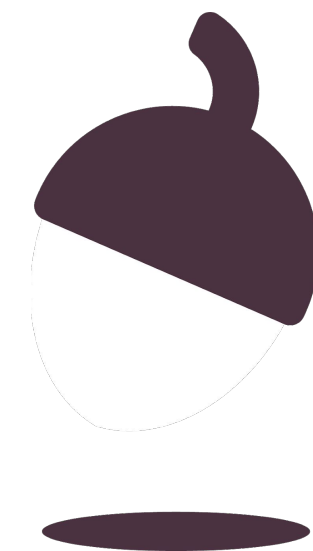


Physics - Key Stage 4 - Waves

Sound Worksheet

Miss Walrond



OAK
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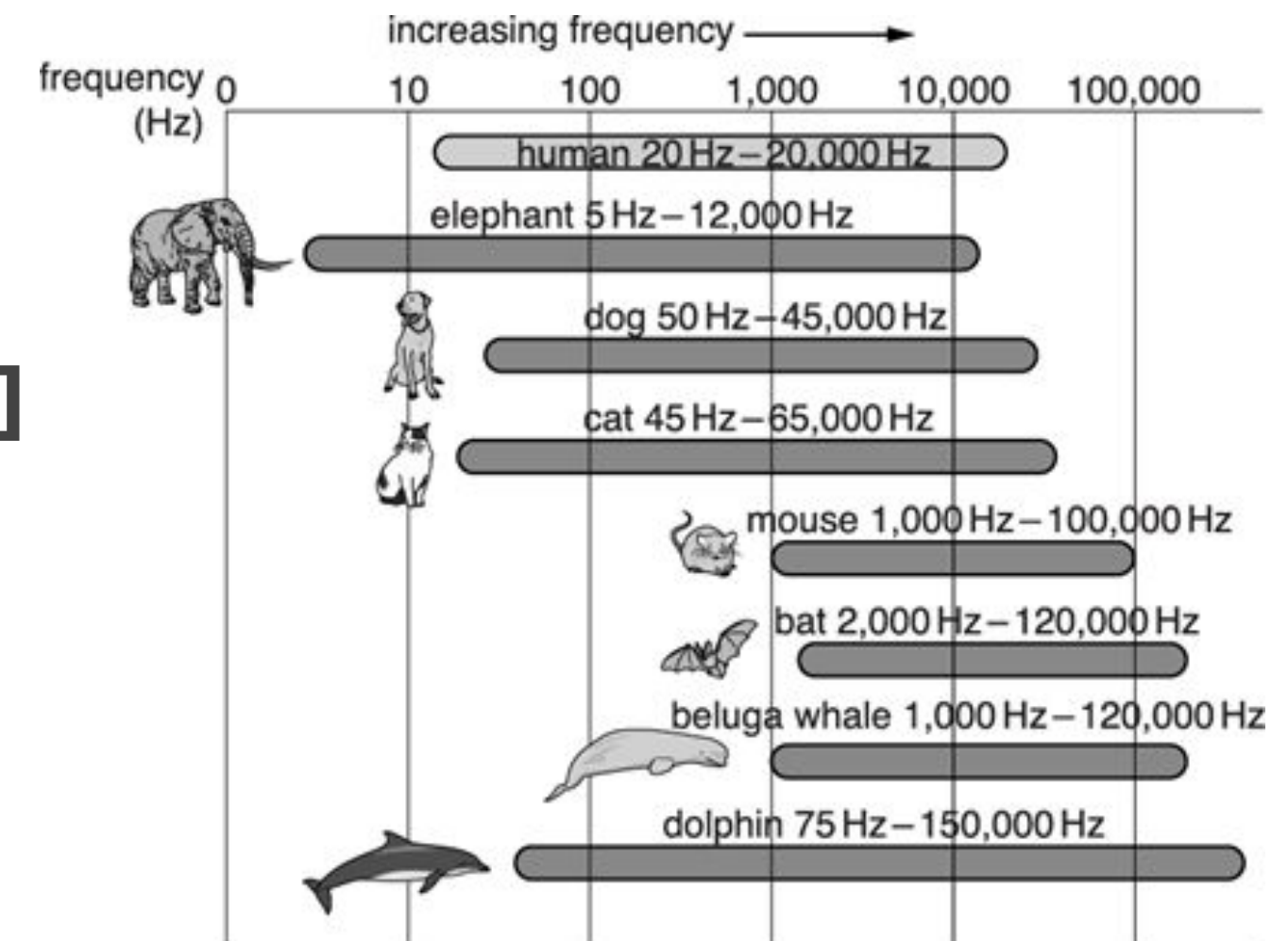
Q1.

(a). Rene researches the range of sounds that different animals can hear.

She finds the lowest and highest frequency sounds the animals can hear.

Look at some of her research data.

- i. Which animal can hear the lowest frequency? **[1]**
- ii. Which animal can hear the highest frequency? **[1]**
- iii. Which animal has the largest frequency range of hearing? **[1]**



OCR, Gateway Physics A, Paper B752/01, June 2015



Q1. (b). Rene's research shows that
‘The average person has a hearing range from 20 Hz up to 20 000 Hz.’

Rene tests the hearing range of a group of people.

Look at the data she collects.

Rene has not completed her table.

i. Which person has the largest frequency range of hearing?

Explain your answer using a calculation.

[2]

Person	Lower frequency limit of hearing in Hz	Upper frequency limit of hearing in Hz	Frequency range of hearing in Hz
Jane	22	19000	18978
Alec	19	20000	19981
Dionne	24	20100	
Niamh	16	19800	19784
Evangelos	15	20000	19985
average	19.2		19760.8

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Q1.

(b). ii. Calculate the average upper frequency limit of hearing for this group of people.

Answer Hz **[2]**

Person	Lower frequency limit of hearing in Hz	Upper frequency limit of hearing in Hz	Frequency range of hearing in Hz
Jane	22	19000	18978
Alec	19	20000	19981
Dionne	24	20100	
Niamh	16	19800	19784
Evangelos	15	20000	19985
average	19.2		19760.8

iii. Rene's original research shows a lower frequency limit of human hearing of 20 Hz. The data she collects shows an average lower frequency limit of 19.2 Hz.

Suggest reasons for this difference. **[3]**



Answers



Q1. Answers

1. (a). i. Elephant (1)
ii. Dolphin (1)
iii. Dolphin (1)

- (b). i. Dionne (1) $20,100 - 24 = 20,076$. This is the largest range.
ii. 19,780 is awarded 2 marks.

But if answer is incorrect or incomplete then 1 mark can be awarded for a correct mean calculation.

- iii. **Any 3 from:** inaccurate measurements, unreliable measurements, idea of different sample size, the sample isn't representative, some may have a hearing defect or different ages in the sample.



In lesson Questions



Independent Task - Sound Waves

Describe a sound wave. You should include the following points:

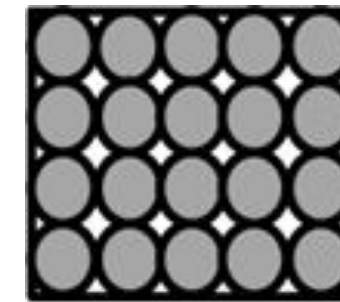
- Transverse or longitudinal?
- Why can't a sound wave travel in a vacuum?
- A link to pitch and volume.



Independent Task - Examination Question

i. Below are diagrams showing the particle arrangements in solids, liquids and gases. Match the diagram to the correct label.

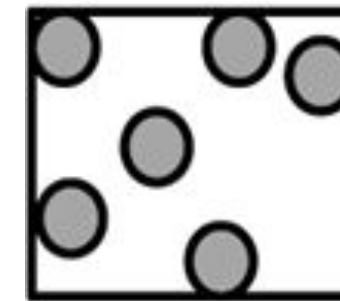
[2]



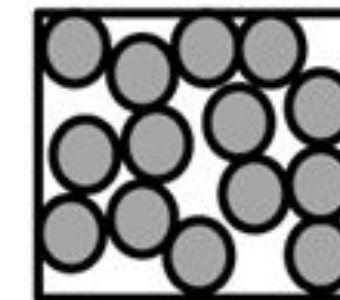
Gas

ii. Sound waves travel through materials by making the particles in the material vibrate.

Use this idea and your knowledge of the particle model of matter to explain why sound travels much faster through water than through air. [2]



Liquid



Solid

Answers as discussed in the next slide have not been seen or verified by OCR.
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Independent Task - The Ear

Sort these statements into the correct order.

- The sound initially reaches the pinna.
- These vibrations are then transferred to the 3 tiny bones in the ear they include the malleus, incus and stapes.
- From here the sound waves cause the ear drum to vibrate.
- The vibrations are then transferred to the cochlea
- It is then directed into the ear canal.
- Tiny hairs in the cochlea vibrate and create electrical signals which are sent to the brain. These signals are interpreted as sound.



Independent Task

- 1) What is the human hearing range?
- 2) What is the name given to sound below this range?
- 3) What is the name given to sound above this range?
- 4) Explain why there is a limit to the frequencies of sound that can be transmitted into solids.

Sound travels in solids via the vibrations

...

At high frequencies, the acceleration ...



Answers



Independent Task - Sound Waves

Describe a sound wave. You should include the following points:

Sound waves are **longitudinal waves**. This means that the oscillations of the waves are **parallel** to the direction of energy transfer. They are **mechanical waves**, which means that they need a medium to propagate through. This is why sound waves **cannot** travel through a **vacuum**.

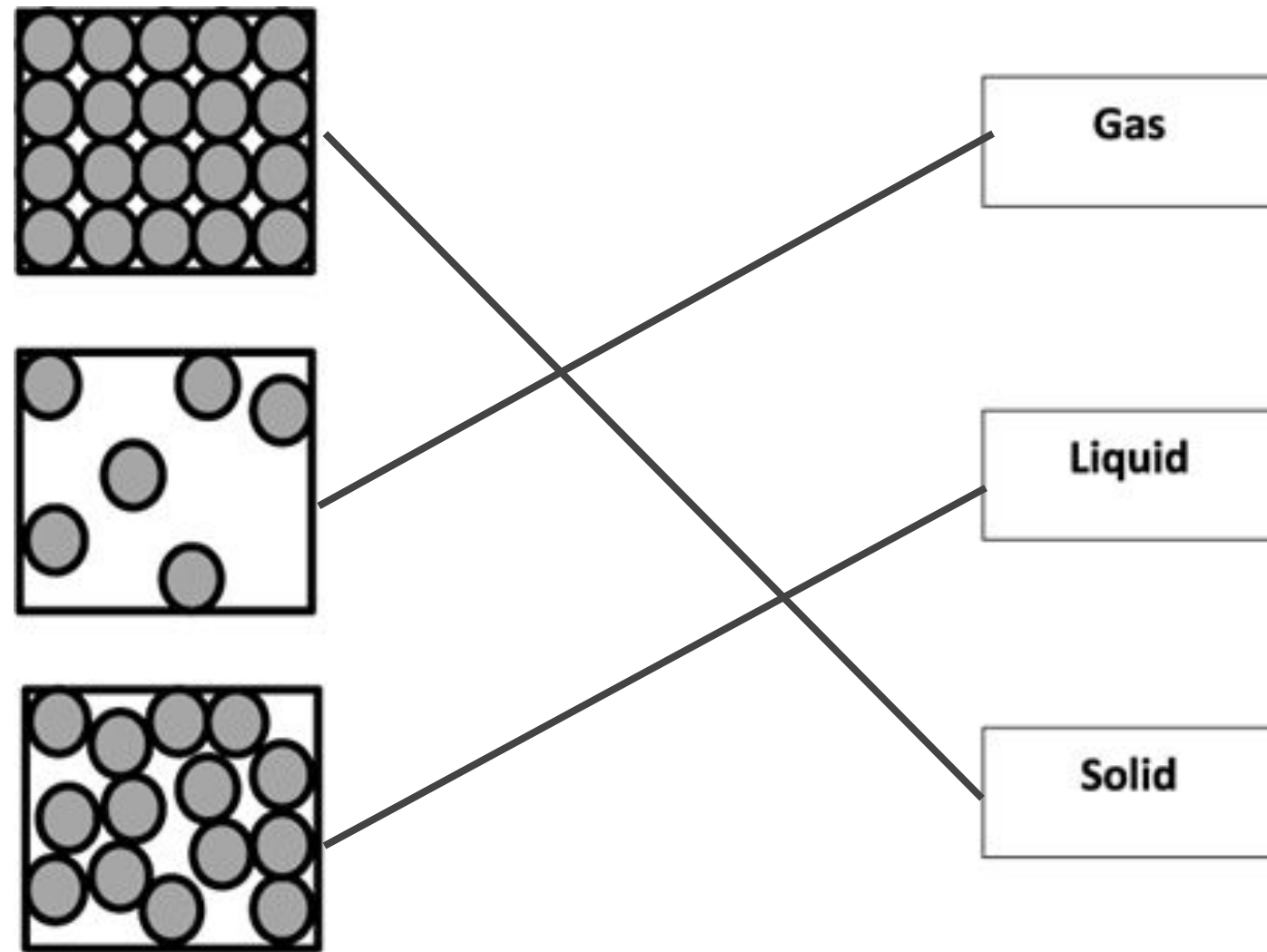
When describing sound waves the **pitch** is related to the frequency, and the volume is related to the **amplitude**.



Review: Independent Task - Examination

Question

i.



ii. In water (liquids) the particles are closer together **[1]**

This makes it easier for vibrations to be transmitted. **[1]**

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OCR, Twenty First Century Physics B, Paper J259/01, Specimen



Review: Independent Task - The Ear

Sort these statements into the correct order.

- The sound initially reaches the pinna.
- It is then directed into the ear canal.
- From here the sound waves cause the ear drum to vibrate.
- These vibrations are then transferred to the 3 tiny bones in the ear they include the malleus, incus and stapes.
- The vibrations are then transferred to the cochlea
- Tiny hairs in the cochlea vibrate and create electrical signals which are sent to the brain. These signals are interpreted as sound.



Review - Independent Task

- 1) What is the human hearing range? **20 - 20,000 Hz**
- 2) What is the name given to sound below this range? **Infrasound**
- 3) What is the name given to sound above this range? **Ultrasound**
- 4) Explain why there is a limit to the frequencies of sound that can be transmitted into solids.

Sound travels in solids via the vibrations **of atoms within the solid**.
At high frequencies, the acceleration **of the atoms becomes very high also, which requires large forces between the atoms**.

