

- (c) Each new generation of scientists builds on the work of previous generations of scientists. For example, Chadwick built on Rutherford's model and proposed the presence of neutrons in the nucleus, in addition to protons.

1.4 THE ELECTROMAGNETIC SPECTRUM

SECTION 1.4 QUESTIONS

(Page 18)

Understanding Concepts

1. Radio waves have a longer wavelength than X rays, therefore, they have a lower frequency and less energy. When radio waves strike an object, they do not damage it. X rays have a much shorter wavelength than radio waves, and therefore a higher frequency and much more energy. When X rays strike soft objects like human tissue, they can cause damage.
2. The human eye can detect wavelengths in the visible range (400–700 nm).
3. When white light is directed through a prism, it separates into different colours. If white light did not consist of different colours, it would remain white when passed through a prism.
4. A continuous spectrum is an uninterrupted pattern of colours observed when a beam of white light is passed through a prism. An example of a continuous spectrum is a rainbow. A line spectrum is discontinuous. The lines, produced when light emitted by an element is directed through a prism, are separated by space with no colour. Hydrogen gas has a line spectrum.

Making Connections

5. (a) It is not safe for the technician to be in the same room during an X ray because the technician would be exposed to X rays each time an X-ray scan is taken: as many as several hundred scans per year. This amount of exposure exceeds the recommended levels of X-ray exposure for an individual. Patients are only exposed during their X-ray scan, therefore the risks are minimal.
(b) Only the desired area to be X-rayed is exposed; the rest of the patient's body is covered with a lead apron, which X rays cannot penetrate. Technicians wear badges that measure radiation levels in the radiation area, and keep detailed records of their cumulative lifetime dose.

1.5 ACTIVITY: IDENTIFYING GASES USING LINE SPECTRA

(Pages 19–20)

Observations

- (a) The spectrum of sunlight is continuous.
- (b) The spectrum of fluorescent light contains dark bands alternating with bands of coloured light.
- (c) The spectrum of incandescent light consists of more red lines but fewer green-blue lines than the spectrum of fluorescent light.
- (d) The line spectrum of hydrogen consists of four lines: red, green, blue, and indigo.
- (e) Student drawings will vary depending on the elements they observe.

Analysis

- (f) Student responses will depend on the spectra used.

Synthesis

- (g) The spectrum of sunlight is a continuous spectrum. The spectra of some incandescent lights contain dark bands and more red lines than the spectrum of fluorescent light. The spectrum of fluorescent light also contains dark bands but is less green-blue than some incandescent spectra. Since sunlight, fluorescent light, and incandescent light all produce different spectra, the light energy they radiate is composed of different wavelengths.
- (h) Student answers will vary depending on the gases that they observe. Neon and barium have a large number of spectral lines.