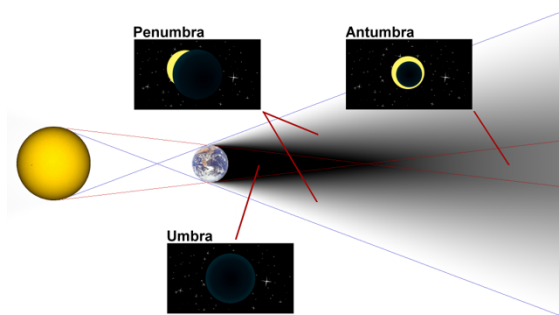


Light always travels in straight lines, called rays, and cannot bend around objects. When light encounters an object it cannot pass through, it creates a shadow of that object directly behind it.



There are three parts to a shadow, the umbra, the penumbra and the antumbra. The umbra is the darkest, sharpest part of the shadow where the light is directly blocked by an object.



The penumbra is the shaded outer region of the shadow where some of the light source leaks back to your eye via reflections. The antumbra is the

area where the blocking object is entirely within the disc of the light source. We most often recognize these regions during solar eclipses.

You don't need the sun to make shadows. Find a dark room in your house that had a blank wall. Grab an adjustable desk lamp and point it at the blank wall.

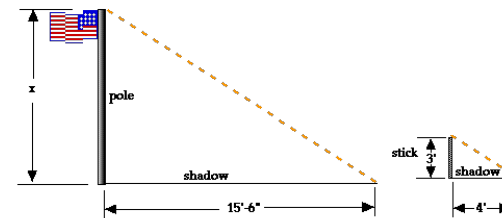
Activity:

Different shape shadows – Find objects around the house and hold them in front of the lamp. What does the shadow look like? Can you see the umbra and penumbra? What happens when you rotate the object? How many different looking shadows can you make with one object? How can you change the shadow without moving the object?

Different size shadows – Take one of your objects and move it closer and further away from the light. How does the shadow change? Can you see the umbra and penumbra here? When is the shadow fuzzy? When is it sharp?

Multiple shadows – How can you give an object multiple shadows at once, without moving the object? If we want more shadows what should we do?

We can also use shadows to measure the heights of very tall objects. You will need a tape measure (a ruler will work, but



$$\frac{x}{15.5} = \frac{3}{4}$$

$$4x = 3(15.5)$$

$$4x = 46.5; \text{ then } x = 11.625' \text{ or } 11'7.5$$

take longer), a calculator, a ruler, a piece of paper and a pen.

Find a tall pole. Measure the shadow of the pole and write down that number. Measure the shadow of the ruler standing straight up and write down that number. Use the equations above to calculate the height of the pole. Ask an adult for help if you need help with the math.

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