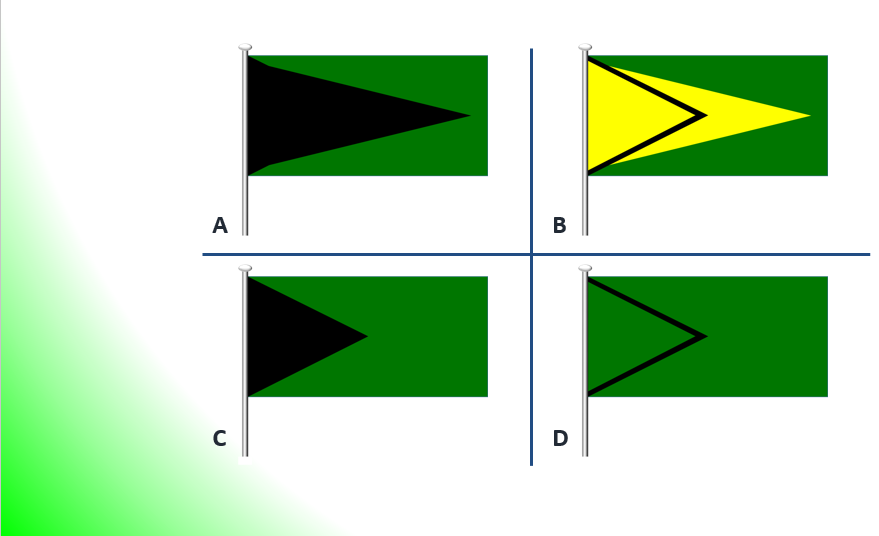
**Flag colours**

This is the flag of Guyana, in South America.

**Predict**

What will the flag of Guyana look like in green light?

****

**Explain**

Why do you think it will look like this?

|  |
| --- |
| **Look at the flag in green light** |

**Observe**

Which flag does it look like?

**Explain**

Were your prediction and explanation correct?

If not, can you explain what you observed?

*Physics > Big idea PSL: Sound, light and waves > Topic PSL2: How we see > Key concept PSL2.2: Seeing in colour*

|  |
| --- |
| **Response activity** |
| **Flag colours** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Light has colours that are seen when reflected by bodies. |
| Observable learning outcome: | Work out the colour of an object that is a secondary colour, in red, green or blue light. |
| Activity type: | Predict, explain, observe, explain - practical/demonstration |
| Key words: | Absorb, reflect |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic question:

* Diagnostic question: Flag of Guyana

|  |  |
| --- | --- |
| **B** | **BRIDGING**  This activity explores ideas that are usually taught at age 14-16, to build a bridge to later stages of learning. |

**What does the research say?**

Martinez-Borreguero et al. (2013) found that students’ explanations of colour formation were most often of the form: ‘bodies have colours that are seen when they reflect light’. They reformulated this explanation to: ‘light has colours that are seen when it is reflected by bodies’ and asked students to consider which statement they found most useful. They found that a shift in focus to the latter made the origin of misunderstandings more explicit and resulted in a significant improvement in students’ longer term conceptual change.

In a sample of 86 secondary students, over 60% thought the colour perceived is the sum of the colour of light plus the colour of the object. In the same study, over 45% of secondary teachers (n=64), who were mostly science specialists, had the same misunderstanding (Martinez-Borreguero et al., 2013). A further 8% of students thought the colour perceived would always be the same as the colour of the object, and 9% that the colour perceived would always be that of the illuminating light. Only one student and eleven teachers in these samples were consistently correct in identifying the perceived colour of a coloured object in different colours of light.

This activity investigates how effectively students can apply their understanding of colour formation to a novel situation that involves the reflection of coloured light from both primary and secondary colours.

**Ways to use this activity**

Students should complete this activity in pairs or small groups, and the focus should be on the discussions. It is through the discussions that students can check their understanding and rehearse their explanations.

To begin, each group should discuss the activity and use their scientific understanding, firstly to predict *what* they think will happen, and then to explain *why* they think they are going to be right. If students in any group cannot agree, you may be able to direct them with some careful questioning.

Students now look at the flag in green light. This can be challenging to do in a typical science laboratory because even small amounts of white light in a dimly lit room can reflect off a coloured object and make it appear a dim version of the colour it looks in white light. A more effective alternative is for students to look through a green filter. Looking through a green filter allows only green light into the eye. What is seen is exactly the same as what would be seen if the room contained only green light.

After the practical each group should be given the opportunity to change, or improve their explanation. A good way to review your students’ thinking might be through a structured class discussion. You could ask several groups for their *explanations* and put these on the whiteboard. Then ask other groups to suggest which explanation is the most accurate and the most clearly expressed, and through careful questioning work up a clear ‘class explanation’.

A useful follow up is for individual students to then write down explanations in their own words – without reference to the class explanation on the board (i.e. cover it up).

*Differentiation*

The quality of the discussions can be improved with a careful selection of groups; or by allocating specific roles to students in the each group. For example, you may choose to select a student with strong prior knowledge as a scribe, and forbid them from contributing any of their own answers. They may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

**Equipment**

For each student/pair/group:

* Green filter

**Expected answers**

Answer C is correct.

Red and black do not reflect green and look black.

Green reflects green and looks green.

Yellow and white reflect green as well as other colours. In green light there is no other colour to reflect so they too look green.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG).

**References**

Martinez-Borreguero, G., et al. (2013). Detection of Misconceptions about Colour and an Experimentally Tested Proposal to Combat them. *International Journal of Science Education,* 35:8**,** 1299-1324.