

## Learning Intention

- Learn some of the vocabulary associated with waves.
- Learn some of the properties of waves and how to classify some types of waves.

## Definitions and Formulas

1. A wave is a disturbance in a \_\_\_\_\_, transferring \_\_\_\_\_ without transferring \_\_\_\_\_.

a. Waves are modelled mathematically using \_\_\_\_\_ waveforms.

2. Label each part of the diagram of a wave:

a.

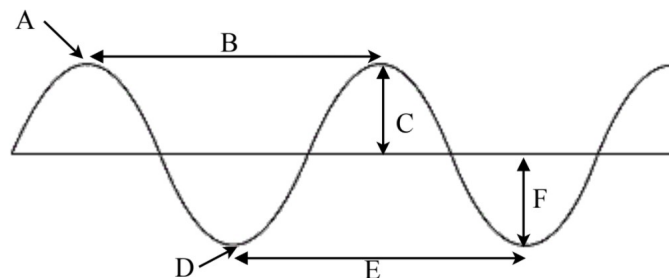
b.

c.

d.

e.

f.



3. \_\_\_\_\_: How many waves pass by a point in a given amount of time. It is measured in \_\_\_\_\_, also known as \_\_\_\_\_ (\_\_\_\_\_).

4. \_\_\_\_\_: The amount of time it takes for a complete wave to pass by a point.

5. Frequency and period are related with the equation:

6. In a \_\_\_\_\_ wave, the waves oscillate parallel to the direction of travel.

7. In a \_\_\_\_\_ wave, the waves oscillate perpendicular to the direction of travel.

8. \_\_\_\_\_ wave: A wave which travels through a physical medium.

a. Examples: \_\_\_\_\_ and \_\_\_\_\_

b. These waves ( can / cannot ) be transmitted through the vacuum of space

9. \_\_\_\_\_ ( \_\_\_\_\_ ) wave: A wave which propagates through the \_\_\_\_\_ field.

a. Examples: \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_

b. These waves ( can / cannot ) be transmitted through the vacuum of space

10. \_\_\_\_\_ occurs whenever a wave passes through a medium.

a. In a given medium, the speed of a given type of wave is \_\_\_\_\_.

11. \_\_\_\_\_ occurs when a wave reaches the boundary between two mediums, and bounces back to the original medium.

a. In sound waves, this is known as an \_\_\_\_\_.

12. When passing from one medium to another, the frequency ( does / doesn't ) change, and the wavelength ( does / doesn't ) change.

13. Waves obey the \_\_\_\_\_ Equation:

14. Waves also obey the principle of \_\_\_\_\_.

a. \_\_\_\_\_ occurs when peaks of one wave are added to peaks of another wave, or troughs of one wave are added to troughs of another.

b. \_\_\_\_\_ occurs when peaks of one wave are added to troughs of another wave.

c. \_\_\_\_\_ yields absolutely no resulting wave. This effect is partially achieved in noise-cancelling headphones.

15. \_\_\_\_\_ occur when two similar but different frequencies interfere, resulting in an oscillation of the \_\_\_\_\_ at a particular frequency.

a. The frequency is calculated as:

16. \_\_\_\_\_ is the bending of a wave when it passes from one medium to another.

a. It is modeled mathematically using \_\_\_\_\_'s Law:

b. The \_\_\_\_\_ represents how fast light passes through a medium:

17. \_\_\_\_\_ is the bending of a wave as it passes beside an object, or through a slit. It is modeled as:

18. The \_\_\_\_\_ Effect is the apparent change in the frequency of waves when there is relative motion between the emitter and the receiver. When a mosquito flies towards your ear, this effect is responsible for the \_\_\_\_\_ in the pitch of its wings flapping.
19. Linear \_\_\_\_\_ occurs when a circular transverse wave is confined to only vibrate in one plane. This effect is used for \_\_\_\_\_ movies.

## Questions

1. An Intel Core i7-9700K processor can execute instructions at a frequency of up to 4.9 GHz. How quickly can it execute each instruction?
2. In 1992, the rapper Twista set a Guinness World Record for the fastest rapper, taking only 0.0893 seconds to pronounce each syllable. What was the frequency of him rapping a syllable?
3. Red light has a wavelength of 700 nm and a speed of  $3.00 \times 10^8$  m/s in a vacuum. Red light can be slowed to a speed of 61 km/h.
  1. What is the frequency of red light in a vacuum?
  2. What is the frequency of red light at 61 km/h?
  3. What is the wavelength of red light at 61 km/h?
4. The velocity of a wave is 14 m/s in one medium, and 9.0 m/s in the second. If an incident ray has an angle of  $75^\circ$ , what is the angle of refraction?
5. Which will diffract more, sound or light? Why?
6. A blue light with a frequency of 750 terahertz passes by a 0.010 mm opening while moving through a vacuum.
  1. What is the wavelength of the light?
  2. What is the first minimum intensity diffraction angle in degrees?
  3. What is the second minimum intensity diffraction angle in degrees?

## Answers

1.  $T = 2.0 \times 10^{-10} \text{ s} = 0.20 \text{ ns}$
2.  $f = 11.2 \text{ Hz}$
3.
  1.  $f = 4.28 \times 10^{14} \text{ Hz}$
  2.  $f = 4.28 \times 10^{14} \text{ Hz}$
  3.  $\lambda = 4.0 \times 10^{-14} \text{ m}$
4.  $\theta = 38^\circ$
5. Sound, because it has a longer wavelength.
6.
  1.  $\lambda = 4.0 \times 10^{-7} \text{ m}$
  2.  $\theta = 2.3^\circ$
  3.  $\theta = 4.6^\circ$