Teacher and Technician Sheet

In this practical students will:

- Carry out the experiment and observe what happens when light passes through water droplets.
- Report their findings, using scientific evidence to explain observations.
- Compare their initial drawings and the experiment results, reflecting on how their understanding of rainbows has changed.

Introduction for teachers:

(This is an important experiment designed to establish some key concepts of light and colour. It should precede the Spinning Colour Disk and Benham's Disk practical.)

To initiate this activity ask the pupils to discuss rainbows – when and where are they seen? How do you think they form?

Pupils can then individually draw their own **rainbows** using different types of coloured medium and on different types of coloured paper.

Ask pupils to draw two rainbows on a piece of **white paper**; one using any kind of coloured crayons and one using felt tip pens.

They should then draw two more rainbows, using the same coloured crayons and felt tip pens, on **dark paper**.

Ask the pupils to get into groups of two or three to discuss their drawings and the colours.

They should compare their drawings and comment on how similar or different they are, particularly the **colour depth**, **combination** and **order** of the **colours**.

Next, using the methods on the student sheet, they will check their work by creating and drawing a 'real' rainbow. In one method a simulated rainbow is formed by light passing through flowing water. In the other, a spectrum is created by light passing through a 'water' prism.

The results are for discussion, along with the theory behind these ideas, to establish a concept of the spectrum. For this, pupils can work in groups of three.

Curriculum range:

All ages of children can take part in this activity, but it is probably best used with upper junior pupils. The aim is to gain some understanding of the thinking of the artist and scientist with regard to colour. It links with:

- setting up simple practical enquiries, comparative and fair tests;

- reporting on findings from enquiries and observations, including oral and written explanations, displays or presentations of results and conclusions;
- using straightforward scientific evidence to answer questions or to support their findings;
- building a more systematic understanding of light by exploring and comparing the properties of light as it interacts with a transparent material;
- asking questions and developing a line of enquiry based on observations of the real world, alongside prior knowledge and experience;
- using appropriate techniques, apparatus, and materials during laboratory work, paying attention to health and safety;
- presenting reasoned explanations, including explaining data in relation to predictions and hypotheses; and
- learning about the concept of refraction to create a spectrum of visible light.

Hazard warnings:

There are no real hazards in this practical. However it is possible that the water will be an inviting distraction and a pupil might get wet. It is also worth warning the children not to look directly at the sun.

Equipment:

- Hose pipe connected to a water tap
- White paper (one per pupil)
- Dark paper (Black or a dark primary colour one per pupil)
- Crayons (various colours)
- Felt pens (various colours)
- Clear glass bottle or glass beaker of water
- Good torch with a strong white beam of light

Technical notes:

The rainbow works best on a sunny day early in the morning, when the sun is low on the horizon.

A torch with a good strong beam of white light is best for the bottle experiment.

Results:

Looking through the water arc with the sun coming from behind them the children should see a rainbow.

The students should see a rainbow if they stand with their back to the sun and look through the water arc in front of them that has the sun shining through it.

It is important they see the range of colour in the order: Red, Orange, Yellow, Green, Blue, Indigo and Violet.

Then they should note the correct order and the mnemonic ROYGBIV = '**R**ichard **O**f **Y**ork **G**ave **B**attle **I**n **V**ain' can be introduced to them. See if you can make up your own mnemonic for the spectrum.

Going further:

Pupils shine a torch through a clear glass screw top bottle, or a glass beaker, full of water

The light beam is split into its colours.

Hold the sheet of white paper where the rainbow appears.

The bottle is acting as the prism and is similar to a very large water drop.