NAME _____ PERIOD ____

UNIT 14 PRACTICE PROBLEMS PHYSICS 1

14.1 WAVE PROPERTIES

1. The Sears Tower in Chicago sways back and forth in the wind with a frequency of about 0.12 Hz. What is its period of vibration?
2. An ocean wave has a length of 12.0 m. A wave passes a fixed location every 3.0 s. What is the speed of the wave?
3. Water waves in a lake travel 3.4 m in 1.8 s. The period of oscillation is 1.1 s.
    a. What is the speed of the water waves?
    b. What is their wavelength?
4. Pepe and Alfredo are resting on an offshore raft after a swim. They estimate that 3.0 m separates a trough and an adjacent crest of each surface wave on the lake. They count 12 crests that pass by the raft in 20.0 s. Calculate how fast the waves are moving.
5. The velocity of the transverse waves produced by an earthquake is 8.9 km/s, and that of the longitudinal waves is 5.1 km/s. A seismograph records the arrival of the transverse waves 68 s before the arrival of the longitudinal waves. How far away is the earthquake?

14.2 WAVE BEHAVIOR

6. Sketch the result for each of the three cases shown in **Figure 14-23**, when the centers of the two approaching wave pulses lie on the dashed line so that the pulses exactly overlap.

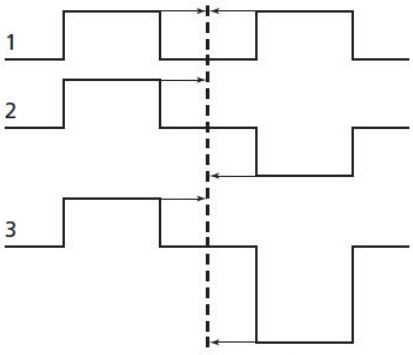

Figure 14-23

7. The wave speed in a guitar string is 265 m/s. The length of the string is 63 cm. You pluck the center of the string by pulling it up and letting go. Pulses move in both directions and are reflected off the ends of the string.
    a. How long does it take for the pulse to move to the string end and return to the center?
    b. When the pulses return, is the string above or below its resting location?
    c. If you plucked the string 15 cm from one end of the string, where would the two pulses meet?
8. Sketch the result for each of the four cases shown in **Figure 14-24**, when the centers of each of the two wave pulses lie on the dashed line so that the pulses exactly overlap.

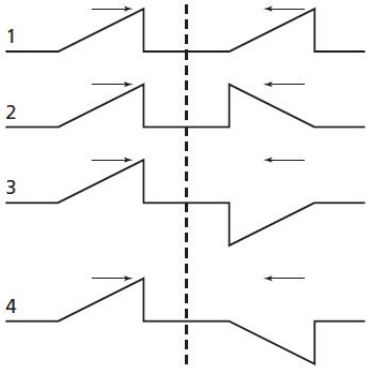

Figure 14-24

14.3 SOUND

9. You hear the sound of the firing of a distant cannon 5.0 s after seeing the flash. How far are you from the cannon?

NAME _____ **PERIOD** ____

UNIT 14 PRACTICE PROBLEMS **PHYSICS 1**

10. If you shout across a canyon and hear an echo 3.0 s later, how wide is the canyon?
11. The sound emitted by bats has a wavelength of 3.5 mm. What is the sound's frequency in air?
12. A baseball fan on a warm summer day (30°C) sits in the bleachers 152 m away from home plate.
    a. What is the speed of sound in air at 30°C?
    b. How long after seeing the ball hit the bat does the fan hear the crack of the bat?
13. A ship surveying the ocean bottom sends sonar waves straight down into the seawater from the surface. As illustrated in **Figure 15-26**, the first reflection, off of the mud at the sea floor, is received 1.74 s after it was sent. The second reflection, from the bedrock beneath the mud, returns after 2.36 s. The seawater is at a temperature of 25°C, and the speed of sound in mud is 1875 m/s.
    a. How deep is the water?
    b. How thick is the mud?

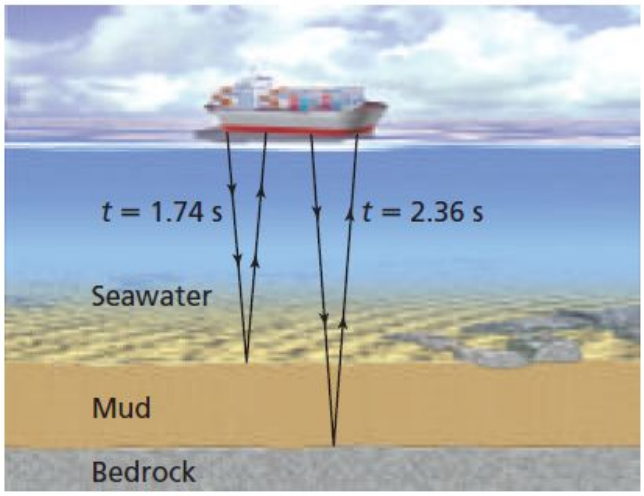

Figure 15-26 (Not to scale)

14.4 DOPPLER EFFECT

14. A train moving toward a sound detector at 31.0 m/s blows a 305-Hz whistle. What frequency is detected on each of the following?
    a. a stationary train
    b. a train moving toward the first train at 21.0 m/s
15. The train in the previous problem is moving away from the detector. What frequency is now detected on each of the following?
    a. a stationary train
    b. a train moving away from the first train at a speed of 21 m/s
16. You are in an car traveling at 25.0 m/s toward a pole-mounted warning siren. If the siren's frequency is 365 Hz, what frequency do you hear? Use 343 m/s as the speed of sound.
17. A fire truck is moving at 35 m/s, and a car in front of the truck is moving in the same direction at 15 m/s. If a 327-Hz siren blares from the truck, what frequency is heard by the driver of the car?