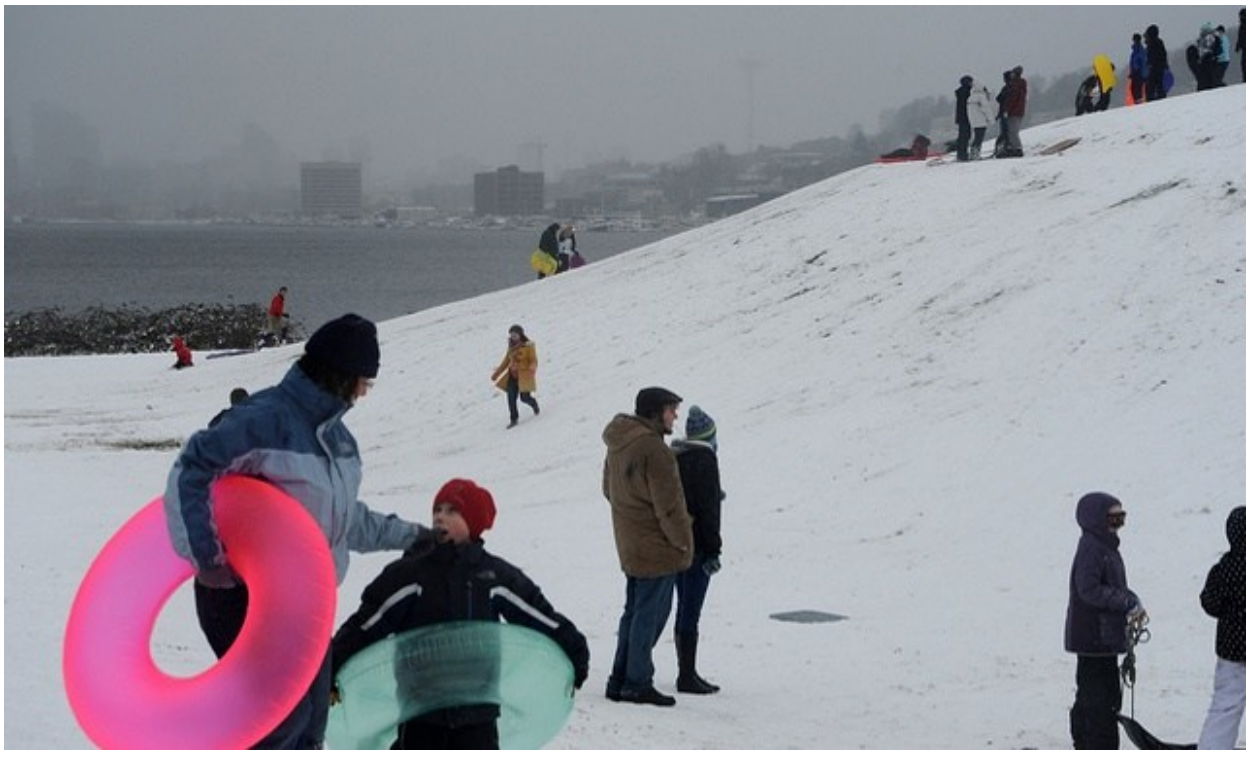
Hold a tray and shine a light onto it. Does the light pass through the tray?
No, the tray blocks the light, and makes a shadow below it.



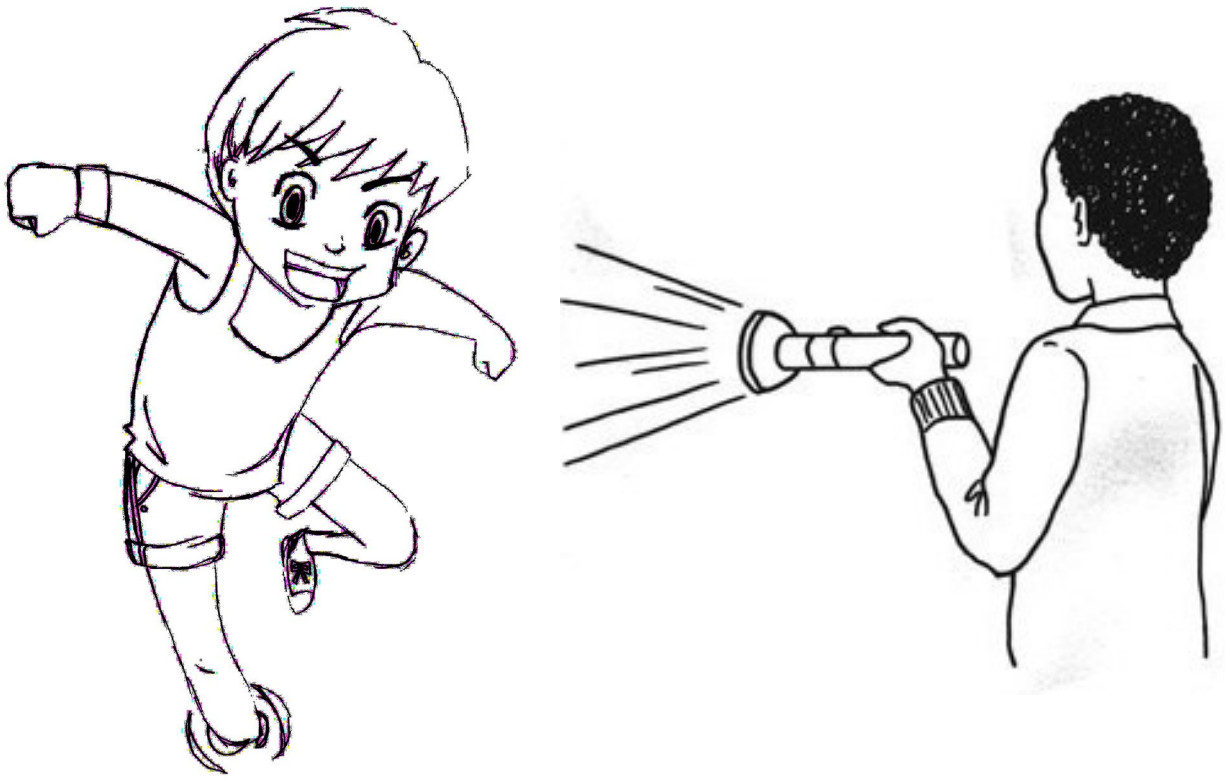
Where is your Shadow?

If the light shines on your back, your shadow is in front of you. If the light is in front of you, then your shadow is behind you.

On a cloudy day, the clouds scatter rays of light all over, and you don't have a shadow.

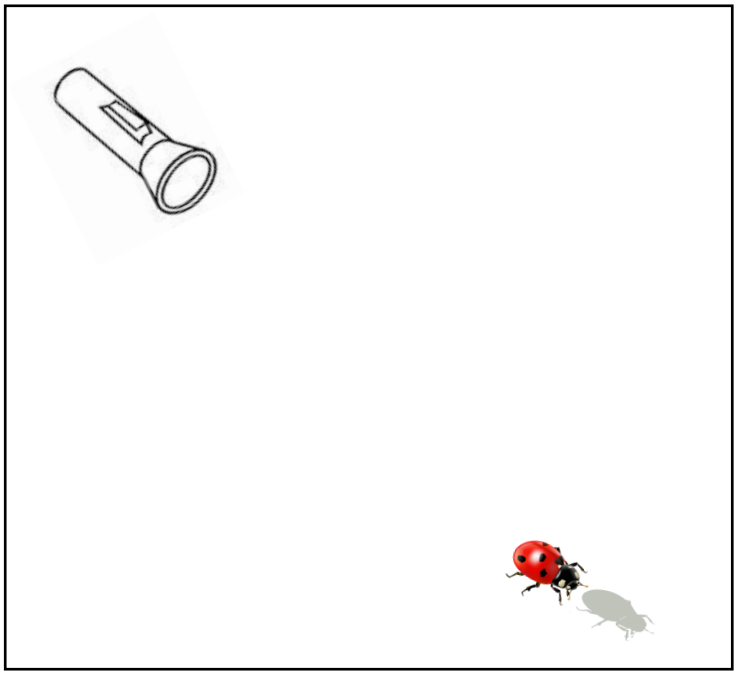


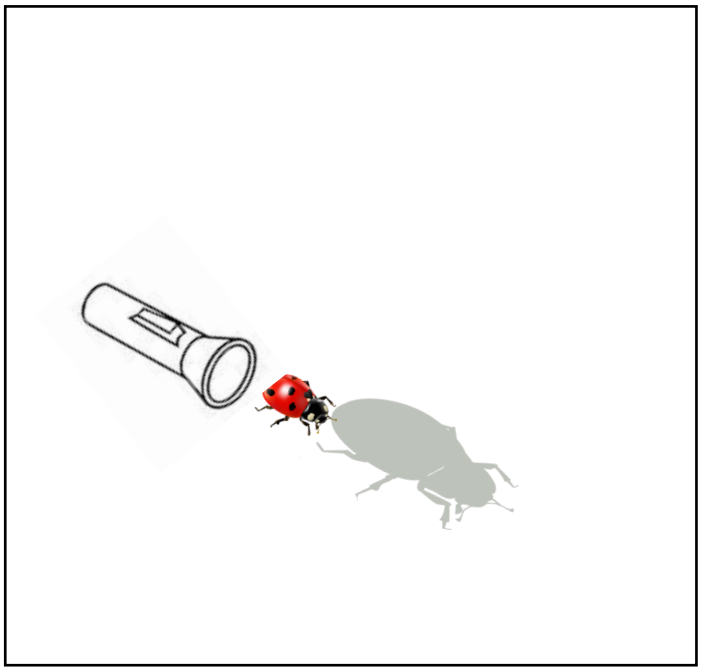
Try these experiments



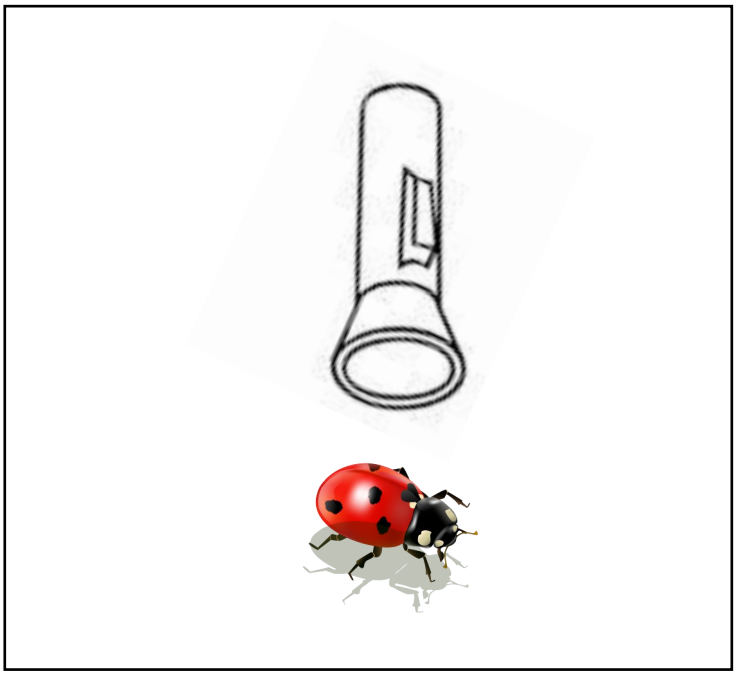
In a dark room, have a friend shine a light on your back… look for your shadow in front of you. Then have them shine a light on your front… look behind you. Then have two friends each shine a flashlight from two different directions… you'll have two shadows. Then turn on the lights, so there's lots of light from all directions. Where did your shadow go?

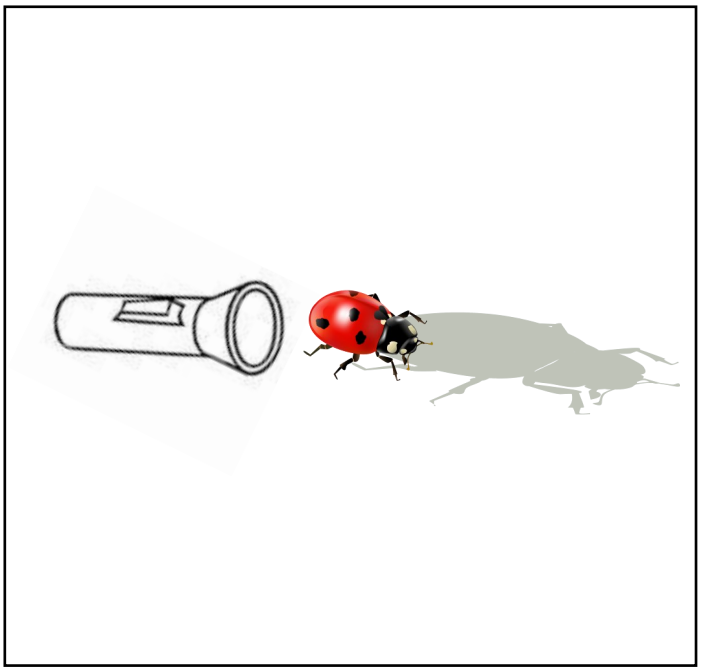
The closer the light is to an object, the bigger the shadow is.





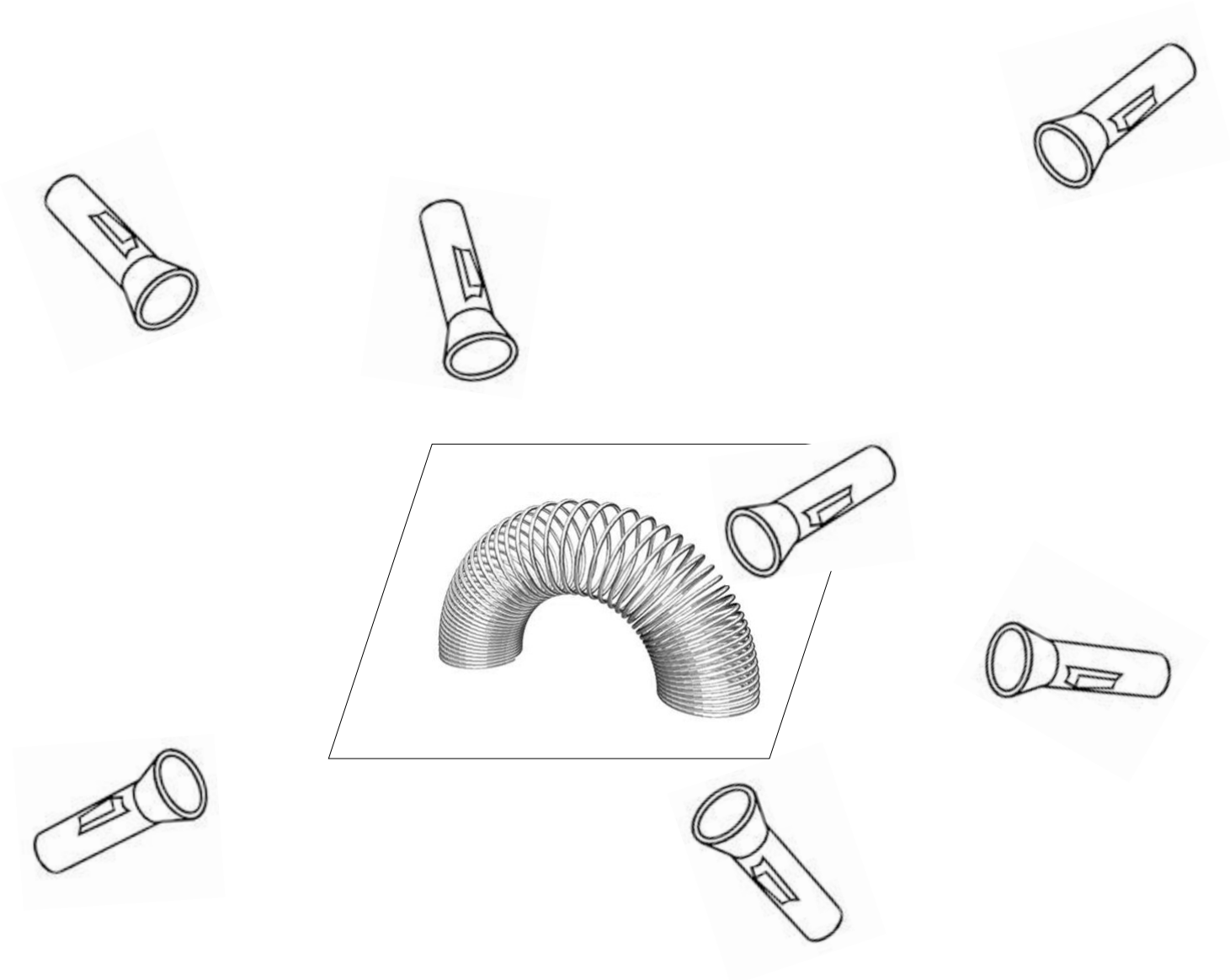
If the light is above the object, it makes a small shadow. If the light is shining from beside the object, it makes a big shadow.





Try this experiment

In a dark room, shine a flashlight on a toy to make a shadow. Move the light further away, then closer to the toy. Hold the flashlight above the toy, then hold it down low next to the toy. What's the biggest shadow you can make?



Put some paper where the shadow falls and trace the shadow on the paper.

Shadows change through the day

The same thing happens with shadows from the sun. In the middle of the day, when the sun is high up in the sky, shadows are small.

At the beginning and end of the day, the sun is low in the sky, and shadows are very long.

Sunny Days

On a sunny day, there's lots of direct light on you, so you cast a dark shadow.

Shade

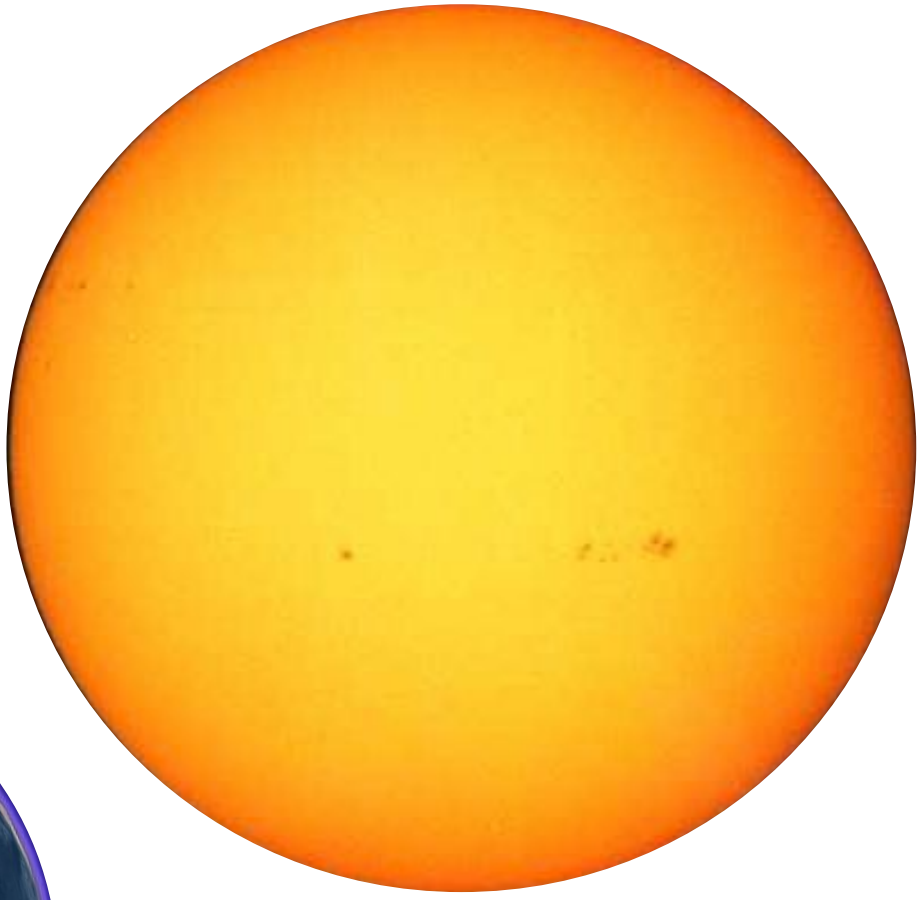
On a hot sunny day, you may like to be in the shade where it's cooler. Shade is a shadow made by a large object like a tree or an building.

Night Time

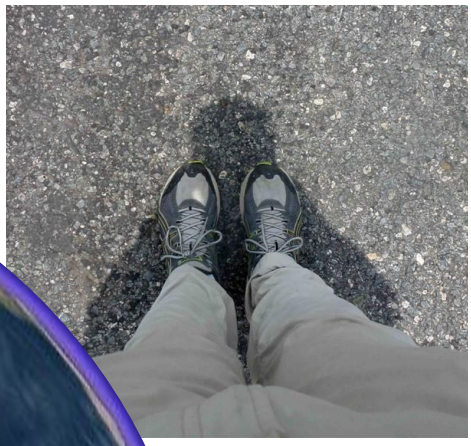
At night, it's dark because we're in the shade of a really big object. (The earth!)

The earth turns (or rotates). At night time, our side of the earth is turned away from the sun and we are in a big shadow cast by the earth.

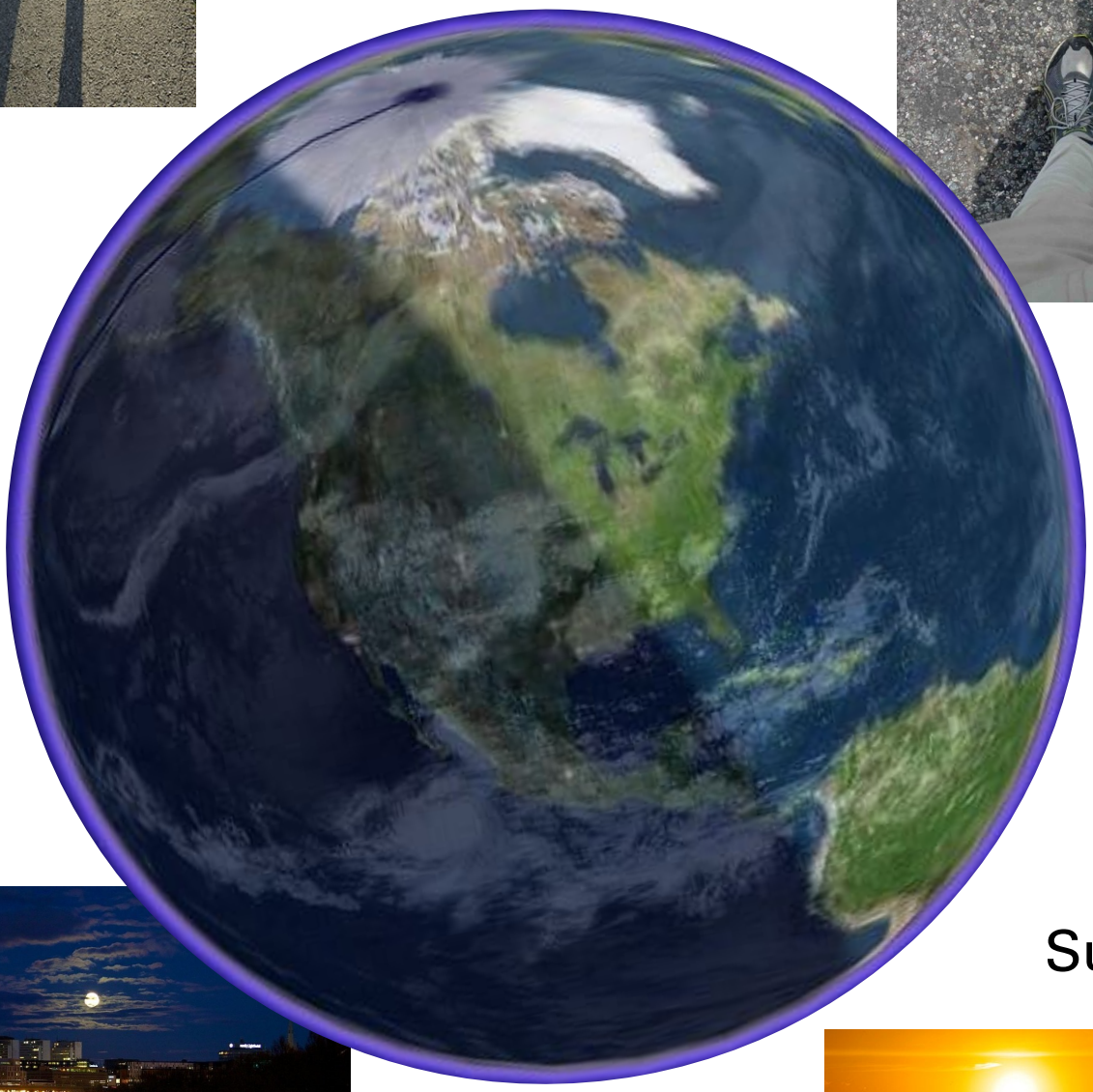
When earth rotates so where we stand faces the sun again, then it's day time.

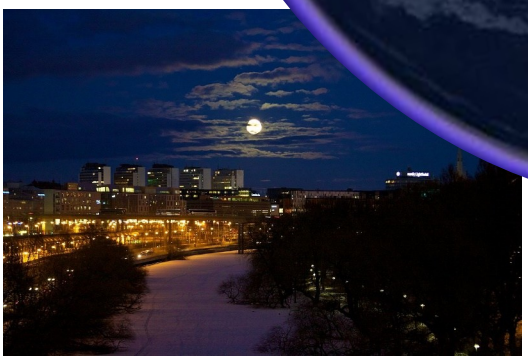


Sunrise



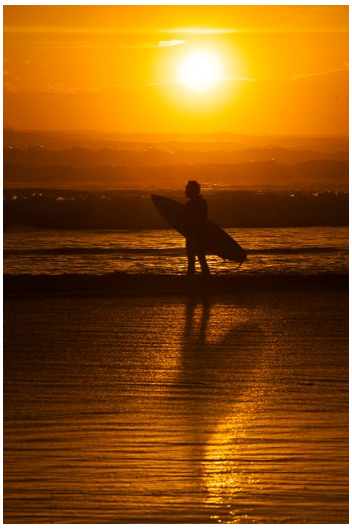
Mid-Day





Midnight

Sunset

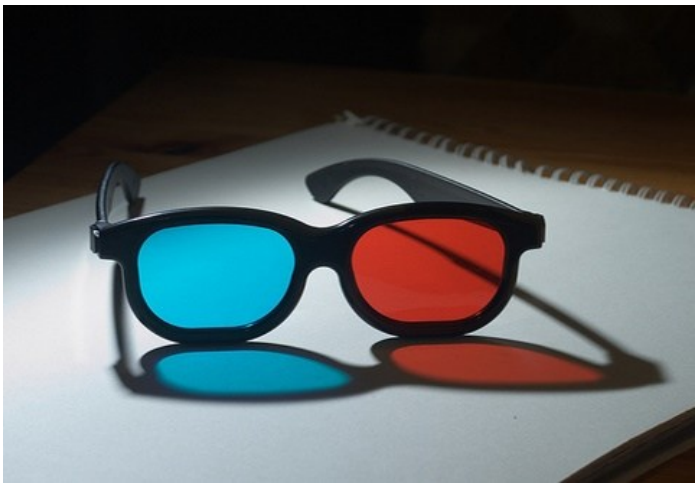


Opaque

Most objects are opaque. They block all the light, and create dark shadows.

Translucent

Some objects are translucent. They let some light through, but not all of the light. They create pale shadows.

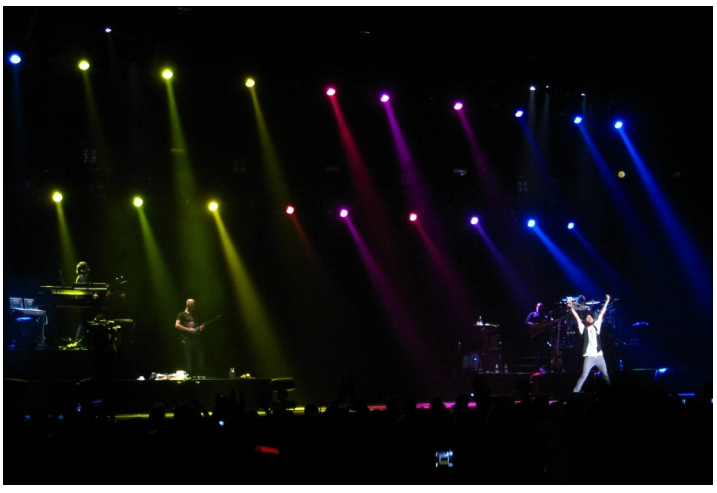


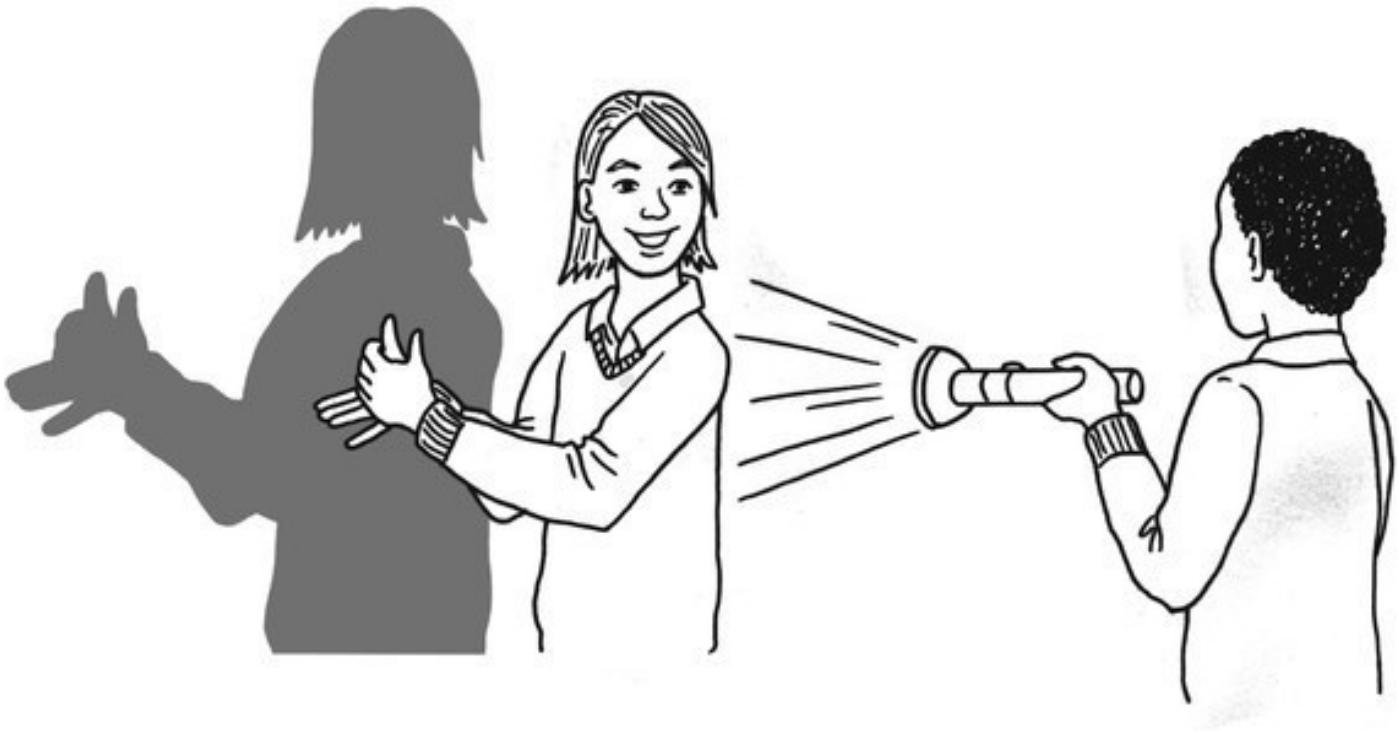
Transparent

Some objects are transparent. They let all the light through. They do not create shadows.

Diffusing

When a beam of light passes through a cloud of steam or smoke, the light scatters.



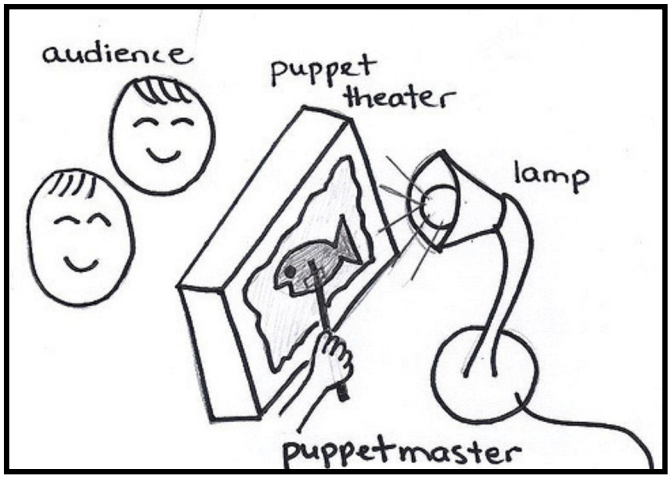


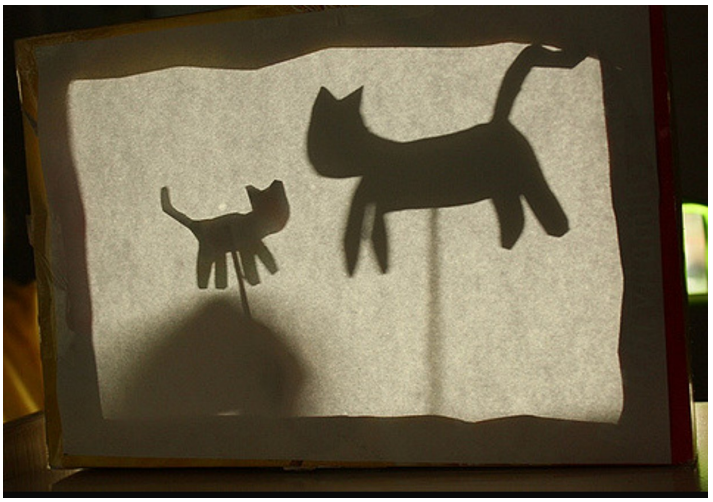
Hand Shadows

You can use your hands to make different shapes of shadows. Set up a light so it shines on a wall. Then hold your hands in front of it so they cast a shadow on the wall. Try making these shapes:

Shadow Puppet Theatre

You can make shadow puppets by cutting shapes out of paper, and taping the shapes to a stick. Can you design a puppet show for your friends or family?





You could build a theatre for your shadow puppets with a cereal box and wax paper.

Another experiment:

You'll need a spray bottle filled with water or diluted paint, a flashlight and paper.

Shine the flashlight on the paper. The whole paper is lit up. Now put your hand between the flashlight and the paper. See how some of the light is blocked by your hand and makes a shadow?

Put your hand on the paper, and spray your hand and the paper. Then lift your hand away and look at the paper. See how some of the water landed on the paper and some landed on your hand and didn't get through to the paper? Now you have a "shadow" of your hand on the paper.

Note to Parents and Teachers:

This book is intended to introduce children ages 3—6 to some basic scientific concepts. When you're reading this book, pause and do the experiments described: you'll need a ball, a flashlight or other bright light that you can aim, a mirror or two, and a tray (or book). Optional: some objects that are translucent, transparent, and diffusing. The puppet theatre project requires paper, popsicle sticks, a cereal box, and wax paper.

Have fun experimenting together!

If you'd like ideas for more hands-on STE(A)M activities for kids, check out my website, www.InventorsOfTomorrow.com