

CHAPTER REVIEW ANSWERS

Note: Part (d) of question 15 should be deleted.

Checking Concepts

- (a) Crest
(b) Amplitude
(c) Wavelength
(d) Trough
- As wavelength increases, frequency decreases, and vice versa. Another way to say this is that they are inversely related.
- Light waves and sound waves both carry energy. Their waves both can be characterized by frequency, wavelength, and amplitude.

- Students' answers may vary. One way to measure the wavelength of a small water wave is to hold a ruler over the top and sight two wave crests at the same instant along a ruler. Using a flashing light, or strobe light, that has variable speed, it is possible to change the rate of flashing so that it makes the wave appear to stand still.
- (a) All colours of light have waves with the same general shape as that of a transverse wave. (Also correct: The light waves move at the same speed in a vacuum, regardless of the colour.)
(b) Different colours of light differ in that their waves have different wavelengths and frequencies.
- Hertz (Hz) is the unit used to measure frequency. 1 Hz means one vibration per second.
- Wavelength measures the distance from crest to crest (or any place on a wave to the same place on the next wave), while amplitude measures the distance from the crest to the equilibrium position, which in a water wave is the position of the surface of the water when there is no wave (or from the trough to the equilibrium position).
- (a) 0.5 m
(b) 1.0 m
- (a) 0.4 m
(b) 2.1 m
- (a) 0.6 m
(b) 2.0 m
- A shirt can appear blue in white light because the pigment in the blue shirt absorbs non-blue colours such as red and green, while at the same time reflecting blue.
- Radio waves and infrared waves have waves that are longer than visible light, while ultra-violet waves, X rays, and gamma rays have waves that are shorter than visible light.

- Radio waves are used in MRI technology to form an image of soft tissues such as those in the brain. The person is placed in a very strong magnetic field. The atoms that make up the tissue behave like little magnets. When stimulated with a small amount of radio waves, the magnets can flip. This causes a radio signal to be released, which is detected by the MRI machine. These signals represent information about the tissues that can be converted into pictures.

Understanding Key Ideas

- Light waves and waves in a fish pond are both disturbances that carry energy. They can both be characterized by wavelength, frequency, and amplitude.
- (a) $14 \text{ crests}/7 \text{ s} = 2 \text{ Hz}$
(b) $30 \text{ crests}/5 \text{ s} = 6 \text{ Hz}$
(c) $0.5 \text{ crests}/10 \text{ s} = 20 \text{ Hz}$
- Wavelength and frequency cannot both increase together because as the wavelength gets longer, the troughs and crests get farther and farther apart. This means that the frequency must decrease rather than increase.
- Students' tables may vary. Sample answer:

| RADIATION TYPE | DIFFERENCES | SIMILARITIES |
|----------------|---|--|
| Infrared waves | Lowest frequency, lowest energy, invisible | - All are forms of radiation that move in the form of waves. - All move at the same speed. - All carry energy. |
| Visible rays | Visible to humans, intermediate frequency and energy | |
| X rays | Highest frequency, can pass through humans, highest energy, invisible | |

- (a) The red light has the longest wavelength.
(b) The violet (or blue, if that is what she sees) has the highest frequency.
(c) Mei Lin would remove green, most likely, and if she did that, recombining the red and blue would yield orange.
- Students' answers may vary but may include the following points: X rays cause cancer if received in too great a dosage. A huge over-exposure could even cause burns or other direct damage to tissue.

Pause and Reflect Answer

Students' answers may vary. Sample answer: If you know the location of the cancer cells you could use gamma rays. There would need to be a very accurate way to target the cancer cells, and the patient would have to be moved continuously so that only the cancer cells received a continuous dose of the deadly rays.