

Wave speed worksheet

$$v = f \times \lambda$$

1. The speed of sound in air that is at normal room temperature (20°C) is about 343 m/s. Thunder is a sound wave created when the lightning superheats the air around it, and causes it to rapidly expand and vibrate at a frequency of approximately 25 Hz. What is the wavelength of the sound from this thunderclap?

$$v = \lambda \cdot f \quad 343 = \lambda (25) \quad \lambda = \frac{343}{25} = 13.7 \text{ m}$$

2. A water wave on the ocean has adjacent crests that are 21.7 meters apart. If 10 waves lap up onto the shore of a particular beach every 2 minutes, what is the speed of a wave while traveling on the ocean?

$$f = \frac{\text{cycles}}{\text{Time}}$$

$$f = \frac{10}{120} = 0.0833 \text{ Hz}$$

$$\lambda = 21.7 \text{ m}$$

$$v = \lambda \cdot f = 21.7 (0.0833)$$

$$v = 1.8 \text{ m/sec}$$

3. A blue light wave has a wavelength of 490 nm (1 nm = 1×10^{-9} m). If it also has a frequency of 6.12×10^{14} Hz, what is the speed of light?

$$v = \lambda \cdot f = (490 \times 10^{-9}) (6.12 \times 10^{14}) = 2.999 \times 10^8 \text{ m/s}$$

4. One sound wave with a frequency of 250 Hz and with a wavelength of 88 cm is traveling in some very cold air. If a tuning fork with a frequency of 440 Hz is set into vibration in the same cold air, what will be the wavelength for the generated sound wave?

Fork 1 $v = \lambda \cdot f = 0.88 (250) = 220 \text{ m/s}$

Fork 2 $v = \lambda \cdot f \Rightarrow 220 = \lambda (440)$

$$\lambda = 0.5 \text{ m or } 50 \text{ cm}$$

5. A xylophone has a middle-C bar that is 28 cm long, and vibrates with a frequency of 261.6 Hz. The length of a wooden xylophone bar set into vibration is exactly equal to one wavelength. The G bar on the same xylophone will vibrate at a frequency of 392 Hz. If the bars are made of the same material, how long should the G bar be?

Key 1 $v = \lambda f = (0.28)(261.6) = 73.3 \text{ m/s}$

G Bar $v = \lambda \cdot f$

$$73.3 = \lambda \cdot 392$$

$$\lambda = \frac{73.3}{392} = 0.187 \text{ m}$$

$$18.7 \text{ cm}$$