

## WAVES, SOUND AND LIGHT PRACTICE TEST

On this worksheet, you may assume that the speed of sound in air is 340. m/s unless otherwise stated.

1. A 'clicker' is sounding at 17 Hz; if you are moving towards the 'clicker' at 22 m/s what apparent frequency do you hear instead?
2. A ray of light travels through air and approaching water. The angle of incidence is  $45.0^\circ$ . Determine the angle of refraction.
3. A sound wave has a frequency of 500. Hz and travels in air at a speed of 343.6 m/s. How far apart are any two adjacent wave compressions?
4. If the moon is approximately  $3.84 \times 10^8$  m from the Earth, determine the time it takes light to travel from Earth to the moon and back.
5. You are riding a bike away from a street musician at 11.0 m/s when the trumpet player hits an 'A'. You know that the frequency of an 'A' should be 440. Hz, what apparent frequency do you hear instead?
6. A light ray is passing through water towards the boundary with a transparent solid at an angle of  $56.4^\circ$ . The light refracts into the solid at an angle of refraction of  $42.1^\circ$ . Determine the index of refraction of the unknown solid.
7. A fisherman notices that wave crests pass the bow of his anchored boat every 3.0 seconds. He measures the distance between two wave crests to be 6.6 meters. How fast are the waves traveling?
8. A light ray approaches a mirror at an angle of incidence of  $25^\circ$ . What is the angle of reflection?
9. You are in an ambulance driving towards an accident at 36.0 m/s. You hear the horns of the cars in the accident sounding at 500. Hz, what is the actual frequency of the car horns?
10. Determine the speed of light in cubic zirconia ( $n = 2.16$ ).
11. Determine the critical angle of the following material when surrounded by air: teflon ( $n = 1.38$ ).
12. A sinusoidal wave travels along a string. The time for a particular point to move from maximum displacement to zero is 0.21 seconds. What is the wave's frequency?
13. If the wavelength is 2.5 m in # 13, that how fast does the wave energy travel along the string?
14. A light ray approaches a mirror at an angle of  $22^\circ$  with the mirror surface. What is the angle of reflection of this light ray?
15. You are speeding away from a loud speaker. If the original frequency of 500. Hz is shifted to 464 Hz, what is your speed away from the speaker?
16. You are measuring the speed of a projectile using sonar. If a frequency of 250. Hz is reflected back at 239 Hz, what is the speed of the projectile?
17. What is the speed of sound at  $65^\circ\text{C}$ ?
18. The frequency of visible light is about  $4.8 \times 10^{14}$  Hz. What is the approximate wavelength of the light?
19. A wave has a speed of 210 m/s and a wavelength of 6.6 meters. What is its period?
20. Sally and her lab partner held the ends of their spring 8.00 meters apart. There were 6 nodes in the standing wave produced. Sally moved her hand from the rest position back and forth along the floor 24 times in 4.00 s. Sketch the situation and determine the following:
  - a. the wavelength of the wave Sally Sue sent
  - b. the frequency of the wave produced
  - c. the speed of the wave

### ANSWERS

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|----------------------------|------------------|----------------------------|
| 1) 18 Hz                   | 2) $32.1^\circ$  | 3) 0.687 m                 |
| 4) 2.56 s                  | 5) 426 Hz        | 6) 1.65                    |
| 7) 2.2 m/s                 | 8) $25^\circ$    | 9) 452 Hz                  |
| 10) $1.39 \times 10^8$ m/s | 11) $46.4^\circ$ | 12) 4.8 Hz                 |
| 13) 12 m/s                 | 14) $68^\circ$   | 15) 24.5 m/s               |
| 16) 15 m/s                 | 17) 370. m/s     | 18) $6.3 \times 10^{-7}$ m |
| 19) 0.031 s                | 20a) 3.20 m      | 20b) 6.00 Hz               |
| 20c) 19.2 m/s              |                  |                            |