Lab: Interference Patterns Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Question:** What is the relative loudness of sound which results when sound from two sources are heard at a given seat location of an automobile?

**Purpose:** To analyze the interaction of sound waves from two speakers of an automobile in order to determine which seat locations in the automobile would experience constructive and destructive interference.

**Equipment:** Diagram of vehicle and wave pattern transparencies

**Discussion:** Sound waves, like any waves, can be made to interfere. For sound, the crest of a wave corresponds to a compression, and the trough of a wave corresponds to a rarefaction (spreading out).

In either case, when the **crests** of one wave overlap the **crests** of another wave, there is **constructive interference** and an increase in amplitude.

Or when the **crests** of one wave overlap the **troughs** of another wave, there is **destructive interference** and a decrease in amplitude.

When constructive interference occurs with sound waves, the listener hears a louder sound. When destructive interference occurs, the listener hears a fainter sound or no sound at all.

**Procedure:** Each student is given a diagram of a car with several marked passenger locations and two speaker locations. A couple of transparency strips consisting of a wave pattern are provided for each student. Students line up the wave patterns with the source (the speakers) and manipulate their orientation to determine the type of interference that is encountered at each passenger location.

**Data:**

**Vehicle #\_\_\_\_\_**

|  |  |  |  |
| --- | --- | --- | --- |
| **Passenger** | **Wave Pattern** | **Interference Type** | **Does the passenger hear the music?** |
| **A** | **A** |  |  |
| **B** | **A** |  |  |
| **C** | **A** |  |  |
| **D** | **A** |  |  |
| **A** | **B** |  |  |
| **B** | **B** |  |  |
| **C** | **B** |  |  |
| **D** | **B** |  |  |

**Analysis: (Keep in mind these are hypothetical situations – in reality, songs do not play at one single frequency)**

1. If you were in the car and a Lady Gaga song came on the radio at frequency A, where would you want to be sitting? Why?
2. If you were in the car and a country song came on the radio at frequency B, where would you want to sit? Why?
3. If you were in the car and the Beatles came on the radio at frequency A, where would you want to be sitting? Why?
4. Why do you think architects who design music halls, theatres, and auditoriums might have to consider sound wave interference in their designs?