SPLITTING LIGHT

SPECTROSCOPE

It might look white, but light is actually a mix of different colors. You can see these colors in a rainbow, because each color bends at a different angle as it bounces off raindrops. Scientists use a device known as a spectroscope to study the range of colors (the spectrum) in different kinds of light. In this activity, you can make your own spectroscope.

HOW TO BUILD A

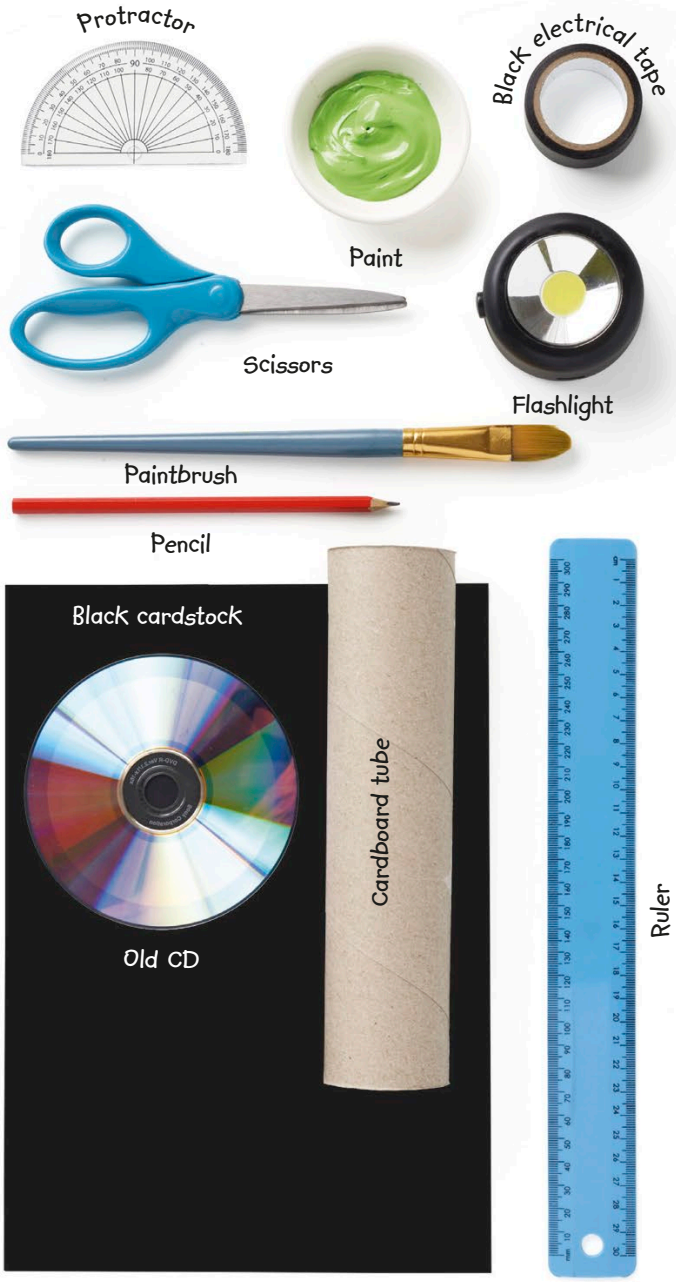
SPECTROSCOPE

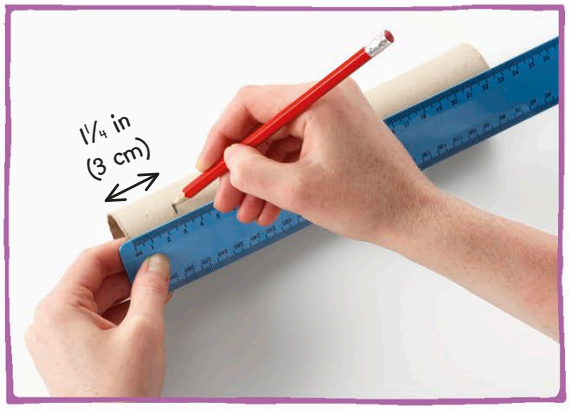
In order to clearly see the spectrum of colors that make up white light, you'll need a shiny CD for the light to bounce off. A slit at the top of a dark tube lets a small amount of light into the tube and onto the CD. You'll need to use a protractor to measure the angle at which you place the CD. You'll also need black electrical tape to block out unwanted light.

Time
30 minutes

Difficulty
Medium

WHAT YOU NEED



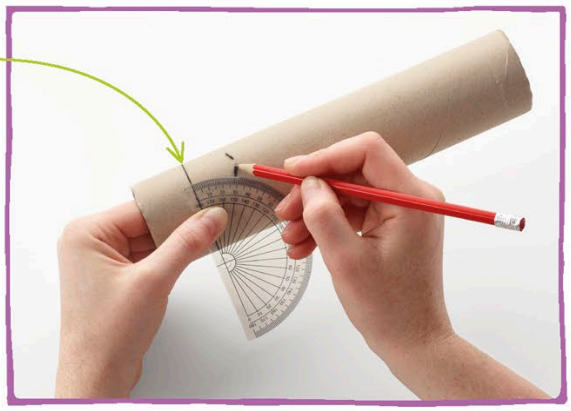


1 Using the pencil, make a mark 1¼ in (3 cm) from one end of the cardboard tube.

2 Wrap the black cardstock around the cardboard tube at the mark. Use it as a guide to draw a line around the tube.

3 Hold the protractor on the tube so the protractor's zero line runs along the pencil line. Draw a short line angled at 30 degrees.

Check that the straight edge of your protractor is still lined up with the pencil line you drew.



4 Move the protractor and draw another line, angled at 30 degrees in the other direction, so the two slanted lines almost meet.

5 Using the ruler, extend both slanted lines so they meet the line that goes around the cardboard tube, forming a triangle.

6 On the opposite side of the tube from the triangle, draw a rectangle ¾ in (2 cm) high and ½ in (1 cm) wide above the pencil line.

Pinch the tube at the bottom to pop the slit open.

7 Cut along the two slanted lines so that you end up with an angled slot. This is where you'll slide in your old CD.

8 Now carefully cut out the small rectangle you drew to make a viewing window for your spectroscope. Ask an adult to help if you get stuck.

9 Paint the cardboard tube in any color or design you like, then leave the paint to dry.

11 Secure the CD in place inside the slot using black electrical tape.

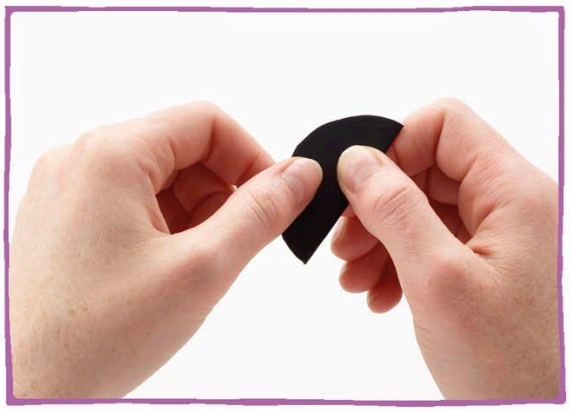
12 Use strips of electrical tape to close off the end of the cardboard tube closest to the CD. Make sure no light can get into the tube.

10 Push the CD into the angled slot, with the shiny, bottom surface facing upward.

It's crucial to get the angle of the CD just right so you can see the spectrum clearly.

The end closest to the CD should be completely covered with black electrical tape.

13 Draw around the open end of the cardboard tube onto the black piece of card using a pencil. Carefully cut out the circle.



14 The circle of card will cover the open end of the tube, but it needs a slit to let in light. To make the slit, first fold the circle in half.

15 Carefully cut two lines close together at right angles from the middle of the fold. Cut off the thin piece between the lines.

Carefully tape around the circle of black card to hold it in place.

16 Unfold the circle and tape it over the open end of the tube. The slit should run from side to side, not front to back, so that it aligns with the slot holding the CD.

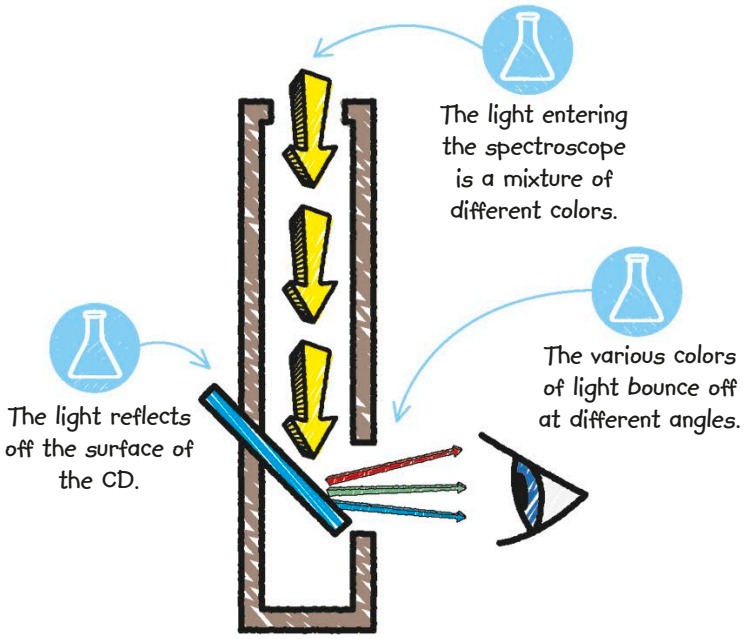
Light from the flashlight enters the slit in the top of the spectroscope.

The light hits the shiny CD and bounces off, splitting into different colors.

17 Your spectroscope is now ready to use! Shine a flashlight into the top and look through the viewing window to see the spectrum. You could also try other light sources, such as daylight through a window, but don't point your spectroscope directly at the Sun.

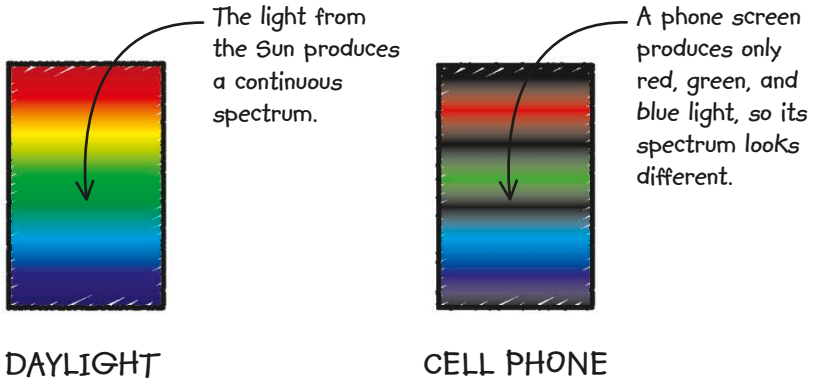
HOW IT WORKS

White light is a mixture of all the colors of the rainbow. When it hits a reflective object, all these colors bounce off, or reflect. Light hitting the shiny underside of a CD reflects in a different way. All the colors reflect, but each one bounces off in a different direction. The different colors spread out to form a spectrum.



COMPARING DIFFERENT LIGHT SOURCES

If you compare different light sources, such as daylight or the screen of a cell phone, you'll find that each one produces a distinctive spectrum. Daylight produces a continuous spectrum, with every color of the rainbow and no gaps. In contrast, an artificial light source typically produces only certain colors, so its spectrum has colored lines with black gaps between them.



REAL WORLD: SCIENCE
THE LIGHT OF STARS

Each of the chemical elements of which matter is made produces light with a different spectrum when it burns. Chemists in laboratories can identify which elements are present in different substances by using spectroscopes to study the light they give off when burned. Astronomers also use spectroscopes to study light from stars; from lines in the spectrum, they can tell which elements are present.