Unit 9 Worksheet 3   Name: ___(KEY)___

Properties of sound waves:

Review:
Match the following wave quantities to the *mini-definition*. Place the letter in the blank.

A. Frequency   B. Period   C. Speed   D. Wavelength   E. Amplitude

__C__   1.   How **fast** the wave moves through the medium.

__D__   2.   How **long** the wave is.

__A__   3.   How **often** the particles vibrate about their fixed position.

__B__   4.   How **much time** it takes the particles to complete a vibrational cycle.

__E__   5.   How **far** the particles vibrate away from their resting position.

6.   A sound wave with its characteristic pattern of compressions and rarefactions is shown below. A metric ruler is included below the pattern. The wavelength of this sound wave is __1.6__ m.

$$2.3 - 0.7$$
$$= 1.6$$
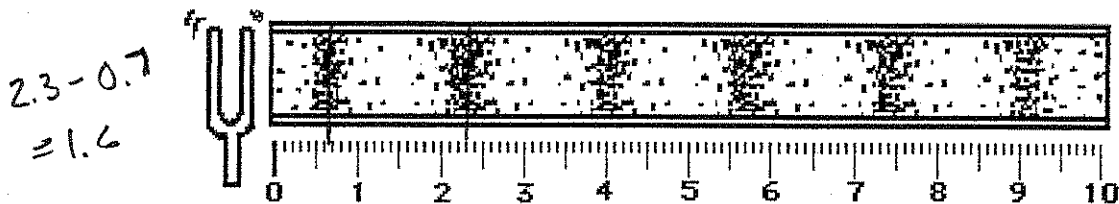
7.   The pitch of a sound is directly related to the _____ of the sound wave.
      (a.) frequency   b. wavelength   c. speed   d. amplitude

8.   High pitched sounds have relatively large _____ and small _____.
      a. period, wavelength   b. speed, period
      (c.) frequency, wavelength   d. period, frequency
      e. amplitude, wavelength   f. amplitude, speed

9.   As the frequency of a sound increases, the wavelength _____ and the period _____.
      a. increases, decreases   b. decreases, increases
      c. increases, increases (d.) decreases, decreases

10.   A sound wave is described as being 384 waves/s. This quantity describes the wave's _____.
      (a.) frequency   b. period   c. speed   d. wavelength

11.   The speed of a sound wave depends upon the _____.
      a. frequency of the wave   b. wavelength of the wave
      c. amplitude of the wave   (d.) properties of the medium through which it moves

12.   If a person <u>yells</u> (as opposed to whispering), then it will cause _____.
      a. air molecules to vibrate more frequently
      b. the sound wave to travel faster
      (c.) air molecules to vibrate with a <u>greater amplitude</u>

13.   If a person yells (as opposed to whispering), then it will cause _____.
      a. the pitch of the sound to be higher
      b. the speed of the sound to be faster
      (c.) the loudness of the sound to be louder

Doppler Effect:

14. TRUE or ~~FALSE:~~

Ken Fused is standing on a corner when a police car passes by with its siren on. Ken hears a different pitch when the police car is approaching him than when it is past him. This is because the siren on the front of the car is set to a higher pitch than the siren on the back of the car.

15. Describe the real reason Ken Fused observes what he does.

The sound source moves toward him causing the waves to get there quicker which sounds to him like a higher frequency sound.

16. TRUE or ~~FALSE~~

The Doppler shift is a phenomenon which is observed only of sound waves.

Explain your answer:

It is also observed in electromagnetic waves (light) when looking at galaxies and other star systems.

17. TRUE or ~~FALSE~~

As the source of a sound approaches an observer, the loudness of the sound increases. This is an example of the Doppler Shift.

Explain your answer:

Doppler shift is only related to a shift (or change) in frequency, NOT a change in amplitude (loudness).

An automobile is traveling away from Jill and towards Jack. The horn is *honking,* producing a sound wave consisting of the familiar pattern of alternating compressions and rarefactions which travel from their origin through the surrounding medium. The circles on the diagram at the right represent wave fronts; you can think of the wave fronts as the compressions. Observe that the compressions are closer together in front of the car compared to behind the car.
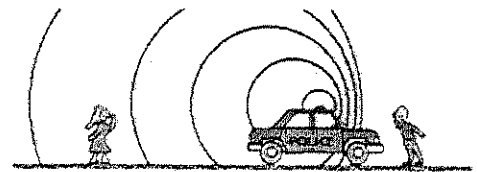
18. Towards which person do the sound waves travel the fastest?
   a. Jack   b. Jill   **c. Both the same.**

19. Who will hear the highest frequency?
   a. Jack   b. Jill   c. Both the same.

20. The Doppler effect can be described as the difference between the frequency at which sound waves are produced and the frequency at which they are observed by the hearer. It occurs when the distance between the source of a sound and the observer is changing. As the source approaches an observer, the observer hears the pitch (or frequency) to be _____ (**higher**, lower). As the source moves away from an observer, the observer hears the pitch (or frequency) to be _____ (higher, **lower**).

This is the BIG Idea

Sound Intensity:

21. The decibel system is a system used to express the intensity of a sound. It is based on the powers of 10. A decibel is 1/10-th of a Bel. The sound level in Bels describes the power on 10 by which that sound is more intense than the so-called *threshold of hearing* (TOH). A 1-Bel sound is 10^1 times more intense than the TOH; it is a 10-decibel sound. A 2-Bel sound is 10^2 times more intense than the TOH; it is a 20-decibel sound. Use your understanding of the powers of 10 to complete the following table. (NOTE: different literature sources cite different intensity levels.)

Description of Sound	Intensity (W/m²)	Sound Level (Bels)	Sound Level (decibels)
Threshold of Hearing	1×10^{-12}	0	0
Broadcasting Studio	1×10^{-10}	2	20
Mosquito Buzzing	1×10^{-8}	4	40
Normal Conversation	1×10^{-6}	6	60
Vacuum Cleaner	1×10^{-5}	7	70
Busy Traffic	1×10^{-4}	8	80
Power Mower or Thunder	1×10^{-2}	10	100
Twisted Sister Rock Band (Mr. H's favorite)	1×10^{-1}	11	110
Threshold of Pain	1	12	120
Jackhammer or Nearby Plane (18')	1×10^1	13	130
Explosions	1×10^2	14	140

22. Compare the decibel level of the following sounds.

    a. If Sound B is 10 times the intensity of Sound A, then its decibel level is __10__ higher.

    b. If Sound C is 100 times the intensity of Sound A, then its decibel level is __20__ higher.

    c. If Sound D is 1000 times the intensity of Sound A, then its decibel level is __30__ higher.

    d. If Sound I is 10000 times the intensity of Sound A, then its decibel level is __40__ higher.

23. How many times more intense is a .... __dB__

    a. ... a 30 dBel sound than a 20 dB sound? __10__ 10^x where x = __1__   or   __10 times larger__

    b. ... a 40 dB sound than a 20 dB sound? __20__ 10^x where x = __2__   or   __100__ " "

    c. ... a 80 dB sound than a 20 dB sound? __60__ 10^x where x = __6__   or   __1000000__ " "

    d. ... a 80 dB sound than a 50 dB sound? __30__ 10^x where x = __3__   or   __1000__ " "

    e. ... a 92 dB sound than a 62 dB sound? __30__ 10^x where x = __3__   or   __1000__ " "