

# Somewhere over the rainbow?

In this week's Pop-Up Science edition, we are dealing with light and colors. Today you also find out how a rainbow is made!

Did you know that light travels 300,000 kilometers in one second? That is a billion kilometers per hour, a one with nine zeros! And did you know that a light year does not measure time, but distance? It tells us how many kilometers light travels in one year. And that is about ten trillion kilometers. That is 10,000,000,000,000 kilometers!

## Experiment: What color is light?



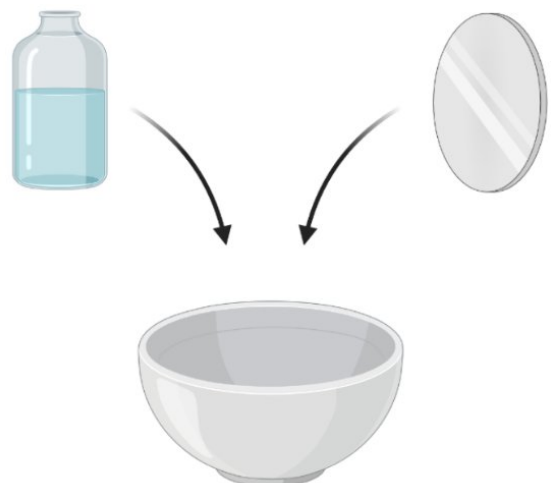
Did you enjoy our DIY-experiment with the CD? Here is another experiment you can do at home so make the colors of light visible.

### For this experiment you need:

- A white piece of paper
- A pair of scissors
- Water
- A mirror

Here is how it works:

1. Fill a shallow bowl half with water and place a mirror into the bowl. If it does not stand by itself, you can tape the mirror to the bowl.
2. When the sun falls on the mirror, rays of light are reflected. Now hold the paper exactly on the spot above the bowl where the light is reflected. The colors that you can see on the reflection are the colors of which light is made of!



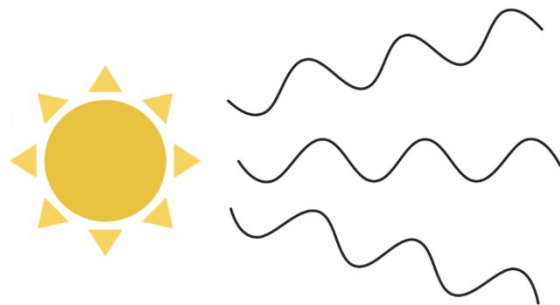
You can also try this with a flashlight.

Does this light have the same colors?

**A. Read the following text and underline the most important pieces of information!**

Light consists of rays of different lengths. Through these rays, we can see objects. When light falls on a piece of cake, for example, parts of the rays are sent back. These rays then contain important information about the color of the cake and where it is located. When these light rays hit our eyes, the information is sent to our brain. This allows us to see the cake and know where it is.

Rays of light coming from the sun or a lamp travel in a certain direction. But as soon as they hit the cake or some other object, they are taken up or redirected to another direction. Today we know that light rays are actually tiny waves!



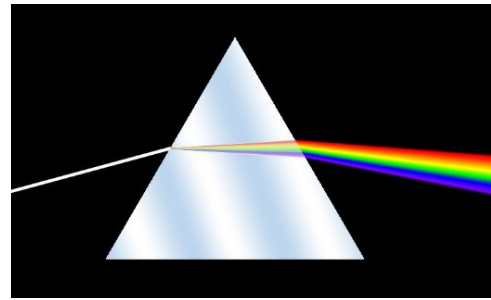
Did you find out what colors light is made of in the experiment on the previous page or with the CD? Did you see the rainbow colors? They are exactly the colors that light is made of! The tiny grooves on the CD split the light into its components. Just like the water in your experiment earlier! Isaac Newton was the first to show that white light consists of all the colors of the visible spectrum.



These are also called spectral colors. This means, that white light consists of the colors: red, orange, yellow, green, cyan, blue and violet.

Images from <https://biorender.com>

In both your experiments, light is split into its components. It is also said that the light is "refracted". The spectral colors then become visible.



[https://klexikon.zum.de/wiki/Datei:Dispersion\\_prism.jpg](https://klexikon.zum.de/wiki/Datei:Dispersion_prism.jpg); CC 1.0

The same effect seen in your experiments, only at larger scale, is what creates real rainbows. They occur when it rains somewhere and the sun shines on the rain. A ray of sunlight hits a drop of water, stopping it from traveling further ahead. The light is refracted. Just as in the bowl of water or on the CD, the light is now divided into the individual colors. And due to this we see a rainbow!

Did you know that a rainbow is actually a whole circle? Every little raindrop in the sky can reflect light, but at a different angle. But we see the colorful light only in those raindrops that reflect it directly into our eyes. Together, these raindrops appear in a circle! So depending on where you stand, the rainbow is in a slightly different place. It has no fixed position. We unfortunately cannot see the whole rainbow circle because the earth gets in the way. But if you look down from an airplane and get really lucky, you can see a full rainbow circle!



Image by James Wheeler von <https://pexels.com>

**B. Try to answer the following questions and check the correct answers.**

1. Light rays travel as simple straight lines. They are not waves!

☐

true

☐

false

2. Rays of light coming from the sun or a lamp travel in a certain direction. But as soon as they hit an object, they are either taken up or redirected in another direction.

☐

true

☐

false

3. Which scientist was the first to show that white light consists of all the colors of the visible spectrum?

☐

Charles Darwin

☐

Isaac Newton

☐

Albert Einstein

4. What are the 7 spectral colors?

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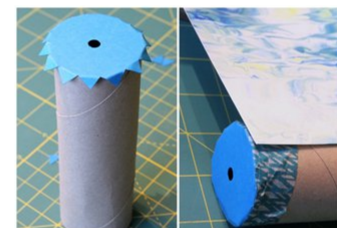
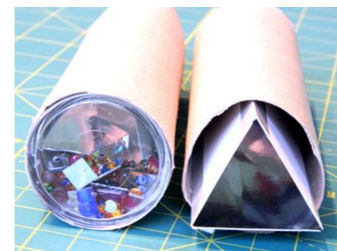
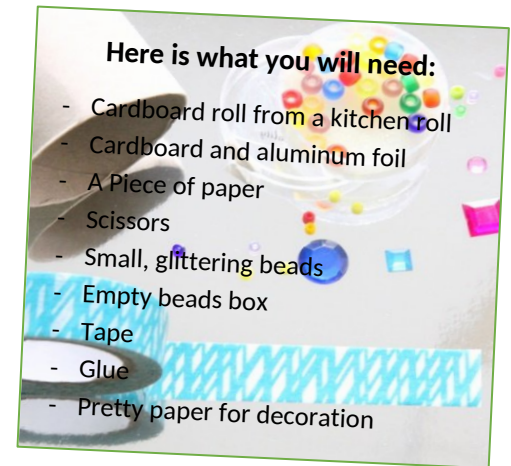
5. Complete the sentences!

When light rays from the sun hit \_\_\_\_\_ a rainbow occurs. In the water drop the \_\_\_\_\_ is refracted. This means, that the rays are redirected. They can no longer travel straight ahead. Also, the rays are split in their components. These components are called \_\_\_\_\_. Light refraction happens in many water drops. Through this we can see a \_\_\_\_\_!

## C. Build your own kaleidoscope!

Here is how you can build your own kaleidoscope:

1. Glue aluminum foil on a cardboard.
2. From this cardboard, cut out a rectangle which has the same length as your cardboard tube. If you use the cardboard tube from a kitchen roll, your rectangle must be about 12 cm wide.
3. Fold the rectangle three times lengthwise and tape it together to form an equilateral triangle with the foil inside. The length of the triangle should now still be the same length as your cardboard tube.
4. Cut away enough of the equilateral triangle so that the triangle and the empty bead box fit exactly into the tube.
5. For the peephole, place the cardboard tube on a piece of paper and draw a circle around the tube with a pencil. Cut it out with a little extra width. If you like, you can cut tips in this extra width. Tape the tips on the cardboard tube. Now prick a hole in the middle of the paper. Your peephole is ready!
6. Fill the box with glittering beads. Put the filled box into the roll, but on the opposite side of the peephole! You can tape the box so that it does not fall out.
7. Now glue paper around the cardboard roll to decorate your kaleidoscope. Your self-made kaleidoscope is ready!
8. If you hold the kaleidoscope against the light and look through the peephole, you can see great patterns!





## D. Word search

Can you discover all the hidden words in our word search this time?

SPECTRALCOLORS

ISAACNEWTON

LIGHTYEAR

LIGHTREFRACTION

PRISMA

SUNRAY

WAVELENGTH

RAINBOW

REDIRECTION

KALEIDOSCOPE

COLORS

RAIN

Circle each word. Good luck!

E	Y	R	S	I	W	I	E	A	T	Y	S	R	M	R	A	G	Z	P	H
F	D	M	H	W	Z	H	O	T	D	N	H	L	W	D	A	W	G	F	T
Q	X	C	G	T	R	W	J	W	H	O	D	C	A	R	F	I	Z	H	Z
E	X	I	H	E	L	P	K	F	C	M	C	T	V	A	T	L	N	Y	T
T	S	E	K	T	Y	I	D	O	I	X	G	N	E	E	T	W	F	H	T
U	E	P	U	A	Z	P	G	I	X	Z	B	F	L	Y	K	A	P	G	O
G	S	L	E	Q	L	C	Z	H	U	Q	D	V	E	T	I	W	V	H	Z
B	X	S	G	C	I	E	U	G	T	S	T	A	N	H	E	O	L	S	O
N	K	S	M	Q	T	S	I	V	Y	R	V	Y	G	G	M	B	F	R	F
O	L	T	S	U	H	R	E	D	I	R	E	C	T	I	O	N	M	O	M
T	R	I	A	P	C	Z	A	G	O	J	N	F	H	L	T	I	G	L	G
W	D	K	J	J	J	V	A	L	J	S	P	V	R	Z	D	A	I	O	I
E	L	E	V	W	B	E	B	A	C	Q	C	A	V	A	Z	R	A	C	Q
N	H	A	P	G	X	F	R	L	C	O	S	O	B	G	C	U	M	Q	Z
C	H	P	T	P	K	G	T	O	Z	C	L	U	P	G	T	T	S	A	M
A	R	S	K	B	L	U	G	I	D	I	J	O	N	E	A	R	I	S	Y
A	C	S	A	A	E	L	U	Z	U	L	E	G	R	R	W	M	R	O	F
S	N	F	P	B	R	C	M	S	P	R	J	N	F	S	A	D	P	Y	N
I	O	V	W	A	B	N	K	Y	I	R	Y	T	B	S	Y	Y	R	B	A
P	J	Z	M	G	Z	T	L	Q	R	R	V	J	S	F	B	C	Q	O	I

**E. Color the picture! Have fun!**

