SOUND

Doppler Effect

Practice Problems

Name:_____

Date:_____Period:_____

1) What is the equation to calculate the frequency in front of a moving sound source?

2) What is the equation to calculate the wavelength behind a moving sound source?

3) What are the units for wavelength, frequency, period, and velocity?

4) A source is moving at 18 m/s in air emitting a frequency of 1225 cycles per second. What is the frequency you would hear as the source approaches?

5) What wavelength would the approaching sound from problem four have?

6) A source sound is detected from a departing whale (in salt water v=1530 m/s) at a frequency of 422 cycles per second. If this whale is known to make calls at a frequency of 425 cycles per second, how fast is the whale moving?

7) A second sound is detected from a submarine at 376 cycles per second. If the submarine generally emits a frequency of 365 cycles per second, how fast is it moving and in what direction?

8) A source is moving past a sound sensor in air. The frequency detected in front of the source was 2626 cycles per second, and the frequency detected behind the source was 1771 cycles per second. How fast is the object moving?

9) A source is moving past a sound sensor in an unknown medium. The frequency detected in front of the source was 2700 cycles per second, and the frequency detected behind the source was 1300 cycles per second. The object was clocked by a radar gun to be moving at 21 m/s. What is the speed of sound in the medium?

10) A stationary sonar system in salt water (v=1530 m/s) emits sound waves at a frequency of 200 cycles per second toward a target. If the sound returns at a frequency of 450 cycles per second, how fast and in what direction is the target moving?

11) The same system from problem 10 detects sound returning at a frequency of 167 cycles per second, how fast and in what direction is the new target moving?

12) If an object is moving in air at a speed of 13 m/s and emitting a tone at a frequency of 1757 cycles per second. What frequency should be detected in front of the car? And behind the car?

13) Consider a sound wave sent from motion detector, it strikes an object and returns in 18 seconds. A second pulse is sent and returns in 16 seconds, and a third pulse returns in 10 seconds. How far away was the target when the first pulse reflected off it? How far away was the target when the third pulse reflected off it? (assume v=340 m/s)

14) How fast is the object from problem 13 accelerating?

15) Assuming the object in problem 13 started from rest and has a constant acceleration, how long will it take to reach the detector, after the third pulse is reflected off it?

16) (Worth 5 points) A sound is detected in an atmosphere with an average molecular mass of .078 kg/mol, with an adiabatic constant of 1.2, and a temperature of 354 degrees Celsius. The sound is first detected to be a frequency of 3289 cycles per second. After several seconds the sound suddenly shifts to a frequency of 1824 cycles per second. How fast is the object moving?