**What’s light?**

Light occurs naturally.

Light can also be made artificially.



What are some properties of light?

*For each statement, tick (✓)* ***one*** *column to show what you think.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | I am **sure** this is right | I think this is right | I think this is wrong | I am **sure** this is wrong |
| **A** | Light can travel through a vacuum. |  |  |  |  |
| **B** | Light can make objects radioactive. |  |  |  |  |
| **C** | Light is a type of electromagnetic radiation. |  |  |  |  |

*Physics > Big idea PSL: Sound, light and waves > Topic PSL7: Electromagnetic waves > Key concept PSL7.1: More than light*

|  |
| --- |
| **Diagnostic question** |
| **What’s light** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Electromagnetic radiation is made of vibrating electric and magnetic fields that can travel through a vacuum. Light and other types of EM radiation are organised in order of frequency across the EM spectrum. |
| Observable learning outcome: | Describe the nature of light as a form of electromagnetic radiation. |
| Question type: | Confidence grid |
| Key words: | Electromagnetic radiation, natural, artificial, vacuum, radioactive |

**What does the research say?**

Most students, age 12-18, do not consider light to be radiation (Rego and Peralta, 2006; Neumann and Hopf, 2012) and they often confuse EM radiation with particle radiation, which includes alpha or beta particles (Plotz, 2017).

**Ways to use this question**

Students should complete the confidence grid individually. This could be a pencil and paper exercise, or you could use an electronic ‘voting system’ or mini white boards and the PowerPoint presentation.

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs.

*Differentiation*

You may choose to read the questions to the class, so that everyone can focus on the science. In some situations, it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

Statements A and C are all right, and statement B is wrong.

**How to respond - what next?**

Light can travel through a vacuum because a light wave transfers energy by vibrating electrical and magnetic fields that can exist in empty space. It is therefore a type of electromagnetic radiation, but like most types of EM radiation it does not cause objects to become radioactive.

A Most students should recognise that light can travel through the vacuum of space, for example from the Sun to the Earth.

B Most students should recognise that light does not make objects radioactive. However, some students may overthink this statement and decide that because light is a type of EM radiation, it could be radioactive and cause objects to become radioactive. (The only EM radiation that can make objects radioactive is high energy gamma radiation, although students often have the misunderstanding that radiation causes objects to become radioactive.)

It is a common misunderstanding that EM radiation is the same as particle radiation, including alpha and beta particles, and also that all EM radiation is harmful.

C It is common for students to think that light is different to EM radiation, because they think it is natural and safe, unlike EM radiation.

If students have misunderstandings about describing the nature of light as a form of electromagnetic radiation, it can help to compare the properties of light with other types of EM radiation. Research evidence suggests students are often familiar with ultraviolet (UV) radiation and the will most likely have been introduced to infrared (IR) radiation in their earlier studies. Careful questioning can elicit the understanding that:

* UV, IR and light all occur naturally in the Sun
* All three can be detected on the Earth from the direction of the Sun
* All three can travel through the vacuum of space
* IR and UV do not cause objects to become radioactive, and neither does light, or else everything on the surface of Earth would be radioactive.

**Acknowledgments**

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Image by PIRO4D from Pixabay.

**References**

Neumann, S. and Hopf, M. (2012). Students’ conceptions about ‘radiation’: Results from an explorative interview study of 9th grade students. *Journal of Science Education and Technology,* 21**,** 826-834.

Plotz, T. (2017). Students' conceptions of radiation and what to do about them. *Physics Education,* 52(1)**,** 014004.

Rego, F. and Peralta, L. (2006). Portuguese students' knowledge of radiation physics. *Physics Education,* 41(3)**,** 259.