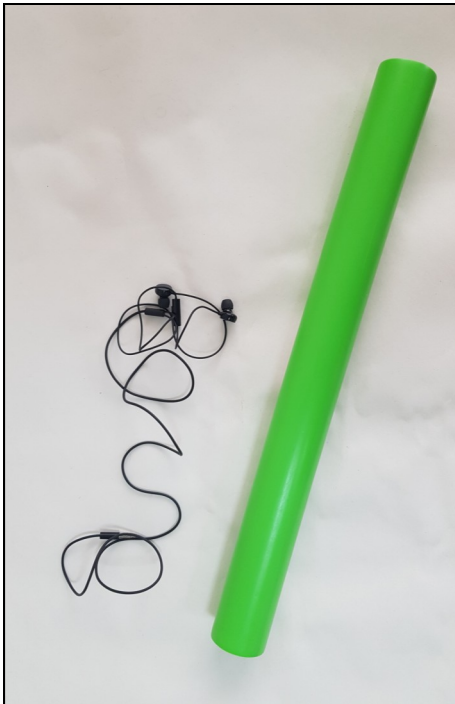


# Professor Brainstorm's Superhearing & Homemade Stethoscope



## About this Activity (Information for Parents and Teachers)

These activities investigate how sound travels from a sound source to our ears. We also discover that usually a sound gets quieter as we move further away from a sound source.

It is most suitable for children between the ages of 7 and 11 years (i.e. Years 3 to 6).

## Superhearing - What you Need

- Music player, e.g. a mobile phone
- Earphones
- Ruler
- A long tube. (I have used a plastic tube in this instance, but a cardboard tube (e.g. the inside of a roll of cling film or kitchen foil) would be fine. Ideally the tube should be about 20-30cm long.

## The Superhearing activity

You need to do this experiment in pairs, so first of all find a helper. (After you have done the experiment, you can be the helper for them.)

1. Play some music on your phone (or whatever music player you are using). Plug the earphones in to your phone, and place one of the earphones close to your ear. Now turn down the volume of the music until you can only just hear it.
2. Now slowly move the earphone away from your ear - until you can no longer hear the music. Ask your helper to measure how far the earphone is from your ear at this point. (If the distance is more than about 5cm, you need to turn the volume down a bit more - and try again.)
3. Now place the earphone just inside the end of the long tube (as shown in the picture at bottom left). Then hold the other end of the tube close to your ear. (You might need to ask your helper to hold the earphone in place!) Can you hear the music now?



### How does it work? (This is the science bit)

So in the first part of this experiment, we found that the sound got quieter as we moved the earphone away from our ear - and by the time it was just a few centimetres from our ear, we couldn't hear the music at all. However, when we put the earphone in one end of the tube, we could still hear the music quite clearly - even though the earphone was much further away.

- When you hear a sound, your ear is actually detecting **vibrations** in the air. If the sound is quiet, this means that the vibrations are very small.
- When the earphones are not in your ear, the earphones act like tiny loudspeakers - and the sound produced by the earphones spreads out in all directions. As you move the earphones further away from your ear, the vibrations become smaller and smaller - until they are too small for your ear to detect. At this point you can no longer hear the music.
- When you place an earphone at the end of a tube, the vibrations travel through the air in the tube - but they can't spread out in other directions.
- Since the vibrations are concentrated in one direction, by the time they reach the other end of the tube, the vibrations are just as big as they were at the other end of the tube. In other words, the music at the far end of the tube is just as loud as it was when it came out of the earphones.

**Would it work with an even longer tube?** I have tried this with a piece of drainpipe which was 4 metres long. And I could still hear the music clearly!

**So it works with a straight tube, but would it still work if the tube was curved?** Try to next experiment to find out.

### Homemade Stethoscope - What you Need

- A plastic funnel. (You may have one in the kitchen - or perhaps one for use in the garden.)
- A length of hosepipe - about 30-50 cm long. (It needs to be the old-style rigid hosepipe. The type of hosepipe which squashes flat does not work very well.)



### The Homemade Stethoscope activity

Making your Homemade Stethoscope is very simple. All you need to do is push the narrow end of the funnel in to one end of the hosepipe.

Now you can repeat the Superhearing experiment using this apparatus. Put the earphone just inside the funnel and place the other end of the hosepipe close to your ear. You should be able to hear the music clearly - even when the hosepipe isn't straight.

However, since the hosepipe is flexible you can do much more with it - including using it to listen to the sounds that your body makes! Try holding the funnel on the left side of your chest. Can you hear your heart beat? (If you run around for a minute before you do this, your heart will be beating harder - so it will be easier to hear.) Or try placing the funnel on your tummy. Can you hear your tummy rumble?

You may be wondering why we need to use a funnel. (After all, we didn't use one for the Superhearing experiment.) For one reason, the hosepipe is much narrower than the tube that we used in the Superhearing experiment. Also, your heart (or tummy) is much bigger than the earphone. So the funnel is needed to collect the sounds from different regions of your heart (or tummy) and direct these sounds in to the hosepipe.