

BLACKBOX

Brief summary of activity:

In this puzzle the user is presented with a 10 x 10 grid in which a certain number of glass balls have been hidden. The user must predict the location of the glass balls by firing beams of light at the grid and observing how the light is refracted as it either passes through glass balls or air.

Specific Curriculum Area:

Year 8 — Unit 8K, Section 8 — Can Light be Bent?

Assessment method:

Progress through levels could be recorded by the teacher. Pupil could sketch lines of refraction and predicted location of glass balls on paper-based 10x10 grid. The pupil could then indicate which, if any, of these were correct.

Differentiation:

Various levels within the task make the task progressively more complex. An introductory tutorial illustrates how the puzzle works. After completing a level, whether successful or not, pupils are shown where the balls were located. Pupils can then click on arrows around the grid to see how the light is refracted.

Learning objectives:

Children should learn: that light changes direction at a boundary between two different media; to identify patterns in observations; to apply understanding of refraction to everyday situations

Use of Activity in a lesson:

This task could be set as a homework activity, assuming Internet access is possible. Alternatively, the teacher could demonstrate the task to the class (via an Interactive Whiteboard) and the pupils could then repeat the first level as shown by the teacher, thereafter trying levels on their own.

Hints and tips for teachers:

1. Tell pupils not to get frustrated if they do not succeed until having had many attempts—encourage trial and error.
2. Encourage pupils who have succeeded in locating 1 or 2 balls, as they may not have passed the level, but they will have shown they can hypothesise correctly, albeit partially.
3. Ensure pupils know they can 'play' with beams of light once they have been shown the location of the balls at the end of each level.

URL:

The image displays two screenshots of the 'Black Box' game interface, illustrating the process of finding the positions of glass balls.

Top Screenshot:

- Level: 1**
- Time: 70** (Time limit)
- Number of balls: 4** (No. of glass balls to find)
- Number of guesses: 4**
- You have made 4 guesses - if you want to check them then use the buttons below. Carry on playing if you don't.**
- Check Guesses** button
- Reset** button
- User predicts position of glass** (indicated by arrows pointing to the grid)
- 1. Arrow clicked by user** (indicated by an arrow pointing to the grid)
- 2. Arrow now highlighted to show where light beam shone from Arrow 1 is refracted to.** (indicated by an arrow pointing to the grid)

Bottom Screenshot:

- Level: 1**
- Time: 94**
- Number of balls: 4**
- Number of guesses: 4**
- On test...to correct guesses, never mind. If you play on this grid, the game will now show you how the beams worked. To start a new game, click on 'Try Again'.**
- Try Again** button
- Correct position of glass balls is indicated** (indicated by arrows pointing to the grid)
- User can then click on arrows to see how light is refracted now that position of glass balls is shown.** (indicated by an arrow pointing to the grid)

Troubleshooting:

If all arrows clicked result in arrows directly opposite them being highlighted, this suggests that no light beams have passed through any balls.

Other links:

http://www.standards.dfes.gov.uk/schemes2/secondary_science/sci08k/08kq7