Make your own spectroscope

Introduction:
Spectroscopy is a method used in scientific research to measure the abundance of chemicals in the composition of a given source. In astronomy, we use a tool called a **spectroscope** to make these measurements.

Spectroscopes are much like prisms in the way that they work; if you shine a torch on a glass prism, the light breaks up into its different constituents and colours and can be seen to disperse into what is known as a **spectrum** (like a rainbow). The spectroscope we will be making in this activity will not bend/redirect light like a prism, but will still break up the light into different constituents and create the familiar spectrum of different colours. This is done via something called **diffraction grating**. The diffraction grating used in this activity is a thin piece of film interspersed with thousands of tiny gratings (so tiny that the human eye cannot see them directly), which splits up the light as it passes through them. Different **colours** within light correspond to different **wavelengths**, these different wavelengths scatter at different angles as they pass through the grating paper, thus land on different parts of whatever device you are using.

The importance of these colours is that they actually represent the abundance of certain elements within the source you are looking at.

Resources:

- Printed spectroscope cutout (printed card works much better than paper)
- Diffraction grating paper
- Scissors
- Ruler
- Sticky tape

Setup:

1. Print off the spectroscope cutout (make sure to print on one double-sided sheet).

2. Cut out the spectroscope around the edges.

3. Score a line down the dash line on the end flap.

4. Cut out a circle on the other end flap.

5. Cut out a small square of diffraction grating and tape it to either the outer or inner side of the **circle** (be careful not to bend the diffraction grating or put tape too far into the centre, as both will obstruct/distort the light passing through the grating).

For this step, it is also beneficial to put another square of diffraction grating over the first piece with the diffraction grating of the second piece perpendicular to the first, like a grid. Make sure to keep track of this as you cut it off the roll, as you cannot see the gratings.

6. Carefully fold the spectroscope using the guide lines given, making sure the writing is on the outside of the box.

7. Stick the two end flaps down (again being careful not to bend the diffraction paper).

8. Look at a light source through the slit (a room light, the sky but NOT directly at the Sun).

9. You should now see a spectrum of light that has been created inside the spectroscope box.

Emission lines
Now that you can see your spectrum, you should be able to see a range of colours which correspond to different wavelengths. These are emission lines – wavelengths of light that have been emitted by our source which correspond to the chemicals that have emitted the photons.

Absorption lines
You should also be able to see that there a parts darker than the rest. These dark sections are not a trick of the light, but are what tell us about the composition between our light source and us, but these can be elements which lie immediately next to our light source (such as the Sun and its photosphere); the specific chemicals which lie between us and our light source have **absorbed** certain photons that have tried to escape and correspond to that specific chemical's **energy levels**, the atoms that make up this chemical then release the absorbed photon in a random direction, resulting in fewer of these particular photons reaching your eye.

Hence you can find out information about the chemical composition of the source and the material in between you and the source by using the **emission** and **absorption** lines of a spectrum.

Safety:

- Remind the students to never look directly at the Sun.
- Extra care should be taken when scoring the lines with the scissors.

*We love to see your students' work! Don't forget to tag us in your posts on social media using **@SchoolsObs.***