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Science Shorts -8

Waves of the Electromagnetic Spectrum

All electromagnetic waves travel at the same speed, but they have different wavelengths and different frequencies. The electromagnetic spectrum is the name for the range of electromagnetic waves when they are placed in order of increasing frequency. The electromagnetic waves in the electromagnetic spectrum possess energy. Complex interactions occur between the energy in electromagnetic waves and matter.

Radio waves are electromagnetic waves with the longest wavelengths and lowest frequencies. A radio receiver converts radio waves into sound waves that you can hear. The radio waves with shortest wavelengths and highest frequencies are known as microwaves. Inside a microwave oven, water molecules in food absorb microwaves, causing the food to get hot. Short-wavelength microwaves are used in radar. Radar, which stands for radio detection and ranging, can be used to locate objects. Police use radio waves and the Doppler effect to find the speeds of vehicles. Radio waves are also used in medicine to produce pictures of tissues in the human body. This process is called magnetic resonance imaging, or MRI.

Infrared rays have shorter wavelengths and higher frequencies than radio waves. Because you can feel the longest infrared rays as warmth, these rays are often called heat rays. An infrared camera takes pictures using heat instead of light. These pictures are called thermograms. A thermogram shows regions of different temperatures in different colors.

Visible light has shorter wavelengths and higher frequencies than infrared waves. The longest waves of visible light are red. The colors in the visible spectrum are red, orange, yellow, green, blue and violet, in that order.

Electromagnetic waves with wavelengths just shorter than those of visible light are called **ultraviolet rays**, or UV. UV lamps are often used to kill bacteria. Small doses of UV are beneficial to humans. Many insects can see ultraviolet light.

X-rays are electromagnetic waves with very short wavelengths. X-rays can penetrate most matter. X-rays are used to take pictures of the human body. They are also used to take pictures of objects used in industry and engineering.

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Gamma rays have the shortest wavelengths and highest frequencies of the electromagnetic spectrum. They are the most penetrating of all electromagnetic waves. Some radioactive substances produce gamma rays. They are used in medicine in radiation therapy to kill cancer cells.

1. Fill in the table below.

The Electromagnetic Spectrum

Type of Electromagnetic Radiation	Example of Use
	Communications
Infrared Rays	
Visible Light	
Ultraviolet Rays	
	Check for broken bones inside the body
	Diagnose and treat cancer

2. List the colors of the visible spectrum in order of increasing frequency.

3. What kind of electromagnetic radiation can honeybees see, but humans cannot see?

4. What is the electromagnetic spectrum?

5. What is MRI and what is it used for?

6. What is a thermogram?

7. What kind of radiation are microwaves?

8. How can a person detect infrared rays without an instrument?
