



**Teacher's Resource sheet  
Episode 4**



**Curriculum Strand – Energy and Forces  
Strand Unit – Light and Illusions**

**Aims and Objectives:**

To investigate how light travels and how our eyes play tricks on our brain and our brain plays tricks on our eyes.

**Class plan**

Suggestions:

- ✓ Ask warm up questions with the class
- ✓ Watch the video
- ✓ Fill out the first two questions of the investigator's sheet (see resources below)
- ✓ Do experiments in class
- ✓ Complete the investigator's sheet

**Resources contained in this print out:**

- ✓ Curriculum questions explaining light and illusions
- ✓ Some warm up question suggestions
- ✓ The Science Investigators Light and Illusions episode can be accessed here:  
<https://scienceinvestigators.wordpress.com/about/episodes-and-resource-sheets/>
- ✓ Experiments to do in class (resources and instructions are included)
- ✓ An investigator's sheet for pupils to discuss and fill out for each experiment

**Curriculum Question Suggestions with answers. Explaining:  
Light and Illusions**

**Question 1**

Do your eyes always tell you the truth?

**Answer:**

Your eyes work with your brain, and between them, they can fool you! For example, there are times when a series of lines can look like they are floating when we know they are not. This is an example of an optical illusion. Our vision also has the capacity to portray action when we view a series of pictures in rapid motion. This is the way cartoons work.

**Question 2:**

When you stare at an image, why does it stay in the back of your brain?

**Answer**

Sometimes we continue to see images even when we've stopped looking at the original picture. This called an afterimage. Afterimages happen because of the sensory signals the eye sends to the brain.

On the back of your eye, you have a thin layer of cells called your retina. These specialized cells are called photoreceptors, they are the cells that respond to light. There are 2 types of photoreceptors in the retina: rods and cones. Rods are sensitive to dim light and black and white; cones are sensitive to colour.

The more we look at a picture, the more chances that colour patches will be registered in our brain thus creating an afterimage if we look at a blank, white page.

**Question 3:**

What is refraction?

**Answer**

Have you noticed how your body slows down when you try to walk through water? You go racing down the beach at top speed but, as soon as you hit the sea, you slow right down. No matter how hard you try, you cannot run as quickly through water as through air. The dense liquid is harder to push out of the way, so it slows you down. Exactly the same thing happens to light if you shine it into water, glass, plastic or another more dense material: it slows down quite dramatically. This tends to make light waves bend—something we usually call refraction.

# EXPERIMENTS

There are lots of experiments in this episode. The materials for each are listed with the instructions below.

## Experiment 1: Magic Arrow

**For this experiment each group will need:**

- ✓ A clear glass
- ✓ A jug of water
- ✓ A black marker
- ✓ A sheet of blank paper

**Directions:**

1. Draw a thick solid arrow on the piece of paper
2. Hold the paper behind the empty glass
3. Look through the glass with the arrow at the other side
4. Slowly fill the glass up with water
5. Watch the arrow change direction
6. As light travels through one material (glass) then another (water) it refracts or bends

## **Experiment 2: Make a pencil bend or break in two**

### **For this experiment each group will need:**

- ✓ A clear measuring jug or glass container
- ✓ Vegetable oil
- A pencil

### **Directions:**

7. Pour some oil into the container
8. Slowly lower the pencil in
9. At the surface of the oil, does the pencil look as if it has been cut in half?

What's happening: Oil bends light even more than water does. In fact, it can bend the light so much that, if you hold the glass the right way, a pencil leaning against the side of the glass container can be completely hidden from your eyes.

## **Experiment 3: Bending Light**

### **For this experiment each group will need:**

- ✓ A bottle of water
- ✓ A deep tray
- ✓ A laser pen
- ✓ Masking tape

### **Directions:**

1. Get an adult to poke a hole in the bottle (using a skewer or screw driver)
2. Mask up the hole with tape
3. Fill the bottle with water
4. Direct the light from the laser beam through the hole
5. Remove the tape and watch what happens as the water flows out
6. The light will bend with the water creating a waterfall of light

## **Experiment 4: Make your own optical illusion**

### **For this experiment each group will need:**

- ✓ 2 white pieces of paper exactly the same size
- ✓ Colouring pencils to draw with
- ✓ A chop stick
- ✓ A Pritt stick

### **Directions:**

1. Draw one image on each piece of paper
2. Stick the 2 pieces together with chopstick in the middle and images on outside
3. Twirl the stick around in your hands and watch the images merge

**Top Tip: A good idea to pick images that might work together. Like a fish and fishbowl.**

# **INVESTIGATORS SHEET**

**What are we going to do?**

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**What do you think will happen?**

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**What actually happened?**

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**Why do you think this happened?**

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