Year 7 Science Distance Learning Booklet

Waves: Sound

CANSFIELD

ACHIEVING EXCELLENCE TOGETHER

Name: .....

Science Teacher: .....

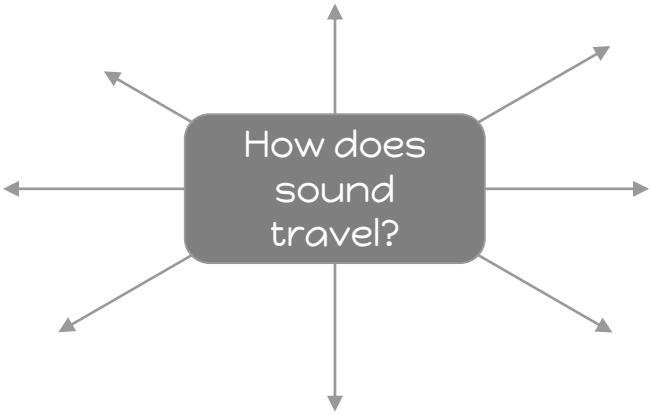
Lesson 1 Sound waves and speed

Learning objective: To be able to describe how sound travels

Learning outcomes:

- I will be able to state the speed of sound
- I will be able to describe how sound waves are made

Starter: Take 5 minutes to form a spider diagram of everything that you know about sound and how it travels, this can be keywords, knowledge from primary school or anything that you know from everyday life:



If you very gently press the front of your throat while you are taking, you will feel a vibration. This is your vocal chords vibrating. The vibration produces the sound waves that travel though the air from your mouth.

Some people think that sound just 'dies away'. It doesn't. It spreads out as it moves away from the source.

Read the text and answer the questions that follow

After an earthquake, rescuers search for survivors under the rubble of fallen buildings. Every few minutes everyone stops what he or she is doing to listen very carefully. The rescuers are listening for shouts from survivors but more often they can hear tapping sounds when survivors tap stones or metal pipes. One person was rescued after 11 days trapped under rubble when the rescuers heard faint tapping sounds.

The table shows the speeds of sound in different materials.

Material	Speed of sound (m/s)	Type of substance
aluminium	6 400	solid metal
steel	5 800	solid metal
brick	4 200	solid non-metal
wood	3 600	solid non-metal
glycerol	1 900	liquid
water	1 500	liquid
mercury	1 450	liquid metal
helium	970	gas
air	340	gas
carbon dioxide	260	gas

Questions

1. State the speed of sound in air. Give the units.

_____

2. State whether sound travel fastest in solids, liquids, or gases.

_____

3. Explain why a sound travelling along a steel rod and an identical wooden rod reaches the end of the steel rod sooner.

_____

_____

4. Sounds travel through materials by passing vibrations from particle to particle. Particles in solids are very close together. They pass on vibrations better than particles in gases, which are far apart. Use this information to explain why tapping sounds from survivors after earthquakes travel better than shouting for help.

_____

_____

Extension

1 Fill in the boxes to show how particles are arranged in solids, in liquids, and in gases.

Solid	Liquid	Gas

2. Explain why sounds do not travel as quickly through liquids as through solids.

_____

_____

_____

3. The Sun is incredibly noisy. The space between Earth and the Sun is called a 'vacuum', a place where there are no particles. Use these ideas to explain whether sounds from the Sun can reach Earth.

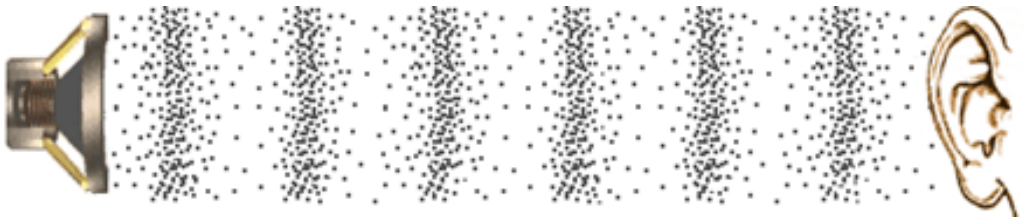
_____

_____

_____

Light travels much faster than sound. The speed of light is 300 000 000m/s where as the speed of sound is around 330m/s.

Sound travels as a wave. It is produce by vibrations which make air molecules move backwards and forwards. Sound waves travel as a longitudinal wave.



Dolphins and whales use sound waves to communicate underwater. Elephants stamp their feet when a predator comes near which sends vibrations through the ground to other elephants to warn them.

 Checkpoint:
Explain why we see lightning before we hear the thunder

……...

……...

Challenge:
When the film ‘Alien’ was first released the film poster had the slogan ‘In space no one can hear you scream’. Explain why is this is correct scientific information.

……...

……...

Plenary:
Return to your original spider diagram and add new knowledge to this in a different coloured pen.

Lesson 2 Loudness and amplitude

Learning objective: To be able to describe the link between amplitude and loudness

https://www.bbc.co.uk/bitesize/guides/z8d2mp3/revision/1

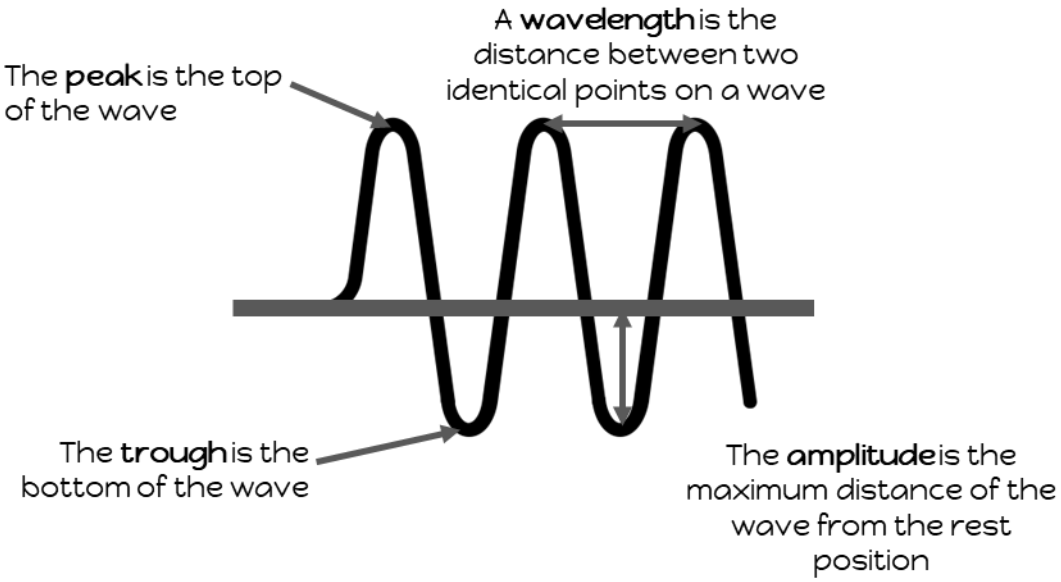
Learning outcomes:

- I will be able to identify the amplitude of a wave on a diagram
- I will be able to describe how sound waves change with volume
- I will know that sound waves can be absorbed and reflected

Starter:

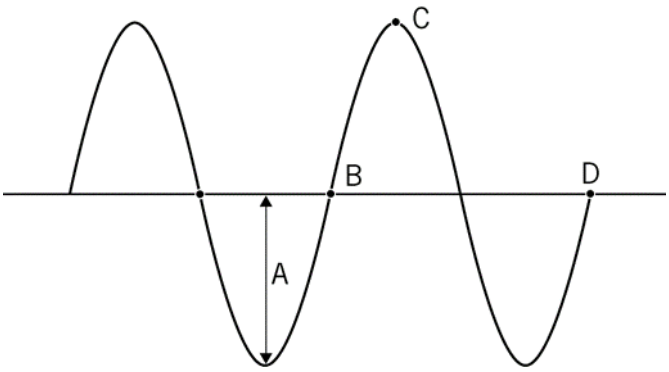
Sound is produced by objects that are v_____ . This makes the air molecules m_____ forwards and backwards producing a sound wave. Sound travels fastest in s_____ and slowest in g _____ . It cannot travel through a v_____ because there are no p_____ .

Features of a wave



Sound can be displayed on an oscilloscope screen. Even though sound is a longitudinal wave it is displayed on the screen as a transverse wave, The wave changes shape as it gets louder or softer or changes pitch.

The diagram shows a transvers wave



Fill in the table to name the parts of the wave shown in the diagram
Choose from the following words:

amplitude **peak** **trough** **wavelength**

Part of the wave	Part of the diagram
	B–D
	A
	C

2. Use your answer to Question 1 to define what is meant by amplitude, frequency and wavelength

Amplitude: _____

_____

Frequency: _____

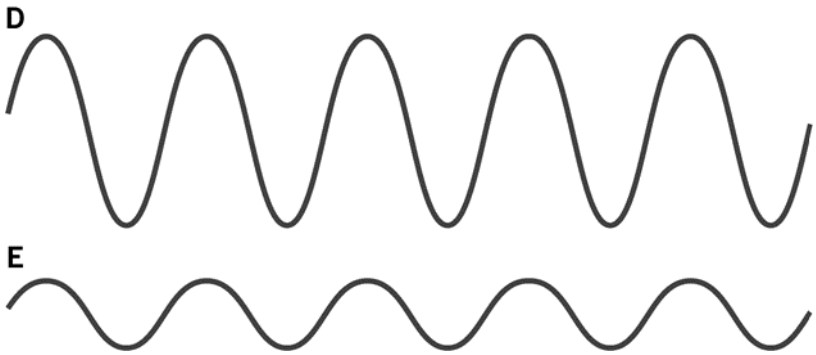
_____

Wavelength: _____

_____

_____

Wave D below has a larger amplitude than wave E. This means wave D shows a LOUDER sound than wave E.



A loud sound has a bigger amplitude than a soft sound. It transfers more energy. To make a louder sound you need to make the vibration bigger.

Checkpoint: Choose the correct word from those in bold

A wave is a vibration that transfers **energy/matter**. The distance from the middle to the top of the wave is the **amplitude/wavelength**. The distance from one crest to the next crest is the **amplitude/wavelength**. Loudness depends on **wavelength/amplitude**. Sound waves are l**ongitudinal/light** waves, which means the vibration is in the **same/ a different** direction to that of the wave.

Sound and materials

A sound wave can be absorbed which decreases its volume and makes it sound quieter. Sound can also be reflected from surfaces, like in large caves or from buildings. We call the reflection of sound an echo. Echoes can be used to find distances to objects, like the bottom of the sea.

Lesson 3 Frequency and pitch

Learning objective: What is the link between frequency and wavelength

https://www.bbc.co.uk/bitesize/topics/zgffr82/articles/z3j3jty

https://www.bbc.co.uk/bitesize/guides/zwd2bk7/revision/4

Learning outcomes:

- I will be able to describe the frequency of a wave from a diagram
- I will be able to describe how sound waves change with pitch
- I will be able to state the unit of frequency

The pitch of a note depends on the frequency. High-pitch sounds have a high frequency and low-pitch sounds have a low frequency. Frequency is measured **hertz (Hz)** or **kilohertz (kHz).** To make a higher-pitched sound you need to make something vibrate faster so there are more waves per second.

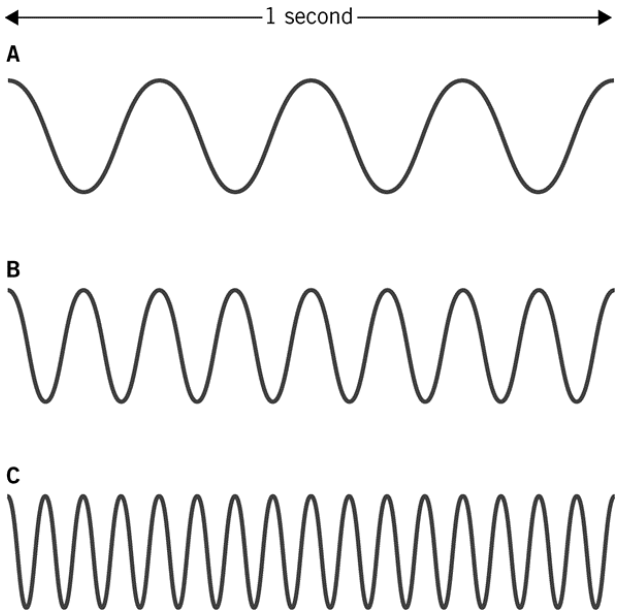
Sort the following actions into groups describing whether it changes pitch or loudness.

Pluck a shorter harp string **Tighten a drum skin** **Loosen a guitar string**

Blow a trumpet harder **Hit a drum softer** **Use a mute in a trombone**

Changes pitch	Changes loudness

Frequency is the number of waves per second. Look at the diagrams below and answer the questions.



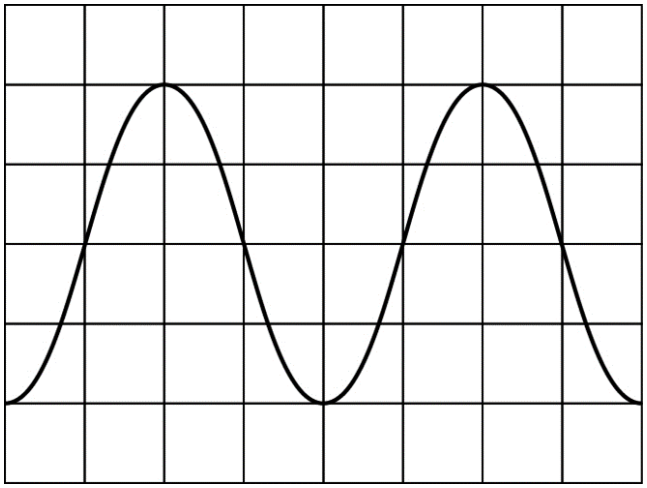
1. Which of the waves A, B or C has the highest frequency? How do you know?

   _____

2. Which wave has the highest pitch? _____

3. What is the frequency in Hertz of wave A (number of waves per second) _____Hz

4. In the space below, draw a wave with the same frequency as wave A but with a louder volume



5. How many squares are there between the two peaks? _____

6. Each square represents 1 ms (0.001 s). Find the **time period** of the wave by multiplying the number of squares between peaks by 0.001s.

   _____

   _____

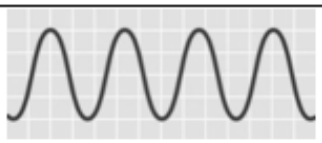
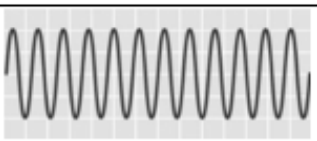
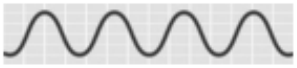
7. Calculate the frequency of the wave using the formula: Frequency = $\frac{1}{Time\ period}$

   _____

   _____

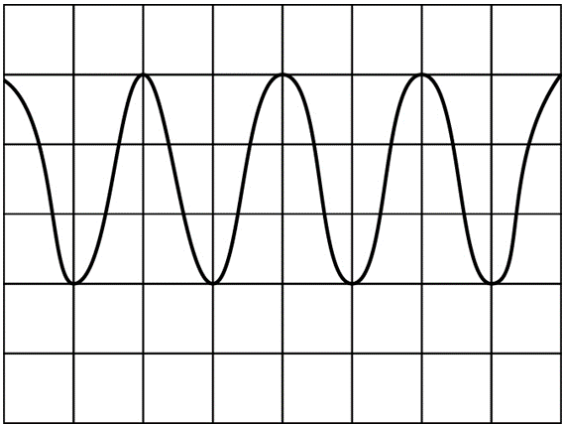
Checkpoint:

Match the waves below to the description in the boxes.

quiet sound, low pitch	
loud sound, low pitch	
loud sound, high pitch	

Extension:

What is the frequency of the wave shown by the oscilloscope trace below?



Each square represents 1 ms (0.001 s).

Questions

The table includes information about animals and the sounds they make and hear. The loudness of sounds is measured in decibels (dB). The loudest sound has the most decibels.

Animal	Hearing range (Hz)	Loudest sound produced (dB)
human	20–20 000	90
dog	40–60 000	113
elephant	10–10 000	117
howler monkey	100–30 000	140
cat	30–50 000	100
bat	3 000–120 000	100

1. Name the animal that can hear the highest sounds _____

2. Name the animal that can hear the lowest sounds _____

3. Name the animal that can make the loudest sounds _____

4. Name all the animals that can hear sounds too high for humans to hear.

_____

5. Calculate the range of human hearing. Show your working.

_____

_____

Lesson 4 The ear and hearing

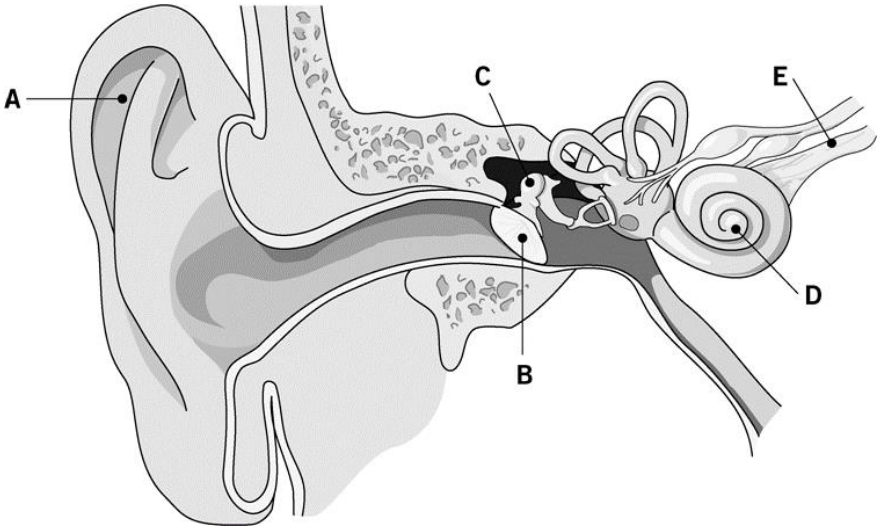
Learning objective: To learn how the ear works

https://www.bbc.co.uk/bitesize/guides/z8d2mp3/revision/2

Learning outcomes:

- I will be able to name some parts of the ear
- I will be able to describe how the ear works
- I will be able to describe how hearing can be damaged

Watch the BBC bitesize clip and then name the parts of the ear on the diagram below



Label	Part of the ear
A	
B	
C	
D	
E	

1. The part of the ear that directs sound into your auditory canal is the p_____
2. The e_____ vibrates passing the vibrations on to the ossicles (small bones) in the middle ear which makes the oval window vibrate.
3. This passes the vibrations on to liquid in the c_____ . This contains thousands of tiny hairs. As the liquid moves, the hairs move. The hairs change the movement into an electrical signal.
4. The electrical signal is carried to the brain along the _____ nerve.

Joe

Joe played the drums in a rock band several times a month and sat next to the loudspeakers.

After each gig Joe's ears would ring and he couldn't hear conversations but his hearing recovered after a few hours. Joe's friends asked him to wear earplugs or sit somewhere else but he wouldn't. When Joe wasn't playing at a gig he was listening to his favourite bands on his mp3 player for inspiration. He used earbud headphones to block out other sounds. After a few months Joe couldn't hear conversations clearly and needed to turn up the volume on his mp3 player. Joe started hearing a ringing sound in his ears most of the time and music sounded muffled.

Joe's dad

Joe's dad worked in a factory with constant noise from machinery. All workers wore earmuffs to protect their hearing from the constant noise. Joe's dad said the ringing sound was noise-induced tinnitus and it would get worse unless Joe stopped damaging his hearing.

Joe and his dad both damaged their hearing because of noise exposure. Loud noises over a period of time damage hairs in the cochlea. Decibels measure how loud sounds are. Sounds less than 80 decibels do not damage these hairs but loud music through headphones (90 decibels) for half an hour a day will. Damage from a rock concert (100 decibels) can happen after just 15 minutes. The factory where Joe's dad worked produced sound levels of 95 decibels. To begin with, the hairs can recover and the damage is reversible but after a while the damage becomes permanent.

Questions

1. Describe how Joe damaged his hearing. Include the length of time that each activity needs to go on to cause damage

_____

_____

_____

2. Describe three effects of damaged hearing

_____

_____

3. Suggest two ways that Joe can protect his hearing

_____

_____

Plenary: Use the grid below to recall five facts from each of the lessons in the topic, you can use images to help with this if you feel it is beneficial, but these would need to be clearly annotated (labelled).

Topic	Sound waves and speed	Loudness and amplitude	Frequency and pitch	The ear and hearing
Fact One				
Fact Two				
Fact Three				
Fact Four				
Fact Five				