Waves: comparing sound travelling in a solid and air

Key stage 3

The scenario

Waves will travel at different speeds in different materials due to the structure of those materials. In this investigation, students will investigate whether sound travels faster in a solid or a gas.

The activity

Student procedure:

1. Take the wire coat hanger hold it so that the hook is pointing towards the ground.
2. Tie a piece of string to each of the top corners of the coat hanger.
3. Wrap about half of the string around your index fingers so that the hanger can hang freely.
4. Lean forward so that the coat hanger hangs down in front of you (make sure it is not touching anything else).
5. Get a friend to hit the coat hanger with the teaspoon and note how much you can hear.
6. Repeat this experiment, but this time with the string still wrapped around them, stick your fingers in your ears.
7. What do you notice about the sound this time?

Get students to use the idea of the molecule arrangement in solids and gases and get them to explain why they can hear the coat hanger chiming so much better when their fingers are in their ears. Discussion points include:

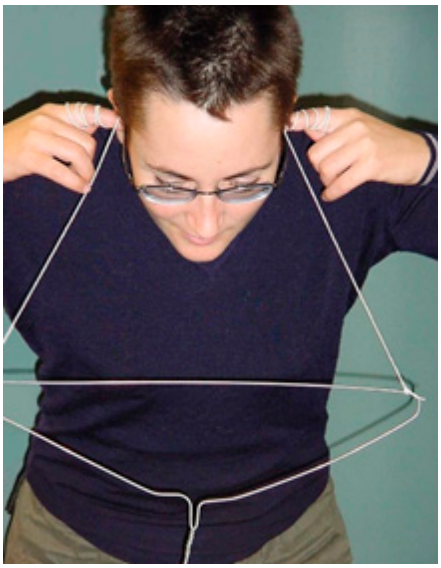
- Sound waves travel through a material by making its molecules vibrate and bump into each other, transferring the energy.
- The molecules in a gas are more spread out than in water and so there will be more time between molecule collisions, resulting in sound travelling slower in a gas than in a solid.
- The molecules in a gas can vibrate in all directions causing the sound waves to spread out. The molecules in a solid can only vibrate in certain direction, limited by their closely packed neighbours, resulting in a more efficient transmission of the sound wave.
- In this activity, when your fingers are in your ears, the sound waves travel straight through the coat hanger, up the string and straight into your ears.

Learning objectives

- sound travels faster in a solid than a gas
- the particle model of states of matter

Equipment needed

- wire coat hanger
- two pieces of string about 50 cm long
- metal teaspoon



MarsQuake

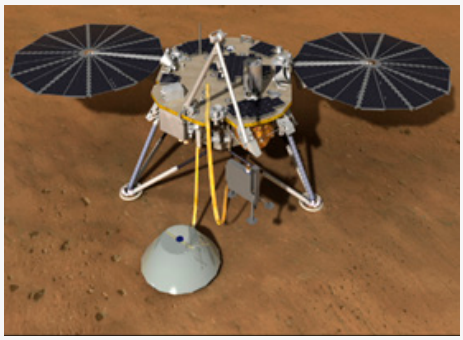
Worksheet

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Key stage 3

Scenario

Sound will be transmitted at different speeds in solids, liquids and gases. The Insight scientists can use this to find out about the structure of Mars. You are going to find out if sound travels better in solids or gases.



In the boxes below, draw the molecule arrangement in solids, liquids and gases.

Solid	Liquid	Gas

Keywords

- gas
- molecules
- solid
- speed
- wave

Sound is a longitudinal wave. This means that the molecules in the material move backwards and forwards, pushing the wave through the material by contact forces.

Which material do you think sound will move better/faster through and why?

Testing which material transmits sound better

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3. Wrap about half of the string around your index fingers so that the hanger can hang freely.
4. Lean forward so that coat hanger hangs down in front of you (make sure it is not touching anything else).
5. Get a friend to hit the coat hanger with the spoon and note how much you can hear.
6. Repeat this experiment but this time, with the string still wrapped around them, stick your fingers in your ears.

Could you hear better with or without your fingers in your ear?
So which material do you think transmitted the sound better?

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