

Spring Block 1

Sound

Small steps

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Vibrations

Notes and guidance

In this small step, children learn that sounds are made when objects vibrate. This is the first time that children have explored sound and they may have some common misconceptions about sound and how it is produced. By the end of this step, children should understand that we hear sounds because an object vibrates. These vibrations then travel through the air (or another medium) to our ears.

It is important that children are exposed to the different ways objects vibrate to produce sounds, including musical instruments, radios, mobile phones and animals. In the previous block, children explored the concept of solids, liquids and gases. It is important that children are aware that sounds can travel through air, but they can also travel through any material, including solids and liquids.

Things to look out for

- Children may think that sound only travels through air. They should be made aware that sound can travel through other mediums, such as solids, liquids and gases. Children could have a discussion around whether sound can be heard through walls or under water to address this.

Key questions

- Which organ in our bodies detects sound?
- What does “vibration” mean?
- How do we hear sounds?
- If you hit a drum harder, what does it do to the sound produced?
- How does a guitar produce sound when played?
- How does a drum produce sound when it is hit?
- Does sound only travel through air?

Explain your thinking.

National curriculum links

- Identify how sounds are made, associating some of them with something vibrating.
- **Working scientifically** – Asking relevant questions and using different types of scientific enquiries to answer them.

Vibrations

Key vocabulary

- **vibration** – a quick back-and-forth movement



- **ear** – an organ in humans (and many other animals) that detects vibrations, allowing hearing



- **sound** – vibrations that travel through the air, or another medium, and are heard when they reach an ear



- **volume** – how loud or quiet a sound is



- **pitch** – how high or low a sound is



Practical ideas

- Gather some musical instruments such as a guitar, drum, violin, recorder and tambourine. Ask the children which part of the instrument produces the sound and how it produces it.



- Stretch cling film over a plastic bowl. Put a thin layer of sand or rice on the cling film. Produce a loud noise near (but not touching) the bowl. The sand or rice will move.
- Use a metal spring toy to show how sound waves travel. Stretch the spring between two people. Tap one end of the spring to model a sound wave.



Factual knowledge

- A vibration is a quick back-and-forth movement.
- Sounds are made when objects vibrate.
- The vibrations travel from the object to our ears.
- Sounds can be heard when these vibrations reach our ears.

The ear

Notes and guidance

In this small step, children learn how sound reaches the ear and how the different parts of the ear allow us to hear sounds. This is the first time that children have explored the ear in detail. It is important that children are introduced to the main parts of the inner ear and the roles that they play in how sounds are heard.

Children build on their understanding of vibrations to explore how the ear drum vibrates, which allows us to hear sounds. They can link this concept to their exploration of how sounds are made using musical instruments in the previous step. Within this step, children learn that as well as detecting sounds, the inner ear also helps humans with their balance.

Things to look out for

- Children may find it difficult to understand how vibrations are detected by the ear. Show children how a drum skin vibrates to produce sound and link this to the ear drum in the middle ear.
- Children may find it difficult to understand how sounds travel through solids, liquids and gases. This is because vibrations cannot be seen, especially in the air.

Key questions

- What is the outer ear?
- How does the outer ear help us to hear?
- What is the inner ear?
- How does the inner ear help us to hear?
- How does sound travel to the ear?
- What else does the inner ear help us with?
- What is the function of the ear drum?

National curriculum links

- Recognise that vibrations from sounds travel through a medium to the ear.
- **Working scientifically** – Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.

The ear

Key vocabulary

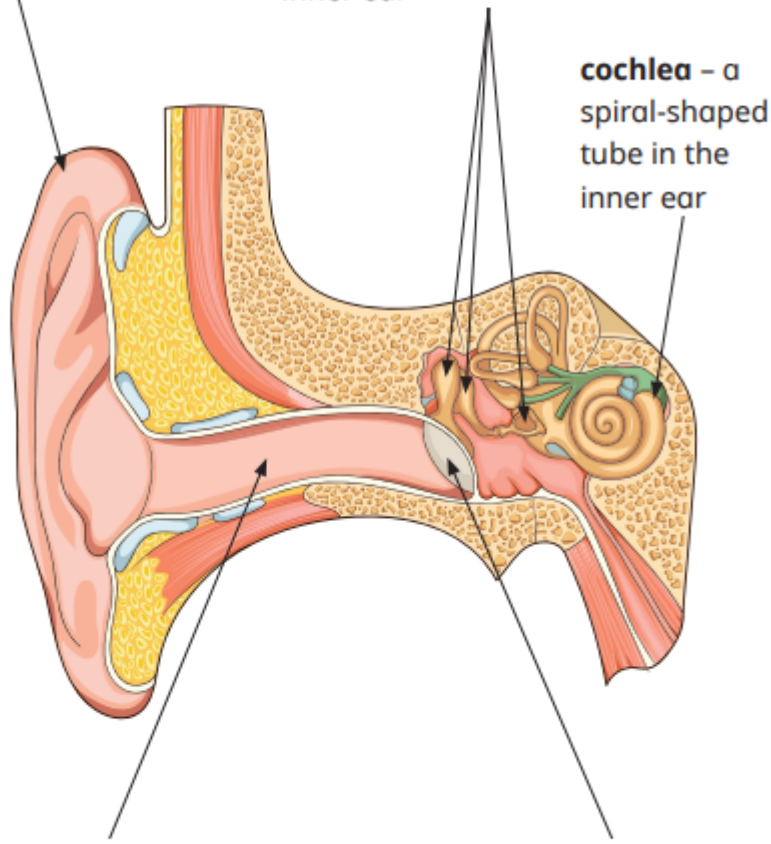
outer ear – the visible part of the ear

ear bones – tiny bones that transfer vibrations from the ear drum to the inner ear

cochlea – a spiral-shaped tube in the inner ear

ear canal – the tube that runs from the outer ear to the ear drum

ear drum – a thin layer that can vibrate



Practical ideas

- Provide children with an unlabelled diagram of the ear.

cochlea

ear canal

outer ear

ear drum

Ask them to match label cards to the parts of the ear.

- Use secondary sources to research the ears of other animals and how they are adapted. Ask questions such as:
 - Do frogs have ears?
 - Why do elephants have large ears?



Factual knowledge

- Sound vibrations travel through the air.
- The outer ear funnels the vibrations into the ear canal.
- The vibrations move down the ear canal.
- The vibrations are passed to the ear drum.
- The vibrations from the ear drum are passed along the ear bones and into the cochlea.
- Signals are then sent to the brain, where they are processed and interpreted as sounds we understand.

Investigate sounds

Notes and guidance

In this small step, children continue to explore sound and understand how the intensity of sound is measured. They learn that the intensity, or loudness, of sound is measured in decibels (dB). Within this step, children should record and measure sound levels over the day to see how the decibel levels increase and decrease. This could include recording the sound level in the classroom in comparison to the playground. Children should also be aware that prolonged exposure to loud sounds can potentially cause damage to the ears.

There are opportunities to use data loggers or decibel meters to record an accurate measure of sound. If data loggers are not available, you can use sound apps as an alternative method for measuring sound levels throughout the day.

Things to look out for

- Children may need support with measuring sound in decibels. If using data loggers or decibel meters, children will need to learn how to use them accurately, as this is the first time they have used this equipment.
- Children have not yet been introduced to decimals, it is important that they record data from the decibel meters as whole numbers.

Key questions

- How is sound measured?
- What equipment is used to measure sound?
- How many decibels is a human talking?
- How many decibels is a human shouting?
- How many decibels is the quietest sound a human can hear?
- What is the level of sound in the classroom?

How is that different from the level of sound in the lunch hall/playground?

- How does the loudness of sound in the classroom change over the day?

National curriculum links

- Identify how sounds are made, associating some of them with something vibrating.
- **Working scientifically** – Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.

Investigate sounds

Key vocabulary

- **sound** – vibrations that travel through the air, or another medium, and are heard when they reach an ear



- **volume** – how loud or quiet a sound is



- **decibel (dB)** – a measure of the loudness of a sound



- **decibel meter** – a piece of equipment used to measure the loudness of sound



- **vibration** – a quick back-and-forth movement



Practical ideas

Children should record the intensity or loudness of sound at different times throughout the day. Examples are highlighted below.

- Record the loudness of sound in the classroom in hourly intervals throughout the day.
- Record the intensity of sound in each classroom from Reception to Year 6. Children can identify which classroom had the highest decibel reading. They may want to identify whether the age of the children in the classroom has an impact on the intensity of sound produced.
- Record and compare the volume of sound in different areas of the school. Suggestions include the playground at playtime, the lunch hall, different lessons during the day and the office of a senior leadership team member.



Factual knowledge

- Sound volume is measured in decibels (dB).
- A decibel is a measure of the loudness of sounds.
- A decibel meter can be used to measure the loudness of sounds.
- If humans are exposed to loud sounds too often, their hearing can be damaged.

Explore volume

Notes and guidance

In this small step, children explore how the strength of the vibrations affects the volume of a sound. They should understand that, in general, louder sounds have bigger vibrations and quieter sounds have smaller vibrations. Children should explore the concept of volume using musical instruments.

Instruments, such as drums and guitars, can be used to demonstrate how the volume of sound can be controlled by the way they are played. When a drum or guitar is played with greater force, the resulting sound is louder because the vibrations produced by the instrument are bigger.

Children could also investigate the concept of sound insulation by experimenting with different materials to measure the reduction in sound volume using decibel meters.

Things to look out for

- Children may find it difficult to make the link between the strength of the vibrations and the volume of a sound. To clarify this, use rice on top of a drum skin to allow children to see if it is struck with a greater force, there is greater movement of the rice grains.

Key questions

- What are vibrations?
- What is volume?
- How can you increase the volume of a sound?
- How can you decrease the volume of a sound?
- How do wooden blocks produce a louder sound than ice cubes?
- Do bigger or smaller vibrations produce louder sounds?
- How do different materials insulate sound?
- Which material would be the best insulator of sound?
Why?
- How will you measure the volume of a sound?

National curriculum links

- Find patterns between the volume of a sound and the strength of the vibrations that produced it.
- **Working scientifically** – Setting up simple practical enquiries, comparative and fair tests.

Explore volume

Key vocabulary

- **vibration** – a quick back-and-forth movement



- **volume** – how loud or quiet a sound is



- **insulate** – to protect something from the transfer of heat, sound or electricity



- **decibel (dB)** – the measurement of the loudness of a sound



- **decibel meter** – a piece of equipment used to measure the loudness of sound



Practical ideas

- Hit a drum softly, then hit the drum harder. Ask children to comment on the difference in volume. How is this linked to the amount of vibration? You can put grains of rice on the drum skin to show the vibrations.
- Children can use four different materials to test which is the best insulator of sound.

Put a loud toy or an alarm clock in a plastic lunch box. Allow children to wrap the box in a different material each time. They should measure the loudness of sound with a decibel meter before and after the object has been insulated, to see the difference in volume.



Factual knowledge

- A vibration is a quick back-and-forth movement.
- Sounds are made when objects vibrate.
- The louder the sound, the bigger the vibration.
- The quieter the sound, the smaller the vibration.

Explore pitch

Notes and guidance

In this small step, children explore the term “pitch”. Children should understand that pitch refers to how high or low a sound is. They should look at a range of instruments and objects (such as elastic bands or different-sized pans) to explore how the pitch of the sound made by different objects can be changed. Children may find it difficult to differentiate between pitch and volume. Practical activities such as using instruments or listening to high- and low-pitched sounds will help address this.

Children also explore the simple shape of some sound waves and how they change with the pitch of the sound. They should understand that a sound with a higher pitch produces vibrations that are faster or more frequent. In contrast, sounds with a lower pitch have vibrations which are slower or less frequent.

Things to look out for

- Children may think that the pitch of an instrument can only be changed in one way. Demonstrate to children that it can be changed in different ways using lengthening/shortening strings or using more or fewer fingers on holes in the instrument.

Key questions

- What is “pitch”?
- When you hit different pans, why do they make different sounds?
- When you pluck the strings on a guitar, which strings have a high pitch and which strings have a low pitch?
- What happens to the pitch of the string when it is tightened and loosened?
- When an elastic band is plucked, how can the pitch be changed?
- How can the pitch of a musical instrument with no strings, such as a trumpet, be changed?

National curriculum links

- Find patterns between the pitch of a sound and features of the object that produced it.
- **Working scientifically** – Identifying differences, similarities or changes related to simple scientific ideas and processes.

Explore pitch

Key vocabulary

- **pitch** – how high or low a sound is



- **high-pitched** – describes a high sound



- **low-pitched** – describes a low sound



- **sound** – vibrations that travel through the air or another medium and are heard when they reach an ear



Practical ideas

- Ask children to stretch an elastic band between their fingers. Stretch the elastic band further and notice any change in pitch when plucked.
- Give children different-sized pans. Allow them to bang the pans and notice any changes in pitch. Ask questions to help children to spot patterns between pitch and the features of the object.



Do larger pans produce a lower pitch?

Do smaller pans produce a higher pitch?



- Pluck different strings on a guitar. Ask the children to describe the differences in pitch.

Factual knowledge

- Pitch means how high or low a sound is.
- High-pitched sounds produce faster or more frequent vibrations.
- Low-pitched sounds produce slower or less frequent vibrations.
- There are different ways to change the pitch of an instrument.

Plan – volume experiment

Notes and guidance

In this small step, children plan a fair test to explore whether distance has an effect on the volume of a sound. Within previous steps, children have recorded the volume of a sound in decibels (dB) using data loggers or sound apps. They should use this skill within this experiment.

When undertaking this experiment, there must be a marked difference in the distances from the sound source, so that the results can show a trend. To produce valid results, the sound source must be the same volume throughout the investigation.

A set sound, such as a recorded noise or a phone alarm, can be used to ensure consistency. A sound produced, for example, by hitting a drum may not have the same volume each time and therefore may provide inaccurate results. Children should be encouraged to create an experiment plan in small groups, so that they get support in making a prediction and creating a logical experiment plan.

Things to look out for

- Children should be aware that background noise can affect the investigation.

Key questions

- What does “volume” mean when thinking about sound?
- What measurement is used to record the loudness of a sound?
- What measurements are used to record distance?
- What will you change in this experiment?
- What will you measure in this experiment?
- What will you keep the same?
- How will you record your results?

Enquiry question

- How does the distance from the sound source affect the volume of the sound?

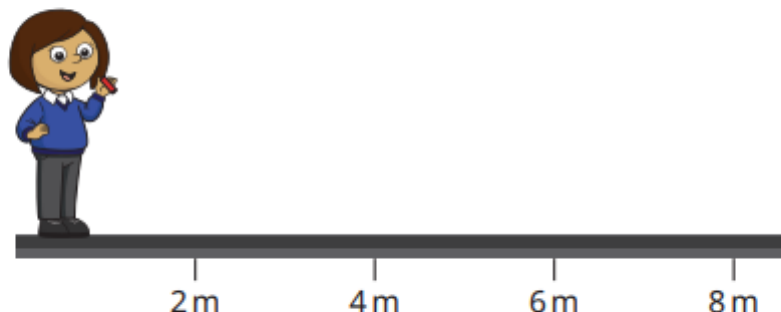
National curriculum links

- Recognise that sounds get fainter as the distance from the sound source increases.
- **Working scientifically** – Setting up simple practical enquiries, comparative and fair tests.

Plan – volume experiment

Experimental variables

- **independent variable** (what will change) – the distance from the sound source



- **dependent variable** (what will be measured) – the volume of the sound heard in decibels



- **controlled variables** (what is kept the same) – the volume of the sound source and the level of background noise (wherever possible)



Equipment needed

- consistent sound source (an alarm or a recorded sound)
- metre ruler or tape measure



- decibel meter, or a decibel meter app on a tablet



Practical activity

- Put children in small groups.
Give each group the equipment needed for the experiment.
Children should identify what the equipment is and why it is used within the experiment.

Planning sentence stems

- I predict that ...
I think this will happen because ...
- We are changing the ...
- We are measuring the ...
- We are keeping the _____ the same.

Investigate – volume experiment

Notes and guidance

In this small step, children carry out a fair test to explore how the distance from a sound source affects the volume. Children should set up practical equipment and make systematic and careful observations throughout.

When undertaking this experiment, it will be difficult to eradicate background noise and therefore this may influence the data they collect. If possible, children could undertake the experiment in a quiet room, such as a hall, to reduce background noise as much as possible. The sound source must be of a consistent volume throughout the investigation, so an alarm or a recorded sound should be used rather than an instrument such as a drum.

Things to look out for

- Children have not yet looked at decimals in maths. As a result, they should record the volume of sounds using integers to avoid confusion with decimals.
- Children may need support with measuring distance in metres. This skill may need modelling to children before they undertake their investigation.

Key questions

- What is your experiment plan?
- What are you changing?
- What are you measuring?
- What are you keeping the same?
- Is there any background noise?
What does the background noise measure on the decibel meter?

Enquiry question

- How does the distance from the sound source affect the volume of the sound?

National curriculum links

- Recognise that sounds get fainter as the distance from the sound source increases.
- **Working scientifically** – Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.

Investigate – volume experiment

Key vocabulary

- **volume** – how loud or quiet a sound is



- **decibel (dB)** – the measurement of the loudness of a sound



- **decibel meter** – a piece of equipment used to measure the loudness of sound



- **ear** – organ in humans and many other animals that detects vibrations, allowing hearing



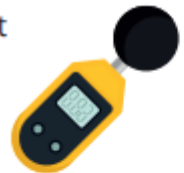
- **background noise** – any type of noise that is not the sound that you are listening to or measuring

Equipment needed

- consistent sound source (an alarm or a recorded sound)
- metre ruler or tape measure



- decibel meter, or a decibel meter app on a tablet



Method

1. Use a sound source with a consistent volume.
2. Place the object on a chair/table. This will be measured as 0m.
3. Use a metre stick to measure intervals at 2m, 4m, 6m and 8m.
4. If the classroom is not large enough, then the measurements can be taken in the hall or outside.
5. Play the sound from 0m and record the decibel level.
6. Repeat this process at distances of 2m, 4m, 6m and 8m.
7. Discuss with children whether distance from the sound source affects the volume of a sound.

Evaluate – volume experiment

Notes and guidance

In this small step, children evaluate their volume experiment. They should work scientifically to analyse data, make conclusions and evaluate their experiment. Within this step, children should be given the opportunity to answer the enquiry question and discuss how the distance from a sound source affects the volume. They should conclude that the greater the distance from the sound source, the quieter the sound will be.

Children could compare their data with other groups to allow them to spot patterns and identify any anomalous results. In Year 4, children do not need to use the term “anomalous”, but they should be encouraged to spot any differences in data and discuss why this may have occurred.

Things to look out for

- Children may think that simply repeating the experiment will increase the reliability of their results. This is not the case. If the investigation is inaccurate, repeating it will just generate more inaccurate results.
- With support, children need to identify factors that could be controlled next time to ensure their results are more reliable.

Key questions

- Was there any background noise?
- What did the background noise measure on the decibel meter?
- Does the sound get louder or fainter as the distance from the sound source increases?
- What conclusions can you make from your data?
- If you were to repeat this experiment, how could you improve your results?
- What questions do you have for further investigation?

Enquiry question

- How does the distance from the sound source affect the volume of the sound?

National curriculum links

- Recognise that sounds get fainter as the distance from the sound source increases.
- **Working scientifically** – Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.

Evaluate – volume experiment

Key vocabulary

- **conclusion** – what has been found out during an investigation based on experimental measurements and observations

Distance (metres)	Volume of sound (decibels)
0	67
2	60
4	56
6	51
8	47

- **volume** – how loud or quiet a sound is



- **decibel (dB)** – the measurement of the loudness of a sound



- **evaluate** – to consider the quality of the results recorded and suggest improvements to the investigation

Practical ideas

- Children could explore whether **doubling** the distance from the sound source **halves** the number of decibels of sound heard.
- Children could repeat the experiment in different areas of the school to see whether there are trends in data. For example, they could complete the experiment in the lunch hall, then outside in the playground.
- Children may want to investigate whether high- or low-pitched sounds can travel further. Children can choose an object that makes a high-pitched sound and take sound readings at set intervals. They could then repeat this investigation with an object that makes a low-pitched sound. They could then compare their data from the two investigations.

Evaluation sentence stems

- I predicted that ...
My prediction was correct/incorrect because ...
- From looking at our results, I can see that ...
This happened because ...
- To make our investigation more accurate, we could ...
- For future investigation, I would like to find out ...