Seeing Invisible Light

Compare electromagnetic waves and the images they help scientists collect.

SC.8.E.5.11 "Identify and compare characteristics of the electromagnetic spectrum such as wavelength, frequency, use, and hazards and recognize its application to an understanding of planetary images and satellite photographs."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each phrase that tells a use for an electromagnetic spectrum region, circle each phrase that tells a hazard, and number the spectrum regions in the first paragraph from 1 for the longest wavelength to 7 for the shortest.

More Than a Camera View

1 Electromagnetic radiation carries energy through space as waves. The spectrum includes radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays. A wavelength is the distance from one wave crest to the next. Frequency is the number of wave crests that pass a point each second. Across the spectrum, longer wavelengths have lower frequencies, while shorter wavelengths have higher frequencies. Human eyes detect only visible light, a small part of the spectrum. Cameras and sensors can record bands our eyes cannot see.

2 Satellite instruments collect more than ordinary camera views. A visible-light image can show cloud shapes, ice, and land during daylight. An instrument that detects near infrared can help distinguish healthy vegetation because leaves reflect much of that radiation. Thermal infrared records energy emitted by warm surfaces, so it can show temperatures of clouds, oceans, or land. Radar sends out microwaves and measures returning energy. Because microwaves can pass through many clouds, radar helps scientists view a stormy surface. Computers may assign visible colors to invisible bands, creating false-color images that reveal patterns.

3 Planetary spacecraft use similar methods. A camera on an orbiter can combine several bands to map minerals or trace dust on Mars. Scientists compare images taken in different wavelengths because each band responds differently to a surface or atmosphere. Electromagnetic radiation has hazards. Ultraviolet can damage skin and eyes. X-rays and gamma rays have shorter wavelengths and higher frequencies, and exposure can damage living cells. Radio waves are useful for spacecraft communication, while X-rays help study energetic events in space. Knowing a band's wavelength, frequency, use, and hazard helps scientists choose sensors.

2 ANSWER WITH EVIDENCE

Use the passage

1. What happens to frequency when wavelength becomes longer?

2. A scientist needs an image of a stormy surface hidden by clouds. Which type of radiation should the scientist use, and why?

3. Why might scientists create a false-color satellite image?

4. Compare ultraviolet with X-rays and gamma rays in wavelength, frequency, and hazard.

3 YOUR TURN

Your own words

Write exactly three sentences that plan satellite images for studying a wildfire. Identify two spectrum regions and what each image would show, compare the two regions' wavelengths and frequencies, and state one radiation hazard.

ANSWER KEY

Seeing Invisible Light

GRADE 8 · SC.8.E.5.11

PART 1 · READ AND MARK

Underline each phrase that tells a use for an electromagnetic spectrum region, circle each phrase that tells a hazard, and number the spectrum regions in the first paragraph from 1 for the longest wavelength to 7 for the shortest. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What happens to frequency when wavelength becomes longer?	**Frequency becomes lower when wavelength becomes longer.**
2	A scientist needs an image of a stormy surface hidden by clouds. Which type of radiation should the scientist use, and why?	**The scientist should use microwave radar because microwaves can pass through many clouds and radar measures returning energy.**
3	Why might scientists create a false-color satellite image?	**They may assign visible colors to invisible bands so patterns can be seen more clearly.**
4	Compare ultraviolet with X-rays and gamma rays in wavelength, frequency, and hazard.	**X-rays and gamma rays have shorter wavelengths and higher frequencies than ultraviolet. Ultraviolet can damage skin and eyes, while exposure to X-rays and gamma rays can damage living cells.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

We will use thermal infrared to locate hot parts of the wildfire because warm surfaces emit this radiation. We will also use visible light to show the smoke plume and burned land, and visible light has shorter wavelengths and higher frequencies than infrared. The team will avoid unnecessary ultraviolet exposure because it can damage skin and eyes.

Accept equivalent descriptions of the inverse wavelength and frequency relationship. For the open response, accept other accurate image plans if they name two regions, make a correct comparison, explain useful image information, and state an accurate hazard.