

# Nine Quick and Easy Light Experiments to Share with Your Kids

By Aurora Lipper

**Can you make the color 'yellow' with only red, green, and blue as your color palette?** If you're a scientist, it's not a problem. But if you're an artist, you're in trouble already.

**The key is that we would be mixing *light*, not paint.** Mixing the three primary colors of light gives white light. If you took three light bulbs (red, green, and blue) and shined them on the ceiling, you'd see white. And if you could un-mix the white colors, you'd get the rainbow. That's what prisms do.

**If you're thinking yellow should be a primary color** - it *is* a primary color, but only in the artist's world. Yellow *paint* is a primary color for painters, but yellow *light* is actually made from red and green light. Confused? Good, because we're going to spin colors, mix and un-mix colors, and play with the electromagnetic spectrum. Let's get started.

**Mixing Colors** Find three flashlights. Cover each with colored cellophane or paint the plastic lens cover with nail polish (red, green, and blue). Shine onto a white ceiling or wall, overlap the colors and make new colors. Leave the flashlights on, line them up on a table, turn off the lights, and dance - you will be making rainbow shadows on the wall! In addition, you can paint the lens of a fourth flashlight yellow.

**More About Mixing Colors** When you combine red and green light, you will get yellow light. Combine green and blue to get cyan (turquoise). Combine blue and red to get magenta (purple). Turn on the red and green lights, and the wall will appear yellow. Wave your hand in front of the lights and you will see cyan and magenta shadows. Turn on the green and blue lights, and the wall turns cyan with yellow and magenta shadows. Turning on the blue and red give a magenta wall with yellow and cyan shadows. Turn on all colors and you will get a white wall with cyan, yellow, and magenta shadows - rainbow shadows!

**Spectrometer** Find an old CD and a cardboard tube at least 10 inches long. Cut a clean slit less than 1 mm wide in an index card or spare piece of

cardboard and tape it one end of the tube. Align your tube with the slit horizontal, and on the top of the tube at the far end cut a viewing slot about one inch long and ½" inch wide. Cut a second slot into the tube at a 45° from the vertical away from the viewing slot. Insert the CD into this slot so that it reflects light coming through the slit into your eye (viewing slot). Aim the 1 mm slit at a light source (such as a fluorescent light, neon sign, sunset, light bulb, computer screen, television, night light, candle, fireplace... any light source you can find. Look through the open hole at the light reflected off the compact disk (look for a rainbow in most cases) inside the cardboard tube.

**Pinhole Camera** Use a cardboard box that is light-proof (no leaks of light anywhere). Cut off one side of the box (there's no need to do this if you're using a shoebox). Tape a piece of tracing paper over the cutout side, keeping it taut and smooth. Make a pinhole in the side opposite the tracing paper. Point the pinhole at a window and move toward or away from the window until you see its image in clear focus on the tracing paper. You can hold up a magnifying glass in front of the pinhole to sharpen an image.

**Kaleidoscopes** Carefully tape together three identical mirrors, making a triangle-tube with the mirrors on the inside. (You can also use Mylar or silver wrapping paper taped to cardboard instead of mirrors.) Tape all rough edges well and peek through the opening as you walk around.

**Kaleidoscope Variations** By changing the size and shape of the mirrors, you can change the dimensional effect you see. Just be sure to look at the mirror surface, not the opening. Variations include: make mirrors wider at the bottom and narrower at the top (easier with cardboard mirrors); use four or five mirrors instead of three; change the length of the mirrors; use curved mirrors instead of flat (find curved cardboard from an oatmeal box or carefully cut apart a soda can and tape Mylar or spray with chrome paint from the hardware store).

**Telescopes and Microscopes** Hold one magnifying glass in each hand. Focus one lens on a printed letter or small object. Add the second lens above the first, so you can see through both. Move the lens toward and away from you until you bring the letter into clear focus again. You just made a microscope! The lens closest to your eye is the EYEpiece. The lens closest to the object is the OBJECTive. Now focus on a far-away object like a tree. You just made a simple telescope... but the image is upside-down!

**Homemade Diffraction** Take a feather and put it over an eye. Stare at a light bulb or a lit candle. You should see two or three flames and a rainbow X. Shine a flashlight on a CD and watch for rainbows.

**Spinning Colors** There are three primary colors of light: red, green, and blue (artists use red, yellow, and blue). Use a cup to outline circles on a sheet of stiff white paper (or manila folders). Stack several blank pages together and cut out multiple circles. Color the circles, push a sharp wooden pencil through a hole in the center, and spin! What color does yellow and blue make? Pink and purple? You can also make a button-spinner to really whirl it around by looping a length of string through two holes in the center of the disk circle.

**Water Prism** Set a tray of water in sunlight. Lean a mirror against an inside edge and adjust so that a rainbow appears on the wall. You can also use a light bulb shining through a slit in a flat cardboard piece as a light source.

**Polarization** If you have polarizer filters, use two of them. You can substitute two sunglass lenses (no need to pop out the lenses) using two pairs of good sunglasses. Make sure your sunglasses are polarized lenses (most UV sunglasses are). Look through both lenses, then rotate one pair  $90^\circ$ . The lenses should block the light completely at  $90^\circ$  and allow light to pass-through when aligned at  $0^\circ$ . Think of your sunglasses as light filters. They allow some light to pass through but not all. When you rotate the lenses to  $90^\circ$ , you block out all visible light.

**More About Polarization** You use the filter principle in the kitchen. When you cook pasta, you use a filter (a strainer) to get the pasta out of the water. That's what the sunglasses are doing – they are filtering out certain types of light. Rotating the lenses  $90^\circ$  to block out all light is like trying to strain your pasta with a mixing bowl. You don't allow anything to pass through. You can make sunglasses tinted darker or lighter by adjusting the amount of rotation between the two lenses before you glue them together into one lens. Astronomers use polarizing filters to look at the moon. Ever notice how bright the moon is during a full moon, and how dim it is near new moon? Using a rotating polarizing filter, astronomer can adjust the amount of light that enters into their eye.