

OPTICAL ILLUSIONS

THAMES & KOSMOS



WARNING — Science Education Set. This set contains chemicals and parts that may be harmful if misused. Read cautions on individual containers and in manual carefully. Not to be used by children except under adult supervision.

DEAR PARENTS,

With this experiment kit, children as young as five years old will be able to perform their first exciting experiments.

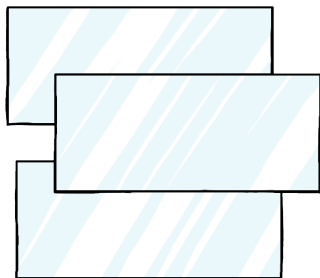
Experiments, astonishment, and play are all closely related, so it's good to offer plenty of fun if you want kids to learn. But even though the experiments here are easy, they won't necessarily come off without some help. So please do help your little researchers, particularly since the curiosity and powers of comprehension of children are more advanced than their manual abilities. And please make sure to assist your children in getting any materials they may need in addition to the ones contained in the kit.

Because the experiment kit was designed with young researchers in mind, the read-aloud explanations have been kept as simple as possible.

Have fun with the experiments!

NOTE! Not suitable for children under 3 years of age. There is a risk of suffocation, due to small parts that might be swallowed or inhaled.

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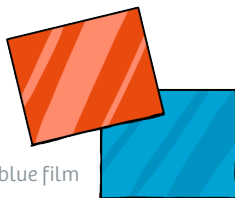
Mirrors



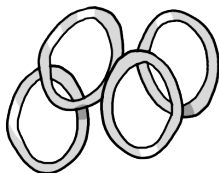
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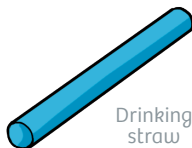
Top



Red/blue film



Rubber bands



Drinking straw

EXPERIMENT 1

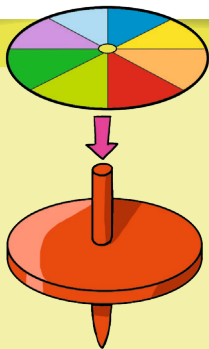


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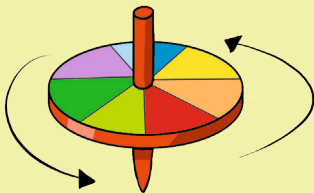


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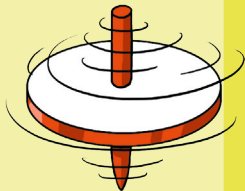
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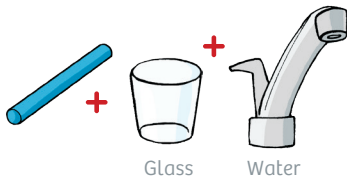
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HERE'S HOW

When the top spins quickly, the individual colors disappear and turn into a light-colored surface. White light consists of all the colors of the rainbow — just like the disk on your top. When you spin the top, you mix the colors, and from all the bright colors you get — white!

EXPERIMENT 2

**YOU WILL NEED ↑**

1



2



3

**HERE'S HOW**

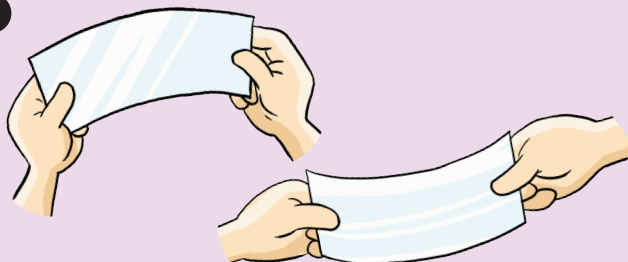
Even if it doesn't look that way, the light around you is always in motion. But in air, it moves a lot faster than it does in water. When a ray of light comes out of the air and strikes the water's surface, it slows down and changes its direction in the process. That's how you get the "bend" in the tube!

EXPERIMENT 3

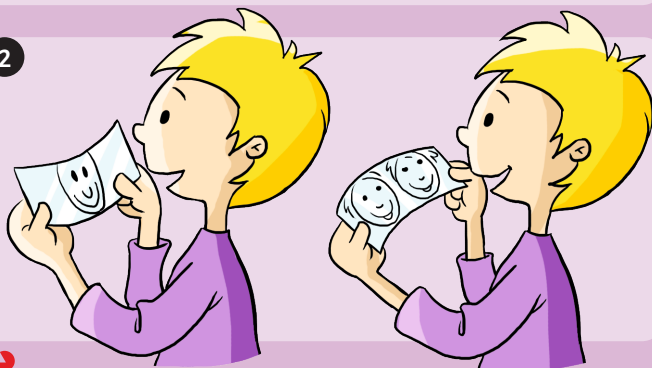


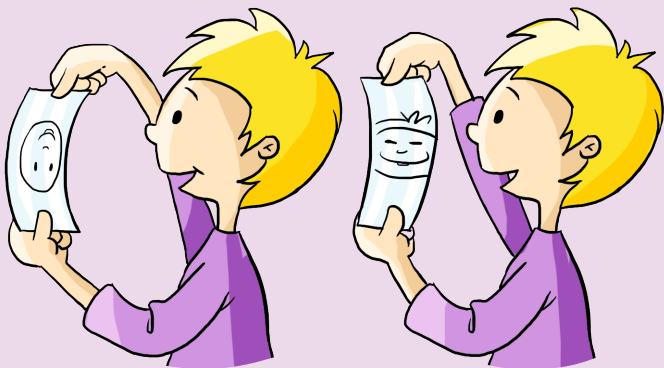
YOU WILL NEED ↑

1



2





HERE'S HOW

A mirror has to have a smooth surface and must not allow any light to enter through its back side. When light hits the mirror, it is thrown back — which is how the mirror image is created! A normal mirror reflects the light in a perfectly straight and orderly manner. But if you bend the mirror, the rays of light get mixed up, and the mirror image becomes warped. You can get a reflection of yourself in a window pane or the water's surface, too. But it always has to be brighter on one side of the "mirror" than the other.

Bird in a Cage

EXPERIMENT 4

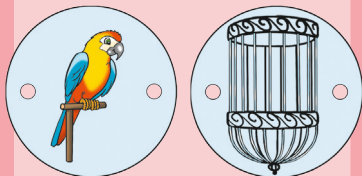


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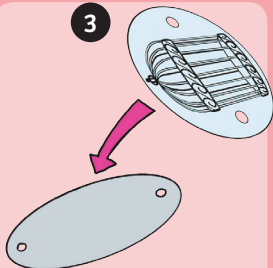
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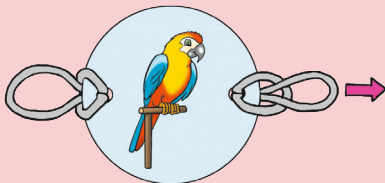
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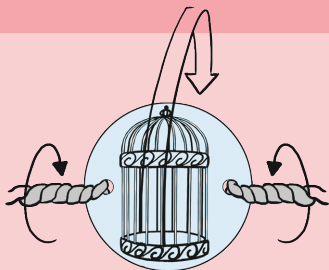
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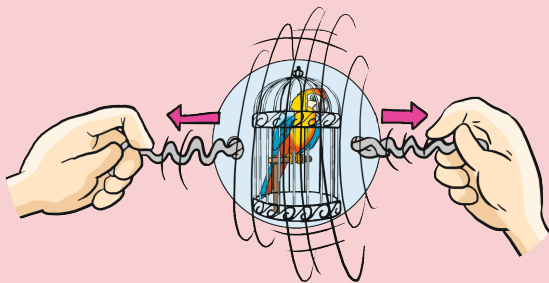


5



Tip: Make your own magic disk out of cardboard and the remaining rubber bands.

6

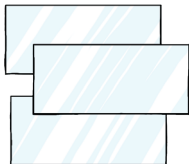


HERE'S HOW

The rapid movement of the cardboard disk makes the two images blend together into one — and you see the bird sitting inside the cage! The device you made here is also called a “thaumatrope” — meaning “miracle turner.”

Kaleidoscope

EXPERIMENT 5

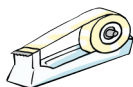


+



Glue

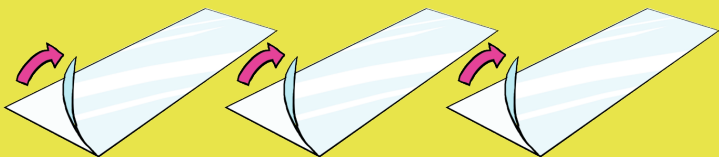
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Tape

YOU WILL NEED ↑

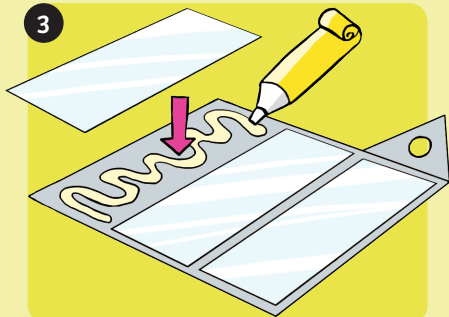
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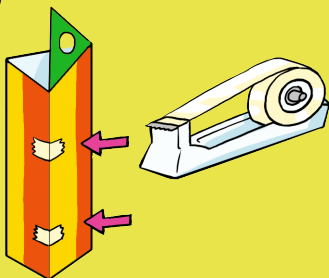
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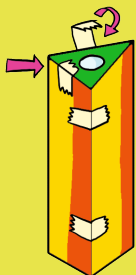
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6



Tip: Take a look at
the next page!

HERE'S HOW

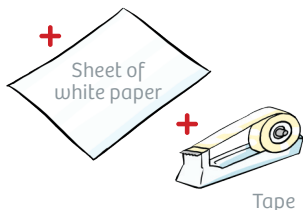
A mirror image is created when a mirror reflects back the light that hits it. In a kaleidoscope, the light is reflected by 3 mirrors, and it strikes several mirrors in turn. That is what creates the beautiful magical images! The word “kaleidoscope” means “beautiful image viewer.”



Tip: Try looking all around you with the kaleidoscope, and turn it as you look through it.

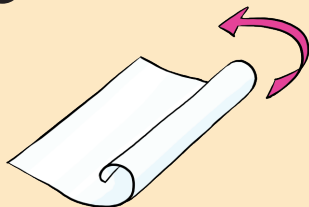


EXPERIMENT 6

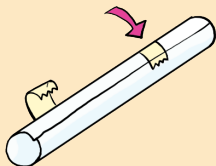


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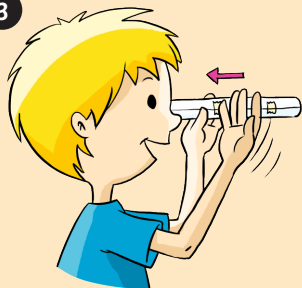
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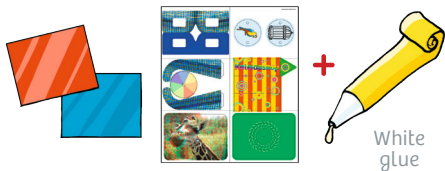


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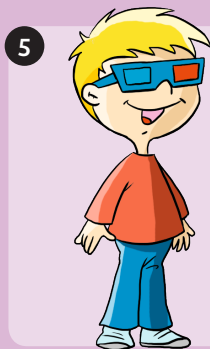
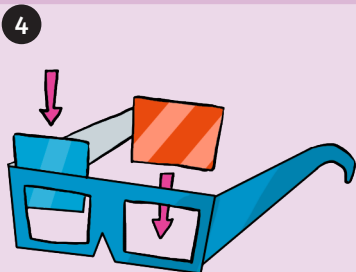
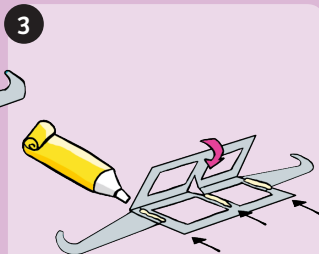
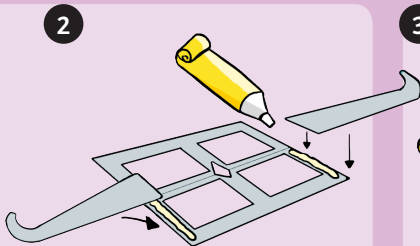
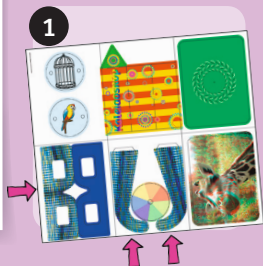
Hold the tube of paper in front of your eye and slowly guide your other hand along the tube toward your other eye. One eye looks through the tube while the other looks at your hand. Since you normally see the same thing with both eyes, your brain gets confused. That is why you see through your hand into the distance, and a hole shows up inside it.

3D Glasses

EXPERIMENT 7



YOU WILL NEED ↑



6



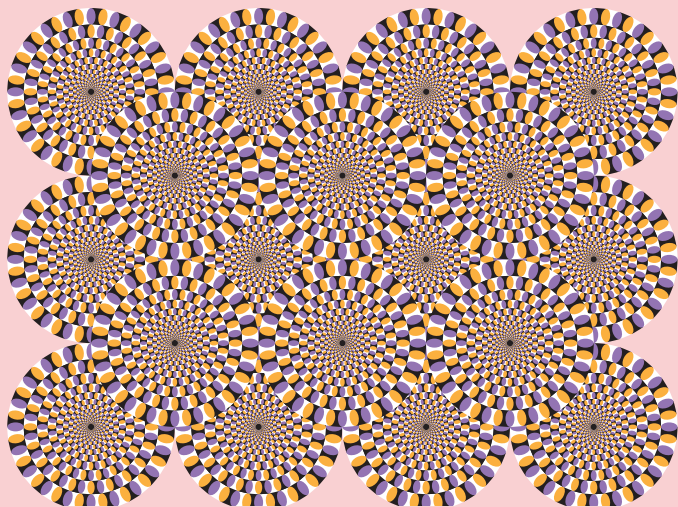
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HERE'S HOW

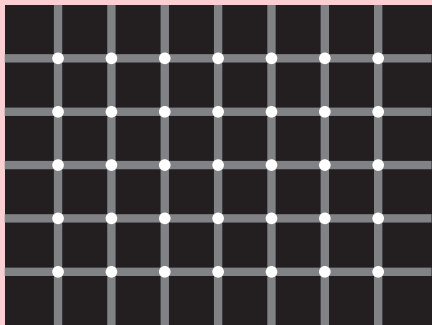
The 3D image contains two almost identical pictures — one red and the other blue. With the colored film, you see just the red image with one eye and just the blue image with the other. Your brain combines the two, and you see the combined image in 3D — in other words, with the kind of depth you see normally in reality rather than just flat on the paper.

EXPERIMENT 8



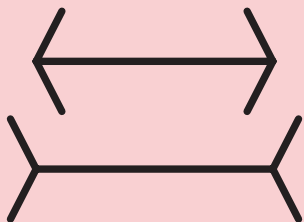
HERE'S HOW

When you look at the spirals in the picture, it looks like they're turning. In reality, of course, they're not turning at all! The illusion comes from the light and dark colors in the spirals. The sharp difference between the two is perceived as movement. When our eye sees something that is interpreted incorrectly by the brain, it is called an "optical illusion."



HERE'S HOW

Here, the great difference in color between the bright circles and the dark squares makes you see black dots inside the white circles — even though they are not really there.



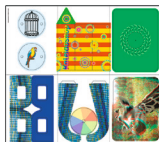
Which line is longer?

HERE'S HOW

Measure them with your ruler. Are you surprised? The different ends deceive us into thinking their lengths are different. The first line appears shorter than the second one.

Turning Circles

EXPERIMENT 9

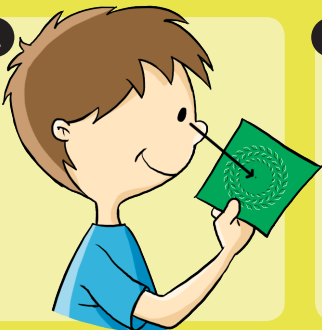


YOU WILL NEED ↑

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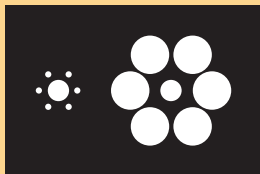
HERE'S HOW

Look at the cross in the center and slowly move the card toward you and away from you. As if moved by a ghostly hand, the middle circle will suddenly start to turn! It will turn to the left or the right depending on whether the card is moving toward you or away from you.

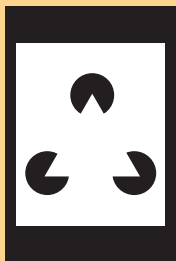
EXPERIMENT 10



Do you see a vase
or two faces?



Which center circle
is bigger?



A triangle without
lines?



Duck or rabbit?



Does the triangle
have an end?

HERE'S HOW

As you now know, we can't always trust our eyes. We can see things completely differently from the way they really are. In fact, though, our eyes are not to blame. It's our brain, which always tries to make sense of what it's looking at, and is therefore easily fooled by optical illusions. We suddenly see triangles where none exist, or two faces instead of a vase.

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