Spectroscope

See the colours in different sources of light using this simple spectroscope made from a CD.

Age Group: 8yrs + (scissors and craft knife required)

Method: Group activity (up to 15 per facilitator)

Level: Introductory

Duration: 20 min

Key Learnings: Light sources emit many different types of radiation (for example, a fire emits heat as well as light, and the sun gives off UV rays we cannot see), including a variety of colours. These colours can be separated when light passes through a prism, or reflects off a grid of very narrow grooves (called a diffraction grating).

Materials and Equipment

* Spectroscope template on A4 card (1 per participant)
* Scissors (1 per participant)
* Opaque stickytape (can be shared between a few participants)
* Wedge cut from a CD or DVD (1 per participant)
* Craft knife (can be shared between a few participants)
* Hotmelt glue for fixing wedge, if available (1 per group)

Preparation

The facilitator should prepare for this workshop by making their own spectroscope using the instructions and materials provided. Note critical stages in gluing the device together, and making the thin slit, and advise the participants accordingly.

If hotmelt glue is used, note how long it takes for the glue to harden enough before final assembly of the spectroscope can be done.

Have a rubbish bin ready for the waste card that will be generated.

Recommendations

Depending on the age and skill levels of the participants, it might be wise to have a couple of extra copies of the template at hand if cutting errors make completion impossible. For this reason, it is a good idea to fix the wedges *after* cutting out the template. Younger group members may benefit from assistance in fixing the wedges to the template if hotmelt glue is used.

Further learning could occur when participants use the device to view a variety of different light sources. What spectrum do you see when you look at a coloured light (or one filtered through coloured cellophane?).

CAUTION: Though sunlight can be viewed through the spectroscope, warn participants to never look directly at the sun and so avoid permanent eye damage.

Workshop Outline

(5 min) Introduction

Introduce yourself, welcome participants and deal with housekeeping.

Ask participants if they know how a rainbow is made, and where they have seen one. Rainbows are sometimes seen when light passes through fishtanks, thick glass sheets and on feathers, raw meat, gems or shells. In the first examples , the effect is caused by light passing through a prism shape, but natural objects cause this effect because they have many very fine ridges on their surface ( like a CD), or inside them (like opals).

(5 min) Preparing the template

Distribute template cards, scissors, rulers and craft knives.

Explain that the solid lines represent cuts, and the dotted lines are to be scored with the craft knife, using the ruler as a guide to get a straight line. Supervise this as necessary. (note that when the spectroscope is assembled that the lines will be on the *outside* to take advantage of the scoring).

Practise folding the spectroscope into shape, and point out that the CD slice will need to be fixed to the inside for it to work (this will avoid later confusion). Participants could mark where to fix the slice if required.

(5 min) Make the light slit and viewing hole

Use scissors or the craft knife to make the 1cm viewing hole (shaded circle at the bottom of the template).

Use the craft knife to cut a very fine slit which will allow the light to enter the device (marked as a horizontal line in the top shaded circle on the template). The narrower the slit the better the spectrum, but less light also means it will be darker. If the slit gets too big, you can use two pieces of opaque tape fixed side by side on the template to remake a narrow gap. Note that the direction of the slit should match the printed line.

(5 min) Fixing the CD slice and sealing the tube

Fix the CD slice onto the template, making sure it is oriented as indicated (turning the slice will stop it from working). Note that the slice is fixed inside the tube, and the diagram on the template is there to show the correct orientation only. Hotmelt glue is best, but stickytape can be used as long as only the edges of the slice are covered. Make sure the slice is fixed back down (the shiny rainbow side should face up).

Fold the tube closed, and seal it shut with glue or stickytape, using the tabs in the template. Make sure the edges and corners are completely sealed to prevent any stray light entering the tube.

Now your spectroscope is ready to use: look through the viewing hole while pointing the slit at a light source. You might need to move your line of sight from side to side a bit to see the spectrum, and sunlight or an incandescent bulb will produce a continuous rainbow. Other lights (try an LED, TV or computer screen) will show discrete bands of colour, and some bands may be much brighter than others, showing that different light sources emit different types of light.

If you can find a coloured light (try covering a torch with coloured cellophane), have a look at that to see a dramatic difference.

Appendices: Digital version of spectroscope template (attached)