

This resource can be used in support of the primary school curriculum – the introductory section and the first experiment can be used in Year 3. The advanced concepts around light and colour can be used in Year 6.

Where does light come from?

Light helps us to see, and it comes from many sources - some natural and some artificial. The sun is our main natural source of light. Some artificial sources include lightbulbs and computer monitors.



The sun as it looks from space



Shadows form where the light can't reach

Where do shadows come from?

Light rays always travel in straight lines from the light source. Once it hits a surface, one of three things will happen:

1. If the object is transparent, the light passes directly through it – this is why you can see through window glass
2. If the object is translucent, some light passes through it, but not all – hold up a white t-shirt to the light to see this
3. When light hits opaque objects, the light is either blocked or reflects off the surface – this is why you can't see through your books.

Opaque object will block the light completely - where the light cannot reach, a shadow forms.



White light is full of hidden colours

Reflections

Although it looks very bright in the night sky, the Moon is not a source of light. It is an opaque object that reflects the sun's light. Lots of materials reflect light – some do it so well that you can use them to see your own face.

This is what happens when you look into a mirror - the light from the room's lightbulb bounces off the shiny mirrored surface and back into your eyes.

Reflective materials look very smooth and shiny because the light reflects off it in straight lines. Rough surfaces look dull because light doesn't bounce off it smoothly.



Rainbows

Light from most light sources looks white, but hidden inside it is all the colours of the rainbow.

We can use a glass object called a prism to unveil all of light's secret colours – it helps to make the light bend and change direction, but it doesn't make every colour change by the same amount.

Violet light bends the most, followed by indigo, blue, green, yellow, and orange, all the way to red, which bends the least. Other transparent objects (like water) can also be used to split white light up.

Experiment! Play with Shadows

Equipment

Torch, black paper or cardboard, access to a blank wall, a ruler, paper and lots of other objects (e.g. toys)

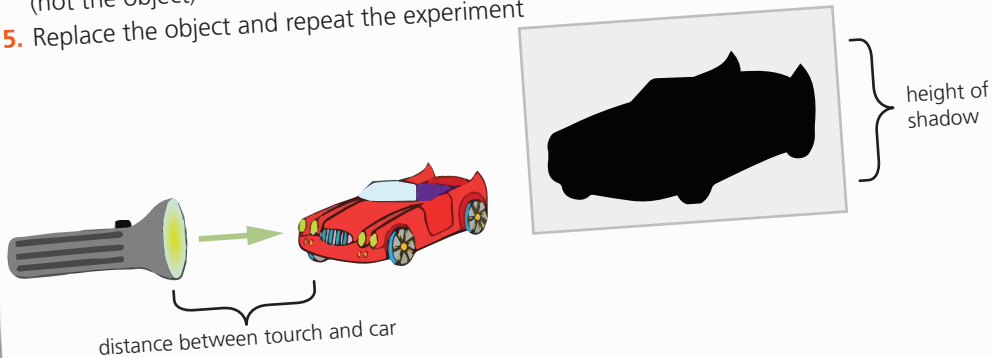
Method

1. Add a piece of black card or paper to the inside of your torch in order to produce a focused beam of light
1. Find a blank wall. Choose a few small objects (toys etc.) and place one of them between the torch and the wall
2. Mark the positions of the torch and object on the desk – measure the distance between the torch and object
3. Shine your torch onto the object and look at the shadow that forms behind it – measure the height of the shadow
4. Experiment! Change the position of the torch (not the object) – does that change the shadow?
5. Replace the object and repeat the experiment

Results

Record your results in this table

Position	Distance between torch and car (cm)	Height of shadow (cm)
1	30	
2	25	
3	20	
4	15	
5	10	
6	5	



Now try to sketch your data on the blank sheet here (hint: put "distance between the torch and object" along the bottom and "height of the shadow" along the side)

Q: Is there a pattern? What does this tell you?

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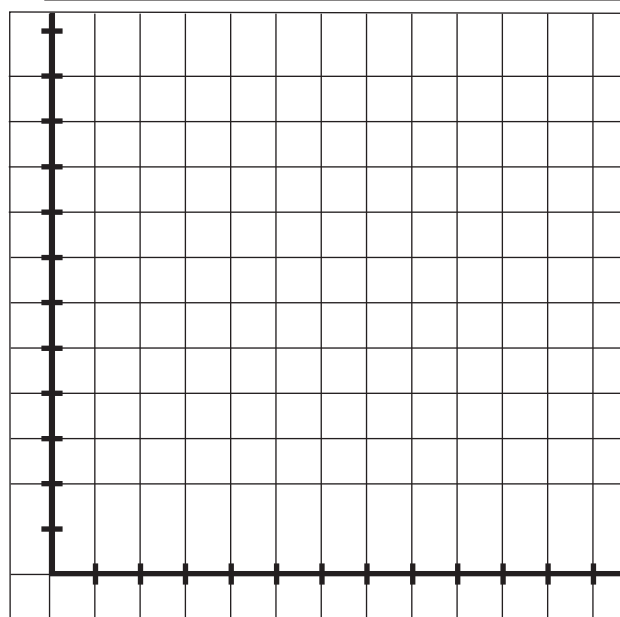
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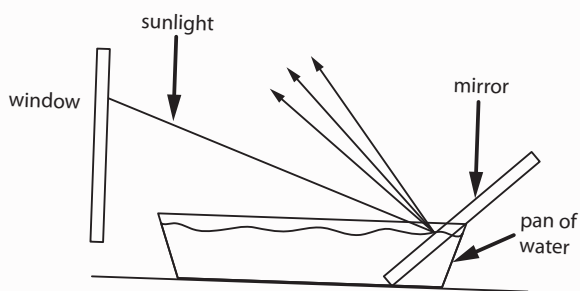
Experiment! Make Rainbows

Equipment

Sunny day or a white-light torch, shallow dish of water, flat mirrors, plasticine to hold the mirror, pieces of paper, other types of light (e.g. incandescent lamp, fluorescent lamp, UV lamp, LEDs).

Method

1. Half fill the dish with water
2. Put the mirror in the dish so that it slopes back – make sure that it can easily reflect the light from the torch or the sun
3. If using a white-light torch, point it so that the light hits the part of the mirror that is sitting under the water
4. Hold the piece of paper above the torch – what do you see?



Did you know?

A rainbow is in fact a full circle of light. However, due to most people viewing a rainbow on the ground we only see a semi-circle or arc of the rainbow.

Bonus activity

If you're lucky enough to have some diffraction glasses in your classroom, they can be used to demonstrate the hidden rainbow in white light. Look at different sources of light (not the sun though, be careful!) while wearing them. Do all lights produce the same sort of rainbow?

Questions

Q: Does a rainbow appear on the paper? If so, why?

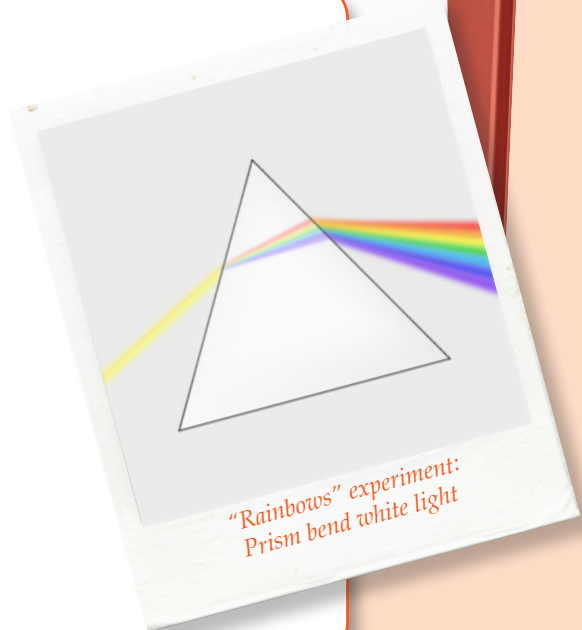
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Q: What order do the colours appear in?

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Q: Why do we get rainbows in the sky? Discuss this with your partner

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Homework

Q1. Can you name a natural source of light other than the sun?

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Q2. Make a list of three artificial light sources in your house

- 1.....
- 2.....
- 3.....

Q3. Can you think of things that are transparent, translucent, and opaque?

Transparent.....

Translucent.....

Opaque.....

Q4. Why can't we see anything without a light source?

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Q5. How is a shadow formed?

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Q6. How many colours are in the rainbow? How do prisms transform white light into rainbows?

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Did you know?
Lasers are a powerful type of light that have just one colour. AWE uses its Orion laser to help scientists see inside opaque materials. The laser produces temperatures in excess of 10 million degrees – as hot as the centre of the Sun!

Learn more!

- International Year of Light: <http://www.light2015.org/Home/LearnAboutLight.html>
- Light and Shadow: <https://www.tes.co.uk/teaching-resource/light-and-shadow-6224597>
- Rainbows: <http://www.metlink.org/primary/key-stage-2/rainbows/>
- For teachers: <http://www.theguardian.com/education/teacher-blog/2013/mar/18/light-teaching-resource-classrooms>
- AWE's Orion laser: <http://www.awe.co.uk/what-we-do/science-engineering-technology/orion-laser-facility/>

