**ACTIVITY: The electromagnetic spectrum – picture dictation**

**Activity idea**

In this picture dictation activity, students use a range of skills to investigate some ways humans use the waves on the electromagnetic spectrum.

By the end of this activity, students should be able to:

* discuss some ways in which humans use the various waves on the electromagnetic spectrum
* understand what happens to the wavelength as we move through the electromagnetic spectrum from radio waves to gamma waves.

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**Introduction/background**

Picture dictation is a strategy that integrates oral, written and visual language skills. Students tend to remember and understand more when they engage with a learning experience through more than one mode.

Picture dictation involves the students in:

* listening carefully to the statements
* drawing – transforming that information into visuals
* writing captions to match the visuals
* speaking – orally describing the visuals back into words
* reading these statements.

In this activity, students use picture dictation to explore the electromagnetic spectrum and the different uses humans have for these waves.

This activity allows the teacher to introduce to students some of the key points about the electromagnetic spectrum that students will encounter in the [See-through Body](https://www.sciencelearn.org.nz/resources/1744-see-through-body-introduction) resources.

**What you need**

* Copies of the student handout [Drawing the electromagnetic spectrum](#handout)
* Copies of the [Electromagnetic spectrum statements](#statements)
* Access to the interactive [The electromagnetic spectrum](https://www.sciencelearn.org.nz/image_maps/63-the-electromagnetic-spectrum)
* Access to the articles [Fundamentals of waves](https://www.sciencelearn.org.nz/resources/119-fundamentals-of-waves) and [Radiation](https://www.sciencelearn.org.nz/resources/998-radiation)

**What to do**

1. You may like to introduce your students to this electromagnetic spectrum activity by using the interactive [The electromagnetic spectrum](https://www.sciencelearn.org.nz/image_maps/63-the-electromagnetic-spectrum) and the articles [Fundamentals of waves](https://www.sciencelearn.org.nz/resources/119-fundamentals-of-waves) and [Radiation](https://www.sciencelearn.org.nz/resources/998-radiation).
2. Give each student a copy of the student handout [Drawing the electromagnetic spectrum](#handout). Instruct students that they are to draw in each grid a simple visual representation of each statement that will be read out about the electromagnetic spectrum.
3. Read each of the seven [electromagnetic spectrum statements](#statements) to the class. Encourage the students to listen carefully and to draw a simple picture that represents each statement in the appropriate grid square. Allow enough time for the students to draw a visual representation. Stress that the students’ visual images do not need to be works of art and reassure them that the occasional word or number is OK.
4. After all seven statements have been read out, have students write a caption underneath each visual.
5. Students then pair off and discuss what they understand about the electromagnetic spectrum using their visuals and captions as prompts.
6. Students can be given a copy of the electromagnetic spectrum statements to read through as they check their understanding of the electromagnetic spectrum.

**Discussion questions**

* What is happening to the wavelength as we move through the electromagnetic spectrum, from radio waves to gamma waves?
* Electromagnetic waves carry energy. The shorter the wave, the more energy it carries. Which has more energy – X-rays or microwaves?

**Student handout: Drawing the electromagnetic spectrum**

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**Electromagnetic spectrum statements**

1. Radio waves have the longest wavelengths – they range from 1 millimetre to 30 000 metres. Radio waves are used for radios, cellphones, televisions, Police radars and in industry to melt materials such as plastics.
2. Microwaves have wavelengths ranging from 1 millimetre to 1 metre. They are used for heat treatment therapy, alarm systems and heating food.
3. Infrared radiation wavelengths range from 750 nanometres to 1 millimetre. (A nanometre is 1 billionth of a metre.) Infrared radiation is usually described as heat. The most important source of infrared radiation is the Sun, although most heating appliances in your home will emit infrared radiation too. Remote controls have an infrared source, and your TV has a detector.
4. Visible light has wavelengths ranging from 400 to 770 nanometres. The most common form of visible light also comes from the Sun. Other sources are light bulbs and lasers. Lasers have lots of uses, for example, in CD players, pointers and laser eye surgery.
5. Ultraviolet light has wavelengths ranging from 300 to 400 nanometres. The main source of UV radiation is the Sun, but it is also generated in industry. It’s used in sunbeds, dentistry, detecting forged banknotes and treatment of skin conditions.
6. X-rays have wavelengths between 0.01 and 10 nanometres. They are used in medicine and airport security. Doctors use them to look at bones, and dentists use them to look at teeth.
7. Gamma rays have the shortest wavelength at less than 0.01 nanometres. They are used in medicine as a diagnostic tool and to sterilise equipment. They can be used in industry for food irradiation, searching for oil, measurement of water and soil densities, and level detectors, for example, making sure cans of food are filled to the correct level.