KS 3 Science
Unit 8L Sound and hearing
Unit 9K Speeding up
Unit 9M Investigating scientific questions

Children should learn:

to compare and evaluate different ways of making measurements
that measurements for different purposes may not be equally precise

How fast is a sound?

First way

You need an open space facing a large wall, e.g. a field and the outer wall of a sports hall.

You also need a long measuring tape (50 or 100m), stopwatch, a calculator, a hammer, an old retort stand base (flat rectangular metal) and a friend to help you.

Measure out a distance of 50 or 100 metres, at right angles to the large wall.

Stand facing the wall and hit the stand base with the hammer.

Listen for the echo. Check that there are no other large walls that could be giving echoes.

Ask your friend to stand close by, and to start timing when you hit the stand base and stop when they hear the echo.

The round trip is 2 x 50m or 2 x 100m. What time did they record?

Distance divided by time = speed. How fast did the sound travel?

How accurate is your result? Where do you think the greatest error occurs?

Now, practise striking the stand base repeatedly with the hammer. Listen to the echoes. Hit the base again to coincide with each echo.

When you can repeat this steadily, ask your assistant to start timing on a “hit” and stop at the **twentieth** echo after it.

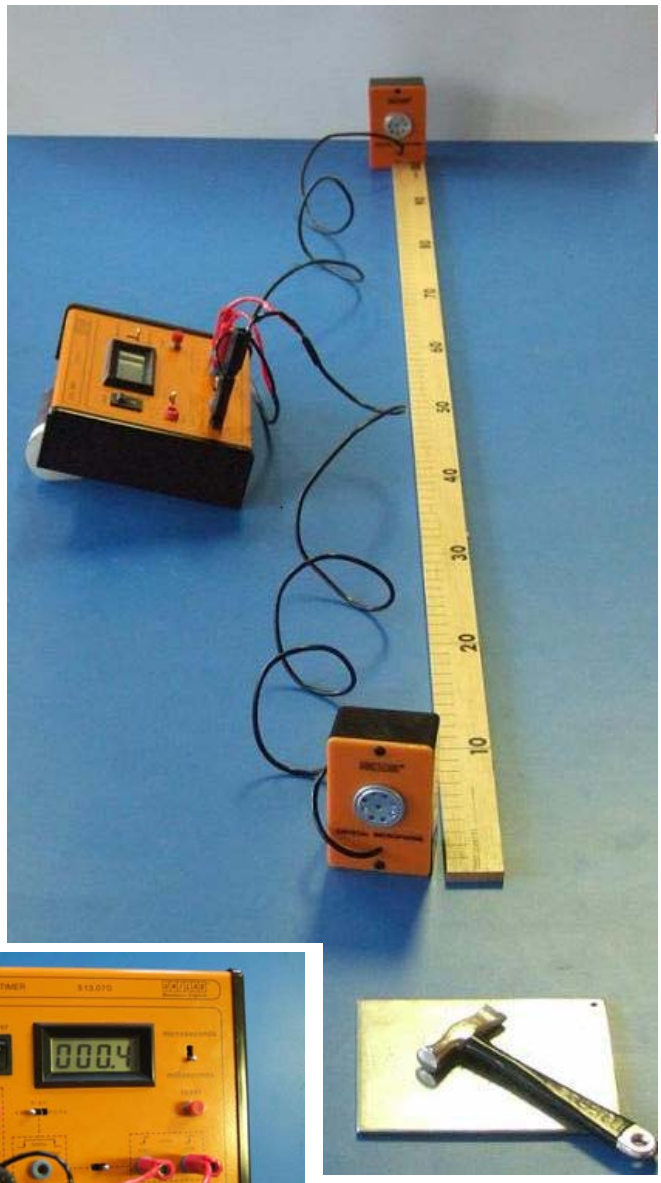
You now have the time for the sound to make 20 journeys of 100 (or 200) metres.

Work out the average speed of the sound.
Is this more accurate than your first result? Why?

How could you make your result more accurate?

There is another way . . .

How fast is a sound?



Second way
You can also measure the speed of sound without leaving the laboratory!

The Fast Timer is connected to two microphones, placed 1 metre apart, facing the same way.

The Fast Timer is set to time in milliseconds (ms) and zeroed by pressing Reset.

Pick up the steel plate and hit it sharply with the small hammer.

The sound travels to the two microphones, and arrives later at the more distant one. The sharp sound triggers the timer to start and to stop.

For a distance of 1 metre, a typical time is 3.2ms

So, in 3.2ms sound travels 1 metre.

In one whole second (1000ms) it will travel
1000/3.2 that is 312.5 metres/second.

You need to repeat the experiment and take an average of number of results.

Then discuss the possible errors that might affect your measurement and calculation.

Sound travels in other materials too!

Turn the microphones face down, 1 metre apart, and press them lightly to the bench.

Reset the Fast Timer. Tap the bench with the hammer.

You should find that the Fast Timer shows a different time. This is the time for the sound to travel 1 metre in the material of the bench. Is it faster than in air? Why?

Using long straight pieces of wood, or even metal bars, you could explore the speed of sound in a range of materials.

You will find that sound travels too quickly in some materials to be timed accurately in milliseconds. Switch the Fast Timer to microseconds (µs) and modify your calculations.

The Fast Timer, Ceramic Microphones, Steel Plate and Hammer together make up the **Speed of Sound Kit, H76488**, from UNILAB and Philip Harris.

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