SOUND - DISTANCE

SENSOR(S) - Internal Sound

INVESTIGATE
- That sounds travel away from sources, getting fainter as they do so.
- That loudness is a property of sound and can be measured in decibels.

INTRODUCTION TO THE INVESTIGATION

Sounds are all around us from traffic in noisy streets to birds in the country side. Have you noticed, however, that some sound is loud and some is quiet ? Why ? What can change the loudness of sound ?

Using the Explorer and it's built in sound sensor we can investigate one of the properties of sound – its volume or loudness. The class can spend some time discussing loud and quiet sounds and what can effect the volume (the change between noisy and quiet).

The loudness of a sound is the amount of sensation produced when sound waves reach the ear – the loudness of a sound is therefore subjective as it depends on the sensitivity of the ear. The loudness of a sound is most commonly measured in DECIBELS (dB), however it can also be measured in phons which take into account that the ear is not equally sensitive to sounds at all frequencies (the optimum frequency for the human ear is around 1kHz – the frequency that most babies cry at).

The Explorer sound level sensor uses a special measurement which more closely mimics the way your ears interpret sound (this measurement is often referred to as dBA - 50dBA = a quiet talk ; 100 dBA = loud band). If you double the level of sound it only shows a 3 dB increase so that a 100 watt stereo system is only 3dB louder than a 50 watt system. When using the sound sensor in the Explorer it should be treated in the same way that you would a microphone, in that you avoid excessive movement or knocking of the unit as this handling noise could be recorded.

RESOURCES

- Explorer datalogger, datalogging software, computer, LogIT computer link cable
- Constant sound source e.g. electronic keyboard, radio not tuned to a station (i.e. 'hiss'), battery & buzzer
- Metre rule to measure start and finish distance.

WHAT TO DO

- Set up the equipment - do not, at this stage, connect the Explorer to the computer.
- Place the Explorer by the sound source and measure & note the distance.
- Turn on the sound source.
- Without the Explorer walk away from the source and try to predict what the Explorer will record and the sort of graph trace it will produce.
- Turn on the Explorer then press the green button (Run).
- Slowly move the Explorer away from the sound source - ensure that the Explorer is kept pointed at the source.
- At about 1 metre press the Explorer red button to stop logging.
- Fetch/collect your results on the computer and view the graph.
- When finished print and save the results - decide on the best way to show the results.
- Discuss and/or write up the findings and whether they matched the predictions.

To make sure it is a fair test the sound source must be kept at the same level (volume).

You will need to find a sound source that will not change too much. One of the best sources of 'constant' sound is to use an AM/MW radio not tuned to a station - this 'hiss' is better known as white noise. Another source might be an electronic key board on which a student plays the same note with the same volume setting; or the pupils can make up an electronic circuit with a battery, switch and buzzer to provide the sound.. Avoid using a source whose volume naturally 'decays' e.g. hitting a drum.

If there are other groups in the classroom doing the same investigation care must be taken to ensure that the different sound sources do not interfere with the results.

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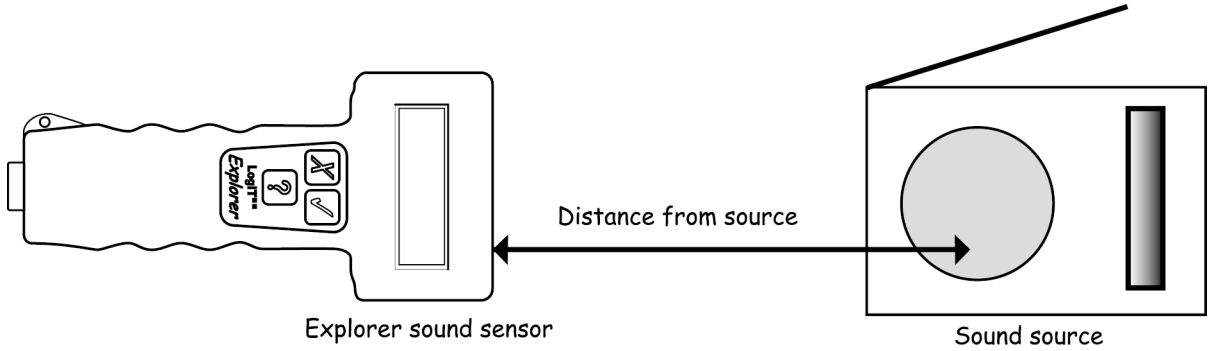
DIAGRAM



SAFETY

- Children should be supervised at all times, especially when dealing with roads and other hazards.
- Prolonged exposure to high noise levels (e.g. of 90dB or more) can result in permanent damage to your hearing.
- If used outside shield the sound sensor from wind and ensure that no liquid contacts any of the datalogging equipment or cables

ABOUT THE RESULTS

- Did the level of sound change with distance ?
- What shape graph was plotted - was it a gradual slope ?
- Did the volume continue to drop or did it fall to a certain point and then remain there ?
- Was it a fair test ? - think about other sources that sound could have come from
- How could it be made a fair test - design a way of blocking background noise, check distances.
- Was care needed in 'aiming' the sound sensor at the sound source ?
- Did the type of sound source matter – try different sources (ensure their volume is set so that the starting level is the same as the original sound source; also ensure that the Explorer is the same starting distance from the source).

EXTENSION ACTIVITIES

- What else can effect the loudness of a sound ?
- Do sounds appear to be the same loudness to everybody ?
- Think about noise pollution.
- Study the difference between noise in the school, by roads and in rural areas.
- Monitor and analyse classroom noise for a day
- Monitor traffic noise - do certain vehicles make more noise than others ? did the noise level change during the day ?
- Point the sound sensor across a road (at a 90° angle to the kerbside) and notice what happens when a vehicle passes from one side to the next - passing in front of the sound sensor.