Name ________________________________
Date _____________ Per. ____________

The Energy of Sound

In this lab, you will perform several activities that will show that the properties and interactions of sound all depend on one thing – the energy carried by sound waves.

Materials:
- 2 tuning forks of same frequency and one of a different frequency
- Pink rubber eraser
- Small plastic cup filled with water
- Rubber Band
- Piece of string 50 cm

Part A – Sound Vibrations

Vibration - ____
____

A **sound wave** is a longitudinal wave caused by vibrations. Sound waves travel through material mediums such as air, water, glass and metal.

In a vacuum, there are no particles to vibrate, so no sound can be made in a vacuum.

Sounds travels quickly through air, but it travels even faster in liquids and even faster in solids.

Temperature also affects the speed of sound. The cooler the medium is, the slower the speed of sound.

1. Lightly strike a tuning fork with the eraser or on the table. Slowly place the prongs of the tuning fork in the plastic cup of water. Record your observations.

   ____

   Record your observations. Strike the tuning fork again and slowly place the prongs on the edge of the cup. Record your observations.

   ____

2. How do your observations show that sound waves are carried through vibrations?

   ____
   ____

Pitch - ____
____

Frequency - ____

Frequency is expressed in units of Hertz (Hz) which is equivalent to waves per second.

The pitch of sound becomes higher as the frequency of the sound wave becomes higher.

Part B – Resonance

A **standing wave** is a pattern of vibration that simulates a wave that is standing still. The frequencies at which standing waves are made are called **resonant frequencies**.

Resonance ____
____

3. Strike a tuning fork with the eraser. Quickly pick up a second tuning fork in your other hand and hold it about 30 cm from the first tuning fork. Place the first tuning fork against your leg to stop the vibration. Listen closely to the second tuning fork. Record your observations, as well as the frequencies of the two tuning forks.

   Tuning fork # 1 Frequency: ____
   Tuning Fork # 2 Frequency: ____
   Observation:____

4. Repeat step 3 using the remaining tuning fork as the second tuning fork. Record your observations.
   Tuning fork # 1 Frequency: ____
   Tuning Fork # 2 Frequency: ____
   Observation:____

5. Explain why you can hear a sound from the second tuning fork when the frequencies of the tuning forks used are the same.

   The vibrating tuning fork causes the air to vibrate at a certain frequency. The ______________________ of the ___________________ is transferred through the air to the second tuning fork, which ____
   ____

6. When using tuning forks of different frequencies, would you hear a sound from the second tuning fork if you strike the first tuning fork harder? Explain you reasoning.

   Hitting the tuning fork harder causes a larger amount of _____________ to be transferred from the tuning fork to the air. However, the __________________ of the air particles is not at the same ________________ as the second tuning fork and will therefore ____

Part C – Interference

Interference ____

Constructive Interference – compressions of one wave overlap the compressions of another wave and the sound becomes louder because the amplitude is increased.

Destructive Interference – the compressions of one wave overlap the rarefactions of another wave and the sound becomes softer because the amplitude is decreased.

7. Using the two tuning forks with the same frequency, place a rubber band tightly over the prongs near the base of one tuning fork. Strike both tuning forks at the same time against the eraser. Hold a tuning fork 3 to 5 cm from each ear. If you cannot hear any differences move the rubber band down further on the prongs. Strike again. Record what you hear.

   ____
   ____
   ____

8. Did you notice the sound changing back and forth between loud and soft? A steady pattern like this is called a beat frequency. Infer how this changing pattern of loudness and softness is related to interference (both constructive and destructive).

   The loudness corresponds to ________________________________ (when the compressions of the sound waves overlap, increasing the ________________), and the softness corresponds to ______________________ (when the compressions and rarefactions of sound waves overlap, decreasing the ____________________).

Part D – The Doppler Effect

The **Doppler Effect** is the ____
____

Your teacher will tie the piece of string securely to the base of one tuning fork. Your teacher will then strike the tuning fork and carefully swing the tuning fork in a circle overhead. Record your observations.

9. Did the tuning fork make a different sound when your teacher was swinging it compared to when he or she was holding it? Explain why or why not.

   _________, as the tuning fork swings towards you, the ____________ is higher because the sound waves in front of it are closer together and therefore have a _____________________________________. As the tuning fork swings away from you, the _______________ is lower because the sound waves are farther apart and therefore have a___________________________.

10. Is the actual frequency of the tuning fork changing? Explain.

    The _________________ you hear changes because of the_________________, but the actual _____________________of the tuning forks_________________.

11. Explain how your observations from each part of this lab show that sound waves carry energy from one point to another through a vibrating medium.

Part A: The ______________________ of the tuning fork have ____________ that does work on water.

Part B: The ________________ from one vibrating tuning fork can be passed by ____________________through the air to cause _______________________ ____.

Part C: The ________________ from each vibrating tuning fork can travel through the air as waves that can ____.

Part D: The ___________________________ from a tuning fork travel through the air to your ears, and the amount of ______________ being carried by the ______________________________ determines what is heard (____).

12. Particularly loud thunder can cause the windows of a room to rattle. How is this evidence that sound waves carry energy?

It takes _____________________to move the windows to cause them to rattle. Therefore, __________________ from the thunder's sound waves must be ___________________________ through the air to the windows.