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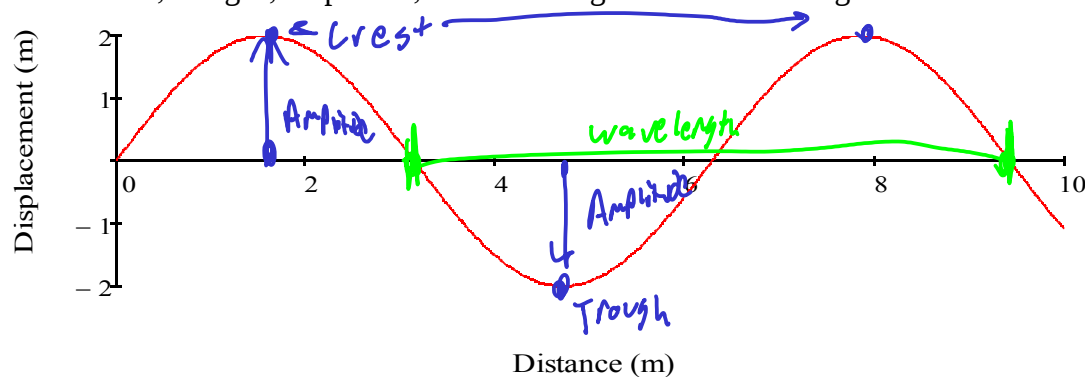
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### Assignment #3: Wave Fundamentals

1. Define:

- a) Wave - *A moving disturbance*
- b) Period - *The time it takes a wave to repeat itself,*
- c) Frequency - *The # of times a wave repeats itself in one second.*
- d) Wavelength - *The length from one point to an identical point on the wave.*
- e) Longitudinal Wave - *A wave where displacement is parallel to motion of the wave*
- f) Transverse Wave - *A wave where displacement is perpendicular to motion*
- g) Crest - *The maximum of a wave*
- h) Trough - *The minimum of a wave.*

2. Label crests, troughs, amplitude, and wavelength on the following wave:



3. An ocean wave has a period of 2 seconds. What is its frequency?

$$f = \frac{1}{T} = \frac{1}{2s} = \boxed{0.5 \text{ Hz}}$$

4. A wave in a slinky has a period of 0.5 seconds. What is its frequency?

$$f = \frac{1}{T} = \frac{1}{0.5s} = \boxed{2 \text{ Hz}}$$

5. A sound wave has a frequency of 1000 Hz. What is its period?

$$T = \frac{1}{f} = \frac{1}{1000 \text{ Hz}} = \boxed{0.001s}$$



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6. A wave has a wavelength of 5 meters. It has a frequency of 3 Hz. What is its velocity?

$$V = f\lambda = 3 \text{ Hz} \cdot 5 \text{ m} = \boxed{15 \text{ m/s}}$$

7. What is the velocity of a wave that has a frequency of 1000 Hz and a wavelength of 2.2 meters?

$$V = f\lambda = 1000 \text{ Hz} \cdot 2.2 \text{ m} = \boxed{2200 \text{ m/s}}$$

8. A wave travels through a rope. Its velocity is 5 m/s and its wavelength is 10 meters. What is its frequency?

$$V = f\lambda \rightarrow f = \frac{V}{\lambda} = \frac{5 \text{ m/s}}{10 \text{ m}} = \boxed{0.5 \text{ Hz}}$$

9. 11. An electromagnetic wave travels at a speed of  $3 \times 10^8$  m/s. Its wavelength is  $6 \times 10^{-7}$  m.  
a) What is the frequency of the wave?

$$V = f\lambda \rightarrow f = \frac{V}{\lambda} = \frac{3 \cdot 10^8 \text{ m/s}}{6 \cdot 10^{-7} \text{ m}} = \boxed{1.667 \times 10^{14} \text{ Hz}}$$

- b) What is the period of the wave?

$$T = \frac{1}{f} = \frac{1}{1.667 \cdot 10^{14} \text{ Hz}} = \boxed{6 \cdot 10^{-15} \text{ s}}$$

10. An ocean wave has a wavelength of 10 meters. It has a frequency of 0.5 Hz.

- a) What is the period of the wave?

$$T = \frac{1}{f} = \frac{1}{0.5 \text{ Hz}} = \boxed{2 \text{ s}}$$

- b) What is its velocity?

$$V = f\lambda = 0.5 \text{ Hz} \cdot 10 \text{ m} = \boxed{5 \text{ m/s}}$$

11. An earthquake generates waves with a frequency of 30 Hz. The waves have a wavelength of 100m. What is the velocity of the waves?

$$V = f\lambda = 30 \text{ Hz} \cdot 100 \text{ m} = \boxed{3000 \text{ m/s}}$$

12. Radio waves travel at a velocity of  $3 \times 10^8$  m/s. What is the wavelength of a radio wave with a frequency of  $1.5 \times 10^8$  Hz?

$$V = f\lambda \rightarrow \lambda = \frac{V}{f} = \frac{3 \cdot 10^8 \text{ m/s}}{1.5 \times 10^8 \text{ Hz}} = \boxed{2 \text{ m}}$$

13. What is the frequency of a wave that takes 0.25 seconds to repeat itself?

$$f = \frac{1}{T} = \frac{1}{0.25 \text{ s}} = \boxed{4 \text{ Hz}}$$



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14. Raymond does a cannonball into a swimming pool. The waves he generates have a frequency of 0.5 Hz and a wavelength of 3 m. What is the velocity of these waves?

$$V = f \lambda = 0.5 \text{ Hz} \cdot 3 \text{ m} = \boxed{1.5 \text{ m/s}}$$

15. A sound wave travels at a velocity of 343 m/s. What is the wavelength of a sound that has a frequency of 440 Hz?

$$V = f \lambda \rightarrow \lambda = \frac{V}{f} = \frac{343 \text{ m/s}}{440 \text{ Hz}} = \boxed{0.780 \text{ m}}$$

16. Gravity waves are thought to be produced by massive stars interacting with each other. If gravity waves travel at a speed of  $3.0 \times 10^8$  m/s, what is the wavelength of a gravity wave with a frequency of  $2.0 \times 10^{-6}$  Hz?

$$V = f \lambda \rightarrow \lambda = \frac{V}{f} = \frac{3 \cdot 10^8 \text{ m/s}}{2 \cdot 10^{-6} \text{ Hz}} = \boxed{1.5 \cdot 10^{14} \text{ Hz}}$$

17. A wave in a slinky repeats itself every 2 seconds.

a) What is the frequency of the wave?

$$f = \frac{1}{T} = \frac{1}{2 \text{ s}} = \boxed{0.5 \text{ Hz}}$$

b) If the wave travels with a velocity of 5 m/s, what is the wavelength of the wave?

$$V = f \lambda \rightarrow \lambda = \frac{V}{f} = \frac{5 \text{ m/s}}{0.5 \text{ Hz}} = \boxed{10 \text{ m/s}}$$

18. Some people in the stadium decide to do the wave. It takes the wave 10 seconds to travel around the stadium, a distance of 250 m.

a) What is the velocity of the wave?

$$V = f \lambda = 0.1 \text{ Hz} \cdot 250 \text{ m} = \boxed{25 \text{ m/s}}$$

b) What is the frequency of the wave?

$$f = \frac{1}{T} = \frac{1}{10 \text{ s}} = 0.1 \text{ Hz}$$

do part  
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