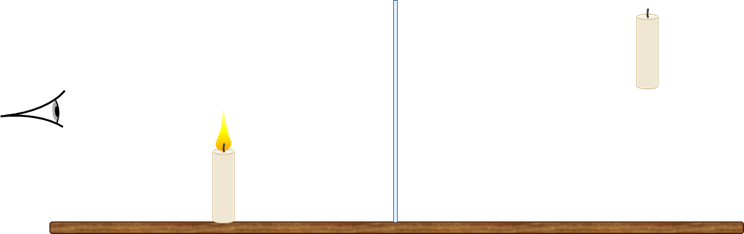
**Reflection hunt**

A candle flame reflects in a safety screen.

You can also see through the safety screen.

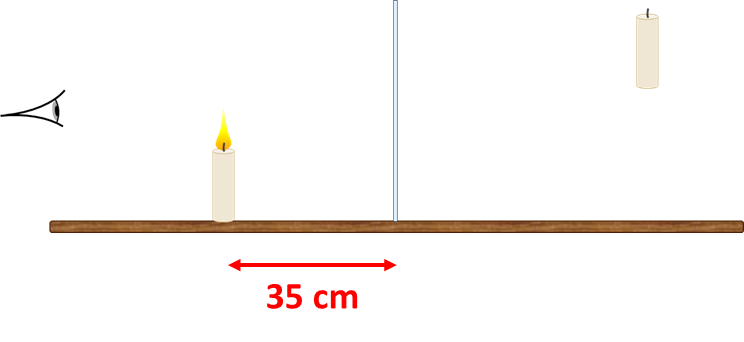
****

You can put an unlit candle *on* the reflection and measure where it is.

**Apparatus and materials**

* Two candles (same size)
* Safety screen
* Metre ruler

**Procedure**

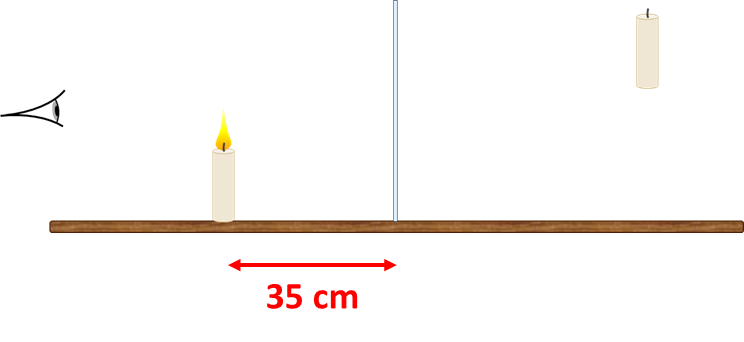
1. Set up the apparatus as shown in the diagram.
2. Light one of the candles.
3. Place the lit candle in front of the screen.
4. Use the ruler to put it 35 cm from the screen.

**Reflection hunt**

A lighted candle is placed 35 cm in front of a safety screen.

A candle flame reflects in a safety screen.

You can also see through the safety screen and put an unlit candle *on* the reflection and measure where it is.



**Predict**

Where do you think the reflection of the lit candle is?

**Explain**

Why do you think it will be here?

|  |
| --- |
| **Put an unlit candle behind the screen.**  **Move it so it is *on* the reflection.** |

**Observe**

Measure the distance from the unlit candle to the screen. It is ……............. cm.

**Explain**

Try to improve your first explanation to explain the position of the reflection more clearly.

What is the rule for describing where the reflection is seen in a flat mirror?

*Physics > Big idea PSL: Sound, light and waves > Topic PSL3: Making images > Key concept PSL3.1: The ray model of light to explain images*

|  |
| --- |
| **Response activity** |
| **Reflection hunt** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | A plane mirror reflects light rays from each point of an object so they appear to come from distinct points behind the mirror and the object is seen as if it were behind the mirror. |
| Observable learning outcome: | Describe where the reflection of an object appears to be in a plane mirror.  Explain why the reflection of an object in a plane mirror appears to be behind the mirror. |
| Activity type: | Predict, explain; observe, explain (PEOE) |
| Key words: | Mirror, reflection |

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

* Diagnostic question: Mirror reflection
* Diagnostic question: Behind the mirror

**What does the research say?**

Unlike pinholes, plane mirrors do not form (real) images that can be projected onto a screen. Notwithstanding, many students think that a mirror forms an image that can be viewed as if the mirror were a photograph (Ceuppens et al., 2018; Galili and Hazan, 2000). About a quarter of 13- to 15-year olds in a study by Fetherstonhaugh and Treagust (1990) thought that light stays on a mirror during reflection. Before teaching, Galili and Hazan (2000) found that about half of students thought that mirrors duplicate (reflect) objects by creating an image. This misunderstanding fell significantly after teaching, but over a quarter of students aged 14-16 persisted in thinking that the image travels to a mirror and *bounces off* it, and any obstacles between the object and the mirror prevent the image from reaching the mirror.

A challenge to understanding how an object is seen in a plane mirror is the fact that the observer is an inherent part of the optical system (Galili and Hazan, 2000; Andreou and Raftopoulos, 2011). It is perhaps helpful to discuss the *reflection* of an object in a plane mirror and the formation of an image by the eye looking at the reflection.

**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 it is perhaps sensible to demonstrate the set up and show students how a lighted candle is reflected in a Perspex safety screen. Each group should then 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 carry out the practical, or watch a demonstration. You will need to decide whether it is better for each group to carry out the practical and risk some unexpected observations, or to demonstrate the activity so that everyone *observes* the same thing.

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:

* Two candles (same size)
* Safety screen
* Metre ruler

For the class:

* A means of lighting candles

**Technician notes**

Perspex safety screens should be used. Two groups of students can use the same safety screen working on opposite sides of the table.

Flat Perspex sheets may be used, clamped vertically in a retort stand. Do not use glass screens.

**Health and safety**

Hot wax can spill from lighted candles. Candles used need a flat base so that the candle is stable. The use of night-light candles is recommended.

Candles may be lit using a lighted splint from a Bunsen burner, or a gas lighter. If matches are used it is advisable to use a limited number of safety matches so it is not possible for students to take matches away.

Perspex safety screens are often supported by heavy clamps on the bottom. These can become loose and fall when screens are carried around.

Practical work should be carried out in accordance with local health and safety requirements, guidance from manufacturers and suppliers, and guidance available from CLEAPSS.

**Expected answers**

The reflection is the same distance behind the *mirror* as the object is in front – and it is the same size as the object.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG).

**References**

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