

Name: _____ Date: _____

SPH3U

Universal Wave Equation Problems

Potentially useful equations:

$f = \frac{1}{T}$	$T = \frac{1}{f}$	$v = f\lambda$
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1. Convert the following frequencies into periods
 - a) 340 Hz
 - b) 20 cycles/s
 - c) 0.33 s^{-1}

2. A tuning fork's tines vibrate 250 times in 2.0 s. Find
 - a) the frequency of vibration
 - b) the period of vibration

3. The frequency of a tuning fork is 1000 Hz. If the wavelength is 35 cm, find the speed of the sound wave in
 - a) m/s
 - b) km/h

4. If $\frac{\lambda}{4}$ is 0.85 m and the frequency is 125 Hz, find
 - a) the wavelength
 - b) the period of the wave
 - c) the velocity of the wave

5. Find the period and velocity for the following frequencies if the wavelength was found to be 0.50 m:
 - a) 0.30 Hz
 - b) 400 s^{-1}
 - c) 102.1 MHz

6. Find the frequency and velocity given that wavelength is 75 cm for the following periods:
 - a) 0.020 s
 - b) 15 ms
 - c) 0.6 h

7. A source with a frequency of 20 Hz produces water waves that have a wavelength of 3.0 cm. What is the speed of the waves?

8. A wave in a rope travels at a speed of 2.5 m/s. If the wavelength is 1.3 m, what is the period of the wave?

9. An FM station broadcasts radio signals with a frequency of 92.6 MHz. If these radio waves travel at a speed of $3 \times 10^8 \text{ m/s}$, what is their wavelength?

10. You are shouting in a monotone voice with a frequency of 440 Hz. Your friend is 300 m away. If the speed of sound waves is 344 m/s, how many wavelengths occur between you and your friend?

11. This full scale diagram shows a series of wave crests. Successive crests pass a given point in 0.5 s.



- a) What is the amplitude of this wave? (measure this)
 b) What is the wavelength in centimetres? (measure this)
 c) What is the frequency?
 d) What is the velocity of the waves?
12. A given crest of a water wave requires 5.2 s to travel between two points on a fishing pier located 19 m apart. It is noted in a series of waves that 20 crests pass the first point in 17s. What is the wavelength of the wave? (A diagram would help)
13. Two men are fishing from small boats located 30 m apart. Waves pass through the water, and each man's boat bobs up and down 15 times in 1.0 min. At a time when one boat is on a crest the other one is in a trough, and there is one crest between the two boats. Draw a well labelled diagram. What is the speed of the waves?

Numerical Answers:

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|------------------------------|-------------------------------------|---|
| 1. a) $2.9 \times 10^{-3} s$ | b) $0.05s$ | c) $3s$ |
| 2. a) $125 Hz$ | b) $8.0 \times 10^{-3} s$ | |
| 3. a) $350 m/s$ | b) $1260 km/h$ | |
| 4. a) $3.4 m$ | b) $8 \times 10^{-3} s$ | c) $425 m/s$ |
| 5. a) $3.3s ; 0.15 m/s$ | b) $2.5 \times 10^{-3} s ; 200 m/s$ | c) $9.8 \times 10^{-9} s ; 5.1 \times 10^7 m/s$ |
| 6. a) $50 Hz ; 37.5 m/s$ | b) $67 Hz ; 50 m/s$ | c) $4.6 \times 10^{-4} Hz ; 3.5 \times 10^{-4} m/s$ |
| 7. $0.6 m/s$ | | |
| 8. $0.52 s$ | | |
| 9. $3.24 m$ | | |
| 10. 385 | | |
| 11. a) $0.7 cm$ | b) $4.3 cm$ | c) $2 Hz$ d) $8.6 \times 10^{-2} m/s$ |
| 12. $3.1 m$ | | |
| 13. $5 m/s$ | | |