UNIT 4 BLM Answer Key

BLM 8.4-1 DETERMINING STRING PROPERTIES

1. 44.5 m/s
2. 0.11 kg/m
3. 3.0×10^2 N
4. 0.24 kg
5. 0.12 kg/m
6. 2.6 m

BLM 8.5-1 MACH NUMBER AND THE SPEED OF SOUND IN AIR

1. 348 m/s
2. $v = 306$ m/s; $M = 0.786$
3. 10.9 °C
4. $v = 296$ m/s; $v_{aircraft} = 1.21 \times 103$ km/h
5. 0.794
6. $v = 303$ m/s; $M = 0.847$
7. 351 m/s
8. 25.7 °C

BLM 8.Q CHAPTER 8 QUIZ

1. (b); 2. (d)
3. T
4. F. If two waves are in phase, their troughs and crests align.
5. F. Infrasonic waves have frequencies below the audible range.
6. (a)(ii); (b)(i); (c)(ii)
7. The particles of water are closer together than the particles of air. Because the particles are closer, vibrations in water molecules are more easily transferred to nearby molecules. Molecules in air rely on translational molecular motion to transfer vibrations.
8. Frequency is the number of wave cycles in a unit time. Intensity is a measure of a sound's energy. A musical note with high frequency and high intensity would sound loud and high-pitched, like the sound of a flute.

BLM 9.2-1 STANDING WAVES

1. 2.78 m
2. 282 Hz
3. 141 m/s
4. 0.69 m
5. fourth harmonic

BLM 9.5-1 THE DOPPLER EFFECT

1. 268 Hz
2. 19 m/s
3. 963 Hz
4. 19 m/s
5. 552 Hz

BLM 9.Q CHAPTER 9 QUIZ

1. (c); 2. (c)
3. T
4. F. Wave motion is usually efficient, and in most media little energy is lost as waves move.
5. T
6. (a) (iii); (b) (i); (c) (ii)
7. Sample answer: A standing wave is an interference pattern produced when incoming and reflected waves interfere with each other; the wave pattern appears to be stationary.
8. Sample answer: The sounds must have frequencies that are close but not the same. The frequency of the beat is the difference in the frequencies of the sounds.

BLM 10.1-1 THE HUMAN EAR

1. pinna -- collects sound waves
2. hammer, anvil, stirrup -- transmit vibrations from the eardrum to the inner ear; magnify pressure
3. auditory nerve -- transmits electrical signals about the sounds to the brain
4. cochlea -- contains hair-like cells that respond to different frequencies of sound
5. Eustachian tube -- equalizes pressure in the inner ear
6. eardrum – separates the outer and inner ear; transmits vibrations to the inner ear
7. auditory canal – magnifies sound

BLM 10.2-1 WAVES IN STRINGS

1. (a) 0.589 m
   (b) $\lambda_1 = 1.51$ m; $\lambda_2 = 1.18$ m
   (c) $v_1 = v_2 = 427$ m/s
2. 174 m/s
3. (a) 0.279 m
   (b) 0.558 m
   (c) 470 Hz
4. 0.193 m

BLM 10.3-1

A. Sample answer: We were all able to judge the location of the tapping.
B. Sample answer: It was more difficult to accurately judge where the sound originated when only listening with one

ear. This is probably because when sound waves travel through both ends of the tubing and reach both ears, our brains can detect the difference in the distance that the waves traveled in each direction from the source and deduce the location of the source. If waves in the tube are only detected by one ear, we lose the ability to compare the distances that the waves traveled in each direction.

BLM 10.Q CHAPTER 10 QUIZ

1. (b); 2. (d)
3. T
4. F. Elephants can hear sounds from distances as long as 10 km because they send out and detect sounds of a much lower frequency than humans can hear.
5. F. Ships far out at sea usually do not notice a tsunami passing by because its amplitude does not increase until it approaches land.
6. (a)(iii); (b)(i); (c)(ii)
7. Buffeting can occur when there is an interruption of airflow. People on the aircraft feel a strong jerking motion.
8. During launch, low-frequency longitudinal resonance vibrations can develop in the rocket's propellant pipes. These vibrations can cause periodic changes in the propellant flow rate, leading to increases and decreases in the rocket's thrust. If the effect is severe enough, the rocket could be destroyed.

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1. (c); 2. (d); 3. (a); 4. (a)
5. F. In a transverse wave, particles vibrate perpendicular to the direction of the flow of energy.
6. F. At any point, the amplitude of two interfering waves equals the sum of the amplitudes of the individual waves.
7. T
8. (a)(iv); (b)(iii); (c)(ii); (d)(i)
9. (a)(iii); (b)(i); (c)(vi); (d)(v); (e)(ii); (f)(iv)
10. 400 m/s
11. Nodes are where the particles of the medium do not move. Antinodes are where the particles of the medium move with the greatest speed.
12. When sound waves reflect off a concave surface, they become concentrated on a single focal point. The resulting sound is more likely to be heard outdoors; indoors, however, the focused sound can be too loud. In contrast, flat surfaces reflect sound waves evenly.
13. When a wave travels into a new medium, part of the wave is reflected back to its source. By sending sound waves underground and recording the reflected waves, scientists can "map" the boundaries and composition of different layers of Earth's interior, including mineral deposits.
14. Sample answer: Mechanical resonance happens when energy transfers from one object to another; if the second object has the same resonant frequency as the first, large-amplitude vibrations can result. As these vibrations become larger, they can cause substantial damage to buildings. Resonance may have caused the Tacoma Narrows Bridge to collapse. Resonance can also create a "pogo effect" in rockets, causing passengers to feel like they are surging back and forth.