

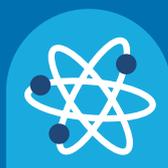
Suitable for
3-7 years

- ✓ Solo
- ✓ Pairs
- ✓ Groups

Sara's activity

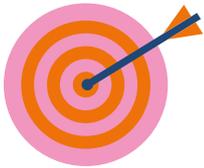
Build your own spectroscope

How to guide



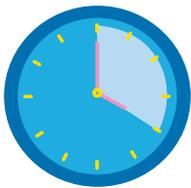
Sara's activity

Build your own spectroscope



Aim

The aim of this activity is to explore light and rainbows by making your own spectroscope. To create a rainbow, water droplets split the sunlight into the different colours. A spectroscope is an instrument that splits light into different colours so we can find out what colours are in different types of light sources.



Timings

~30 mins



Materials and equipment

- Cardboard tube, e.g. from paper towel or toilet roll (alternatively you can make a tube by rolling up some card/paper and securing with tape)
- Tin foil
- [Diffraction grating](#) (1 small piece of diffraction grating plastic). Each pack comes with two sheets, when cut this should do ~60 students. Alternatively if you can't source the diffraction grating an old CD can be used.
- Sellotape (or elastic bands)
- Scissors



Safety

NEVER look directly at the sun.



Instructions

1. Stand the cardboard tube on the tin foil and draw around it
2. Fold the tin foil in half and cut out a hole smaller than the diameter of the tube
3. Tape this tin foil over one end of the tube – try to tape it to itself while covering the end of the tube. This will mean it can rotate. An alternative would be to try using elastic bands to attach the tin foil
4. Take one smaller piece of tin foil with a straight edge and tape it on covering almost half of the end of the tube
5. Take a second piece of tin foil with a straight edge and tape it onto the other half leaving a narrow slit (adult help might be required to create a narrow slit)
6. Repeat steps 1-2 for the other end of the tube and then tape a piece of diffraction grating to the cover the hole that was cut out – be careful not to touch the diffraction grating to avoid getting fingerprints on it
7. Add this tin foil with diffraction grating to the other end of the tube
8. Look through the diffraction grating while pointing the other end at a wall reflecting sunlight and rotate the slit end until you see a rainbow (see images below)

Look through the large window and point the spectroscope toward a light source. **Never look at the sun directly.**

The slit at the other end should be vertical like the image below.

Rotate the ends of the spectroscope until the narrow-slit end is vertical and the light is being refracted on the left and right side of the spectroscope tube like the image below.

The light from the sun (reflected off of a white wall) gives us a continuous spectrum like this:



If you have fluorescent lights in your school looking through the spectroscopes will show you an emission line spectrum like this:



The lines you can see are directly related to the gas inside the lights.

If you see a red-green-blue continuous looking spectrum – your lights are probably LEDs!

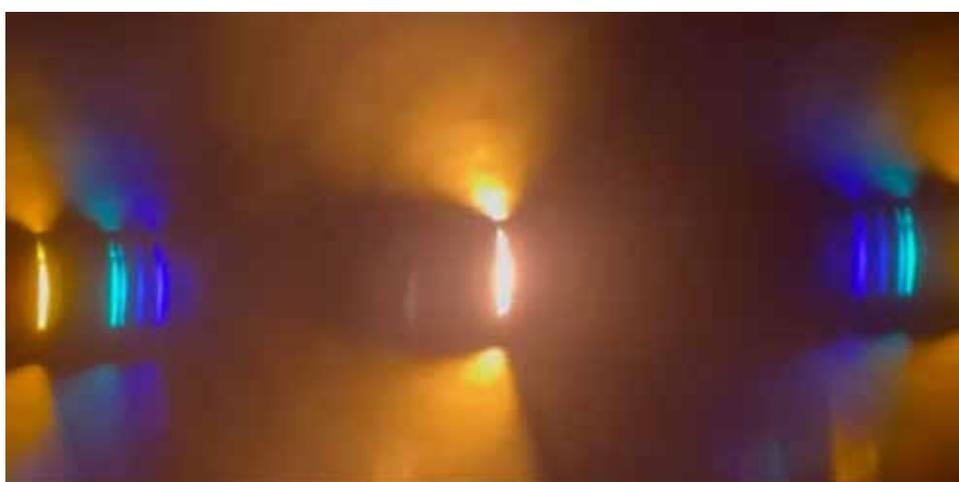
If you have access to any gas emission lamps this can be made into a great little experiment.

Here are some examples of the line spectra below from several gasses.

Hydrogen



Helium

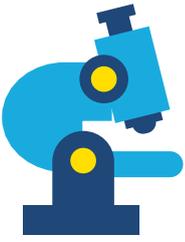


We have tried to simplify the build for younger children utilising the flexibility of tin foils. You can also use cardboard as in either of the following suggestions though this may require further adult preparation and support in the cutting.

Visit [EU-HOU](#) for an alternative build suggestion using a cardboard tube and cardboard along with more images of spectra.

Using just rolled up card, elastic bands and some careful cutting a spectroscope can be built like [this](#).

[Visit Buggy and Buddy](#) to discover how you could create a spectroscope using a cardboard tube and an old CD.



How does it work?

A spectroscope uses the slit to isolate light from one particular source and the diffraction grating then splits the light into different colours. By looking at the different colours we can figure out what the light source is made of – if we use a spectroscope in space we can work out what different stars are made up of and learn more about the universe. Our engineer Sara is designing spectroscopes to go on a Mars Rover to investigate different light sources in space. By looking at the light reflecting off surfaces on Mars we can find out more about what the planet is like.

Selection of tube: In general, the longer is the tube, the better we can see different colours, but also the more light has to fall on the slit i.e. one has to look at brighter sources of light.

Width of slit: the slit lets the light into the spectroscope. The cleaner (i.e. straight) and thinner the narrow slit the better the resultant spectra will be – if it doesn't work well trying to align two edges to create the slit an alternative is to ask an adult to cut a narrow slit instead.

Diffraction grating: the diffraction grating splits the light up so we can see the different colours

Troubleshooting: make sure light can only enter the spectroscope through the slit – check for any other gaps and if any are found cover them up



Prompt questions

→ What happens if you look at different lights? Try sunlight on the wall, lamps etc



Extensions

Find out more about space and space exploration with Sara – dance your way through Astronaut training and build your own model space Rover

Adah and Jinglang also have space based activities – why not try launching a rocket or cleaning up space junk

Images to support step by step build:

