FLEET ARC CENTRE OF EXCELLENCE IN FUTURE LOW-ENERGY ELECTRONICS TECHNOLOGIES

Activity 1: What is light

Learning Intentions
This activity is to get students to think critically about the nature of light by asking questions and start to challenge their perceptions of what light is.

Materials

- Whiteboard, butcher's paper – anything to write or draw on (Or online shared document)
- Crayons, marker pens, pencils

Teacher Notes	Teaching Notes: Running the activity
Light is a packet of energy, though that is a bit simplistic because everything is a packet of energy when broken down to its simplest or smallest elementary particle. The simplest form of light is a photon, which is an electromagnetic wave that as it moves – oscillates – it produces an electrical and magnetic field. One does not exist without the other and together, it makes up the electromagnetic spectrum. The part of the electromagnetic spectrum that enables us to see and to produce the colours of the rainbow sits in a narrow part of the spectrum we call visible light. If you consider only the electrical part of the electro-magnetic wave, waves on water that we can observe are a reasonable analogy. The electrical waves have a peak and trough (up and down), and they have a forward motion, but it is the energy that propagates forwards rather than anything physical. Remember that light is massless and the key point here about a photon (light) is about its energy, not the space or size of the elementary particle because a photon does not actually occupy space in the same way you think of a classical object such as a bacterium, rock or planet. Other properties of a photon include the following: • It has no charge (unlike electrons and protons). • Their speed in a vacuum is 299,792,458 metres per second (or about 300 million metres per second)	**Method** Students work in small groups and think about and discuss what they think light is. Use the whiteboard, butchers' paper or share document (eg, Google doc) to write down their ideas using descriptions or drawings/images. Can the students explain the rationale for their theories? Get the students to communicate and present their thoughts with other groups. Compare and contrast each group's thoughts in a class discussion. **What about sound?** How does sound compare to light? Select two students. Get one student to hide behind a wall/obstacle out of sight. Can students hear the hidden student when they speak, even though they can't see them? Why can they hear each other, but not see each other? What makes light different to sound? Questions for students to consider can include, can light curve and travel around corners/obstacles? Can sound? **How do we see?** Ask students, how do we see? If they suggest that light lets us see, ask them how does light enable this?

Student concepts of light and sound
Do not correct students here. They can re-examine and reflect on their perceptions following the hands-on activities.

Deeper thinking
If you have some torches handy, get students to shine the torch on walls and mirrors and see if there is anything different happening. Can they see the beam of light between the torch and wall or object it is being shone on? Why or why not? Get them to record their observations. Note, they might be able to see the light beam between the torch and wall if there is a lot of dust in the air. If this is the case, can students explain what they are observing? Note also the difference in light hitting the wall and a mirror can be explained by absorption which is covered in the next section of the teacher resource.

You can replicate the dust in the air if you have a laser light or laser pointer. Turn it on and spray a mist of water around the beam to expose the light beam.

Has this refined their ideas of what light is in any way? What questions do they now have about light?

Do students consider light to just exist? Do they have a concept that light 'travels' and that it travels at a certain speed and in a straight line – for example it takes light about eight minutes to travel from the sun to the Earth? How does light travel? Explore their perceptions and get them to reflect back on these after they have tested some of these ideas through the activities you choose for them.

Humans use of light
Get students to think about how humans use our understanding of light to develop technologies. For example, converting it to electricity, lasers for cutting metal, or passive control of temperature in homes. Because light is an electromagnetic wave, we use other parts of the electromagnetic spectrum such as X-rays, microwaves, radio waves, etc, but more on that later.

Back to the whiteboard and butchers' paper. Get students to illustrate and then explain how they think we use light to see.

Deeper thinking.
Get students to illustrate how light travels. How many students show it travelling in a straight line and reflecting off objects?