

Who Can Hear Monte Tone?

Teacher's Guide

Topic:

Sound and Music

The following information is provided to the student:

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.

A complete lab write-up includes a Title, a Purpose, a Data section, and a Conclusion/Discussion of Results. The data section should include the provided diagram (taped in) of the car with the indicated vehicle number and wave pattern letter. A table of data should be included indicating the part of each wave (compression or rarefaction) which reaches a given seat location and the resulting type of interference which results. The Conclusion/Discussion describes the relative loudness of sound which is heard at each indicated seat location. A short explanation is given for why the relative loudness is high or low at a given location.

Materials Required:

Diagram of vehicle and wave patterns (provided); transparencies; copy machine.

Description of 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 which is encountered at each passenger location.

Alternative Materials and Procedure:

Alternative materials and procedures are not recommended.

Safety Concern:

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Student *horseplay* and off-task behaviors should not be tolerated.

Suggestions, Precautions, Notes:

1. The PDF file and Microsoft Word files listed below provide all the materials which students need.
2. This lab is a great introduction to the early labs in the Light and Color. Those labs pertain to the topic of two-point source interference.

The Laboratory

3. A great follow-up demonstration can be performed using two speakers connected to a digital function generator. Space the speakers about 1-meter apart and set the function generator to produce a 1000 Hz signal. Students can stand about 5 to 10 meters away and walk parallel to the imaginary line which connects the speakers. As they walk slowly (with one ear covered), they should observe positions of minimum and maximum loudness along the line at which they are walking. The demonstration works best in an open space with minimal reflecting surfaces (e.g., on a football field).

Auxiliary Materials:

A multipage document with several *tape-in* items is available on a separate page. The document includes several diagrams of a car with the location of the speakers and several labeled ear locations. The diagrams are unique and can be passed out to different lab groups so that each group is likely to have a different *problem* to solve. Two basic patterns of compressions and rarefactions are also provided from which transparencies can be made; the wave patterns can be cut from the transparencies and distributed to students. Finally, there is a table which can be taped into the students' lab notebook.

View separate page as a:

[PDF file](#)

[MS Word file](#)

Scoring Rubric:

S11. Who Can Hear Monte Tone? Lab	Score
____ Included, labeled and organized all parts of the lab report. ____ Data section includes the provided diagram (completed and taped in); the vehicle number and wave letter is indicated. A table of data summarizing the results is provided; indicated the seat location, the part of each wave which interfered at the seat location and the type of interference which results. ____ Conclusion/Discussion described the relative loudness of sound heard for each seat location. A short explanation is given for why the sound is heard as soft (minimum) or loud (maximum); discussion reveals understanding.	____/____

Connections to The Physics Classroom Tutorial:

The following reading is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/sound/u1113a.cfm>

Connections to Minds on Physics Internet Modules:

There are no sublevels of Minds on Physics which pertain to this topic.