

Waves & Sound Review

Name: _____ Date: _____

Concept Inventory Checklist:

Write a brief summary (including diagrams or equations) for each of the concepts below.

1. What are waves? What are the three types of waves?
2. What are the two types of mechanical waves and how are they characterized?
3. What is the speed of a wave dependent on?
4. What are period, frequency, wavelength, and amplitude? Units?
5. Wave equation
6. Interference – Constructive and Destructive
7. What happens when waves travel from one medium into another?
8. Sound as a longitudinal wave – needs a medium
9. Speed of Sound in air
10. Doppler effect – Doppler shift
11. Resonance – explain this effect and how it comes about.
12. Standing waves – how and why are they produced.
13. Resonance Lengths – fixed at both ends, closed at one end, open at both ends

Questions & Problems

1. A child on a swing completes 18 cycles in 70 seconds. Calculate the period and the frequency of the swing.
2. A duck floating on water waves that have a frequency of 0.25 Hz. How long does it take the duck to complete 5 cycles?
3. A wave takes 0.0124 s to vibrate 10 times and has a wavelength of 20 cm. What is the speed of the wave in m/s?
4. A 12 Hz longitudinal shock-wave with a wavelength of 700 m passes through a thick layer of the earth's crust (solid rock). How long will it take the wave to travel 50 km?
5. Two ducks, 1.5 metres apart floating on the water, bob up and down with the passing waves. If one duck is at the top of crest and the other duck is in the adjacent trough and they bob up and down 30 times in 2 minutes, calculate the speed of the waves. Include a diagram.
6. A destroyer sends out a sonar pulse (sound) that *returns* from a submarine in 1.68 s. If the speed of sound in water is 1531 m/s, calculate the distance from the destroyer to the submarine.

7. The bang from a fireworks explosion was heard 1.2 s after the flash. If the air temperature was 8°C calculate the distance to the explosion.
8. Superwoman is flying very quickly through the desert. The temperature in the desert is 31°C and she was measured to be flying at Mach 2.4. Calculate her actual speed and convert to km/h.
9. A person holding a 300 Hz tuning fork is running towards you on a nice spring afternoon ($T=14^{\circ}\text{C}$) such that you perceive a frequency of 310 Hz. Calculate the speed of the person. Is this a reasonable speed to be moving? What is this affect called?
10. A car goes flying past you blasting its 700 Hz horn. You perceive a frequency of 660 Hz. The speed of sound in the air is 348 m/s. Calculate the speed of the car.
11. A string 100 cm in length is vibrating at its 5th harmonic. Calculate the wavelength.
12. An air column, closed at one end, has a fundamental frequency (1st harmonic) of 500 Hz. The air temperature in the room is 19°C . Calculate the wavelength of the sound. Also, calculate the length of the air column.
13. A pipe (open at both ends) is vibrating such that the sound waves have a wavelength of 3 metres and the air temperature is 27°C . Calculate the frequency of the resonating pipe if it is resonating at its second (2nd) harmonic. Also, calculate the length of the air column.
14. Two people are 7 metres apart and spending a Friday night playing with slinkies from physics class. They begin vibrating the slinky across the floor until a standing wave is produced. There are nodes at each person's hands and two in the middle. A third person measures that it takes 6 seconds to complete 10 cycles. What is the speed of the waves in the slinky?

Extension

List 3 things that you found interesting about this unit and why.