



KS3 Science

Sound

Question Paper

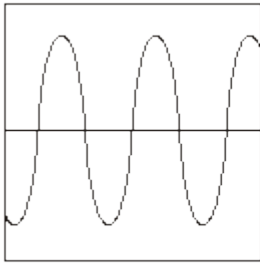
Time available: 42 minutes

Marks available: 50 marks

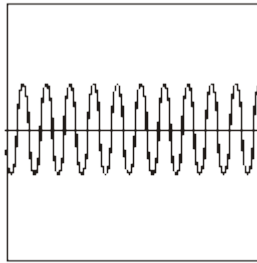
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1.

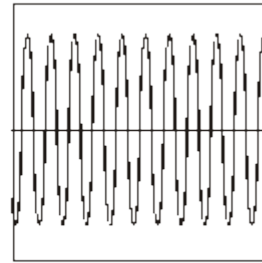
(a) The diagrams below show the patterns produced on an oscilloscope by three different sound waves.



A



B



C

(i) Which **two** waves have the same loudness?
Write the letters.

..... and

How do the diagrams show this?

.....
.....

1 mark

(ii) Which **two** waves have the same pitch?
Write the letters.

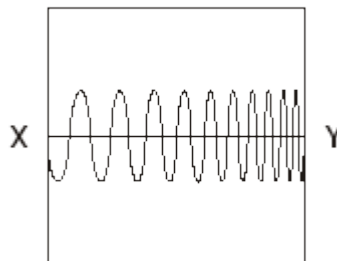
..... and

How do the diagrams show this?

.....
.....

1 mark

(iii) Shuli is listening to a sound that produces the pattern below.



Describe how the sound that Shuli **hears** changes between X and Y.

.....

1 mark

- (b) The table below shows the maximum time a person can listen to music at different sound levels without damage to the ear.

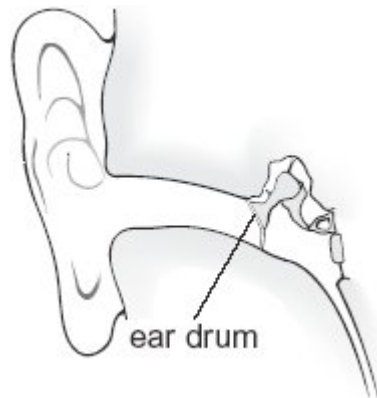
sound level (decibels)	maximum time (hours)
86	8
88	4
90	2
92	1
94	0.5

Estimate the maximum time a person could listen to a sound of 87 decibels.

..... hours

1 mark

- (c) The diagram below shows part of the human ear.



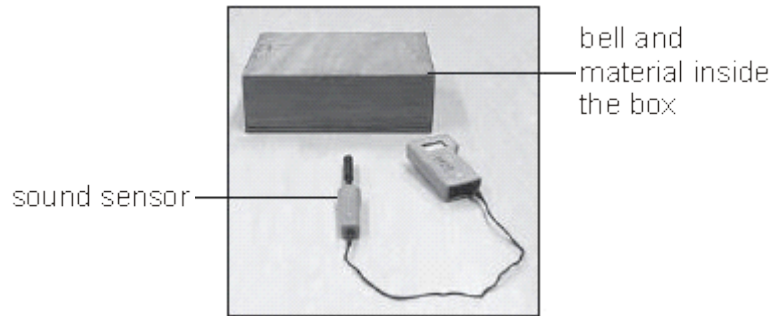
What happens to the ear drum as a sound gets louder?

.....
.....

1 mark
maximum 5 marks

2.

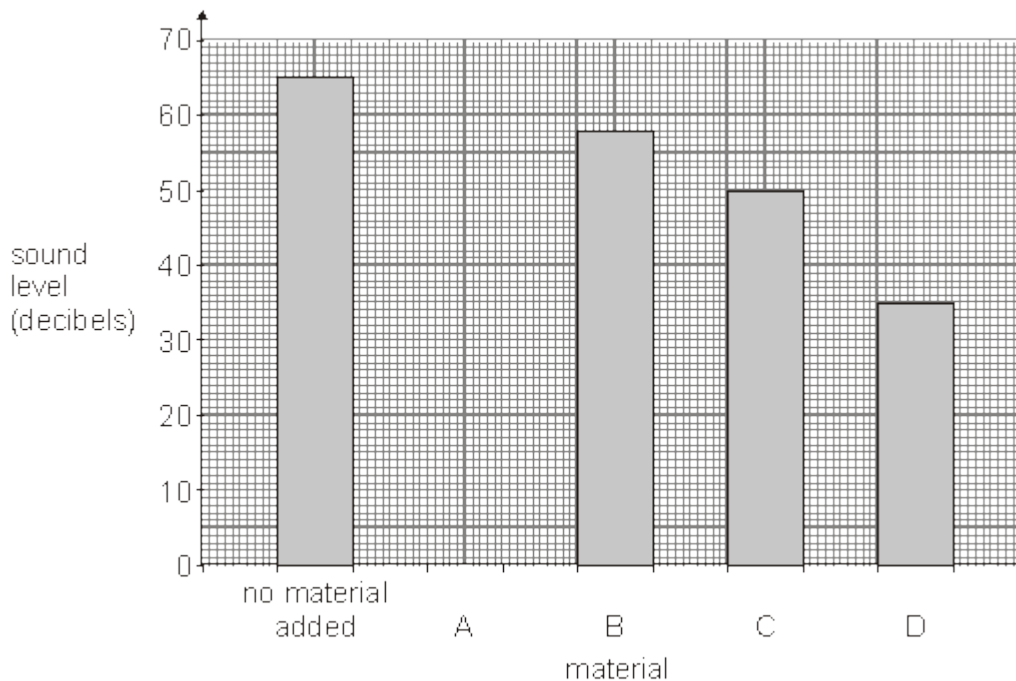
John investigated which material would be best for sound-proofing. He put a bell inside a box. He covered the bell with each material in turn. He put a sound sensor outside the box to record the sound level.



He tested different materials and got the following results.

material	sound level (decibels)
no material added	65
A	40
B	58
C	50
D	35

(a) On the chart below, draw the bar for **material A**.



1 mark

(b) How many types of material did John test?

.....

1 mark

(c) Which material was best at stopping the sound going through?
Give the correct letter.

.....

1 mark

(d) Which **two** things should John have done to make his test fair?
Tick the **two** correct boxes.

Use the same box each time.

Make sure a different person recorded the results each time.

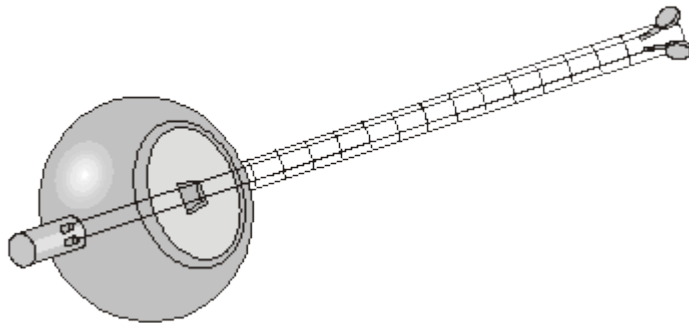
Use the same material each time.

Keep the distance between the sound sensor and the bell the same each time.

Test each material in a different room.

2 marks
maximum 5 marks

3. The dotar is a musical instrument with two strings.



(a) Aftal plays the dotar very quietly.

What must he do to the strings to make a louder sound?

.....
.....

1 mark

(b) Aftal makes the strings tighter so they vibrate more quickly.

How does this affect the sound produced by the strings?

Tick the correct box.

The sound has a lower pitch.

The sound is louder.

The sound has a higher pitch.

The sound is quieter.

1 mark

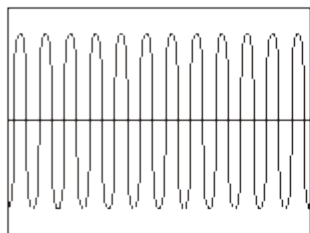
(c) One of the strings is thicker than the other, so it vibrates more slowly.

In what way is the sound made by the thicker string different from the sound made by the thinner string?

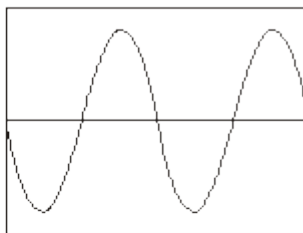
.....

1 mark

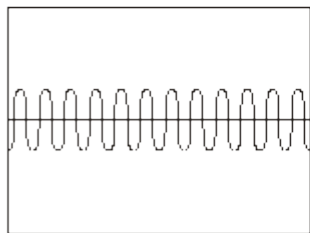
(d) Aftal played the dotar near a microphone connected to an oscilloscope. The diagrams below show the patterns made by four sounds.



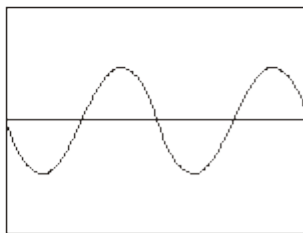
A



B



C



D

(i) How does the sound shown in trace A differ from the sound in trace B?

.....
.....

1 mark

(ii) How does the sound shown in trace A differ from the sound in trace C?

.....
.....

1 mark
maximum 5 marks

4.

(a) (i) Air contains nitrogen.

In the box below draw **five** circles, ○, to show the arrangement of particles in nitrogen gas.



1 mark

(ii) Zeena carries a personal emergency alarm. It uses nitrogen gas to produce a very loud sound.



The nitrogen gas in the container is under much higher pressure than the nitrogen gas in the air.

How does the arrangement of nitrogen particles change when the gas is under higher pressure?

.....
.....

1 mark

(b) Use words from the boxes below to complete the sentence.

greater than

less than

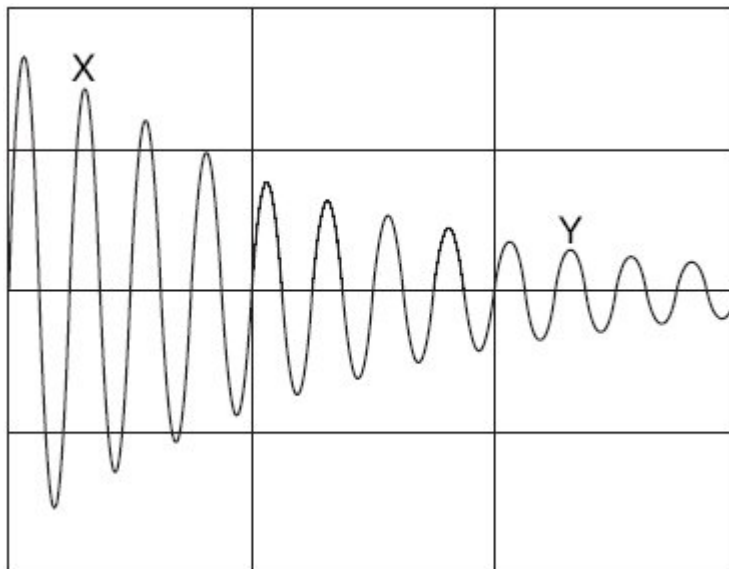
the same as

The rate at which the nitrogen particles hit the inside of the container is the rate at which nitrogen particles hit the outside of the container.

1 mark

- (c) Zeena pushes the lid down and nitrogen gas escapes through the diaphragm. The diaphragm vibrates and produces a sound.

The pattern on the oscilloscope screen below represents the soundwave produced by the alarm.



- (i) The loudness of the sound produced by the alarm decreases between X and Y.

How can you tell this from the graph?

.....
.....

1 mark

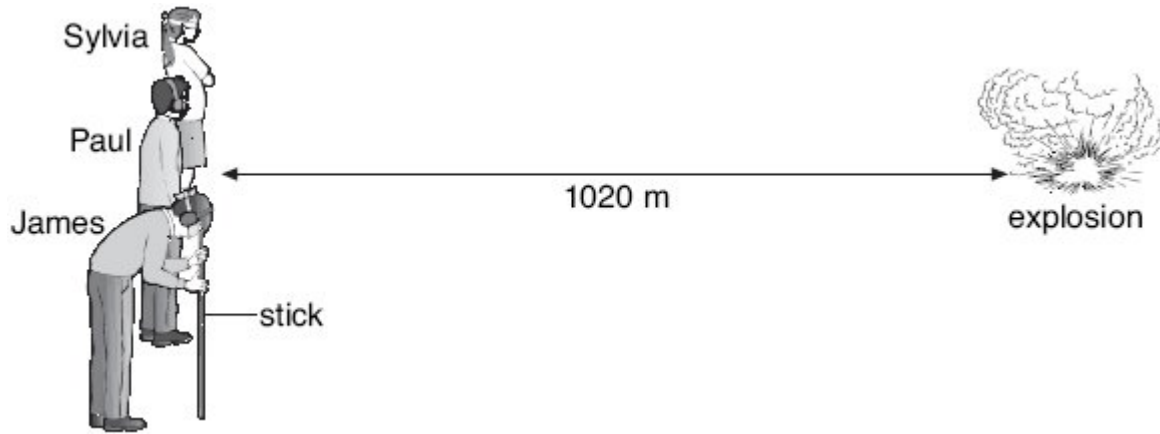
- (ii) The pitch of the sound produced by the alarm stays the same between X and Y.

How can you tell this from the graph?

.....
.....

1 mark
maximum 5 marks

- 5.** Three pupils took part in an investigation into the speed of sound. All three pupils stood 1020 m from an explosion.



- Sylvia wore a blindfold.
- Paul wore ear defenders.
- James wore a blindfold **and** ear defenders. He rested his head on a wooden stick pushed into the ground so that he could feel vibrations.

The explosion produced sound and light at the same time. The table shows the speed of sound in two different materials.

material	Speed of sound (m/s)
air	340
soil	3200

(a) Use all the information above to help you answer parts (i) and (ii) below.

(i) In which order would the pupils notice the explosion?

first

second

third

1 mark

(ii) From the information given, calculate the time it would take for the sound to travel through the air to Sylvia.

.....

..... s

1 mark

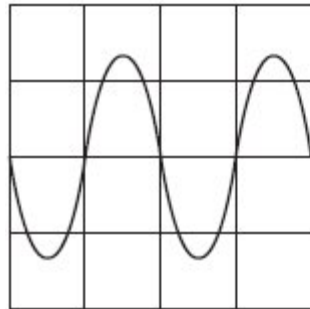
(b) Another pupil, Nasah, stood 2000 m away from the explosion.

- (i) The sound heard by Nasah was quieter than the sound heard by Sylvia.
The further sound travels the quieter it becomes.
Give the reason for this.

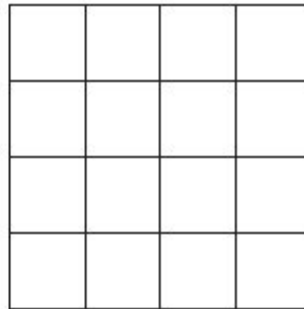
.....
.....

1 mark

- (ii) The oscilloscope trace below represents the sound Sylvia heard.



Sylvia



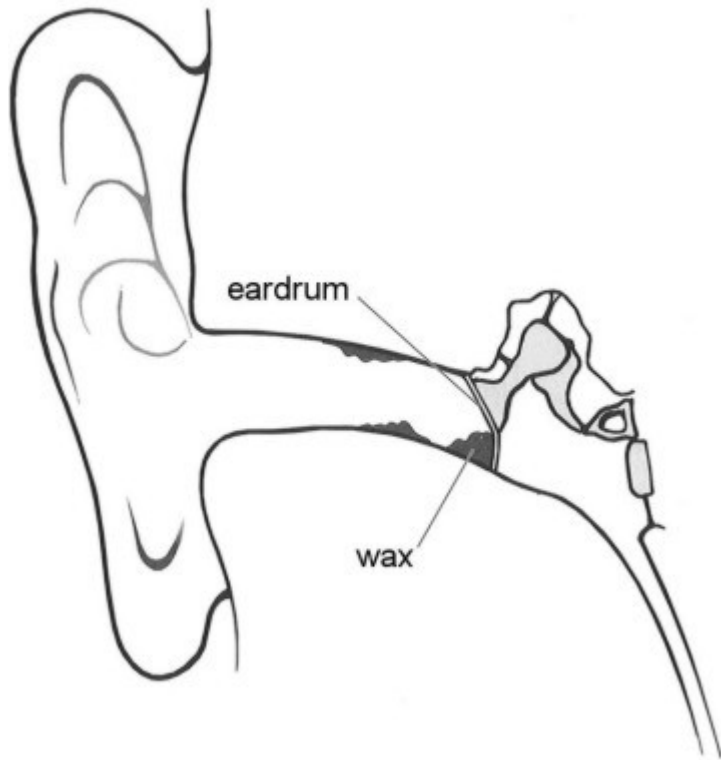
Nasah

The sound Nasah heard was quieter but the pitch was the same.

On the right-hand grid, draw the trace to show the pattern of the sound Nasah heard.

2 marks
maximum 5 marks

6. The diagram below shows part of the human ear.



We can hear somebody speaking because sound waves enter our ears.

(a) (i) What do our eardrums do when sound waves reach them?

.....

1 mark

(ii) Sometimes a lot of wax is produced in the ear.
The wax rests against the eardrum, as shown above.

Give **one** reason why we **cannot** hear very well when our ears contain a lot of wax.

.....

.....

1 mark

(b) The table below shows the lowest and highest frequencies that five living things can hear.

living thing	lowest frequency (Hz)	highest frequency (Hz)
human	20	20 000
sparrow	300	20 000
dog	20	45 000
cat	20	64 000
rabbit	300	42 000

(i) Which **three** living things from the table **cannot** hear a frequency of 43 000 Hz?

..... and and

1 mark

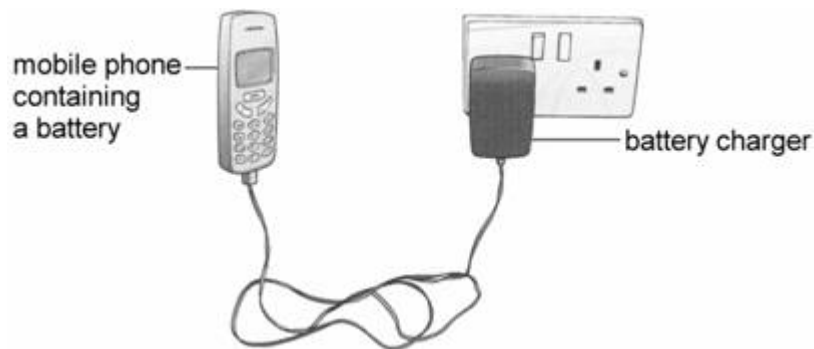
(ii) From the table, choose the living thing that can hear the biggest **range** of frequencies.

.....

1 mark
maximum 4 marks

7.

(a) Jacquie has a mobile phone. Energy is stored in the battery of the phone. The drawing shows the battery being charged.



(i) Which energy transfer takes place in the battery as it is being charged? Tick the correct box.

chemical to sound	<input type="checkbox"/>	sound to thermal	<input type="checkbox"/>
electrical to chemical	<input type="checkbox"/>	thermal to electrical	<input type="checkbox"/>

1 mark

(ii) When the battery is fully charged, Jacquie unplugs the phone.

Which energy transfers take place when the mobile phone rings?
Tick the correct box.



chemical to electrical to sound

electrical to chemical to sound

kinetic to electrical to sound

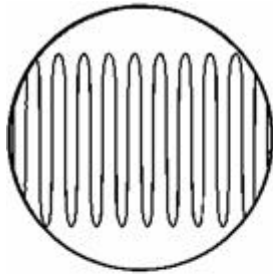
thermal to electrical to sound

1 mark

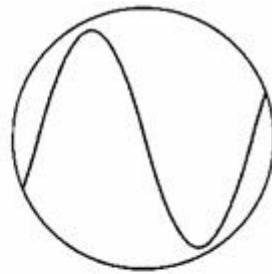
(b) Jacquie can change the ring-tone of her phone.

The diagrams below show the patterns made by four sound waves on an oscilloscope screen.

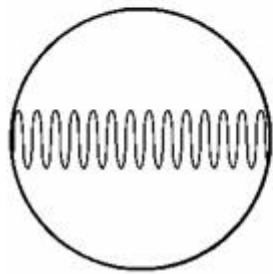
They are all drawn to the same scale.



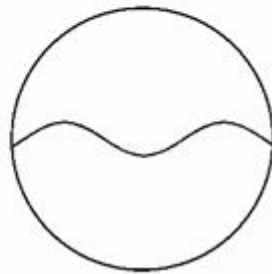
P



Q



R



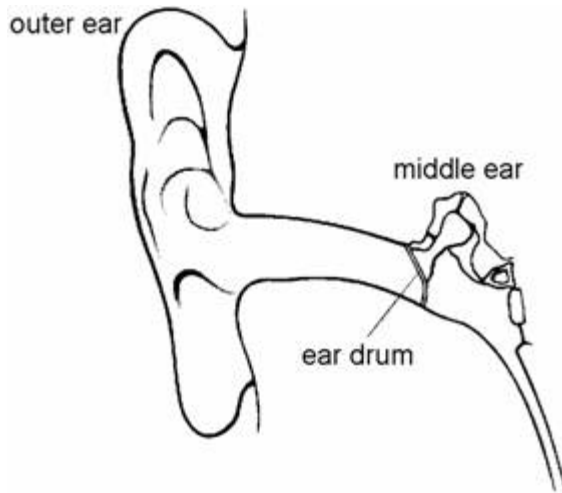
S

Write the letter of the sound wave that matches each of the descriptions below.

- (i) a loud sound with a low pitch
- (ii) a quiet sound with a high pitch
- (iii) a loud sound with a high pitch

3 marks
Maximum 5 marks

8. The diagram shows part of an ear.



Sound waves enter the ear and make the ear drum vibrate.

- (a) The pitch of the sound is increased. What difference will this make to the way the ear drum vibrates?

.....
.....

1 mark

- (b) The sound is made louder. What difference will this make to the way the ear drum vibrates?

.....
.....

1 mark

- (c) Explain how a person's ear can be damaged by loud sounds.

.....
.....

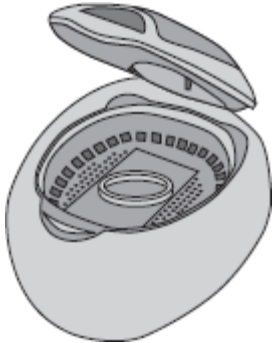
1 mark
Maximum 3 marks

9.

Ultrasound waves are very high frequency sound waves. They cannot be heard by humans.

(a) Ultrasound waves can be used to clean jewellery.

The jewellery is put into a container of cleaning fluid.



Complete each sentence to explain how ultrasound can clean jewellery.

The ultrasound generator makes the molecules of the cleaning fluid The molecules knock particles of from the surface of the jewellery.

(2)

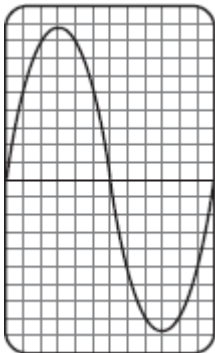
(b) Give a medical use for ultrasound.

.....

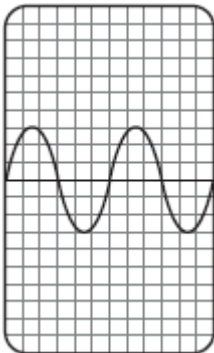
(1)

(c) Ultrasound waves can be represented on the screen of a cathode ray oscilloscope (CRO).

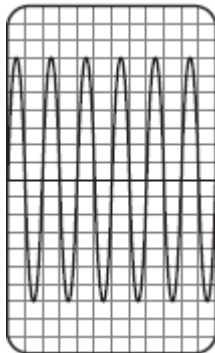
The diagrams show three ultrasound waves. Each wave is represented on an identical CRO screen, **A**, **B** and **C**.



Screen **A**



Screen **B**



Screen **C**

(i) How many complete waves are shown on screen **B**?

(1)

- (ii) Which screen shows the waves with the highest frequency?

Screen

(1)

(Total 5 marks)

10.

Table 1 shows the hearing ranges for some different species of animal.

Table 1

Species of animal	Approximate hearing range in Hz
Bat	20–120 000
Cat	45–64 000
Chicken	125–2000
Porpoise	75–150 000

- (a) Use the data in **Table 1** to answer the questions.

- (i) Which species of animal can hear the highest frequency?

.....

(1)

- (ii) Which species of animal has the smallest frequency range?

.....

(1)

- (b) (i) What is the average hearing range for healthy young humans?

.....Hz

(1)

- (ii) Human hearing is sensitive to a range of loudness. The units of loudness are decibels (dB).

Table 2 shows the loudness of some sounds.

Table 2

Sound	Loudness in dB
Busy road traffic	70
Disco (at the front)	110
Normal talking	60
Personal stereo (loud)	100
Vacuum cleaner	80
Whisper	20

Sounds up to 80 dB cause no damage to hearing, no matter how long you listen to the sound. They are described as 'safe sounds'.

Which sounds in **Table 2** are considered 'safe'?

.....
.....

(2)

(c) Damage to hearing also depends on how much time you listen to the sound each day.

The maximum time that does not cause damage to hearing is shown in **Table 3**.

Table 3

Sound loudness in dB	Time limit for exposure
Up to 80	No limit
85	8 hours
90	4 hours
95	2 hours
100	1 hour
105	30 minutes
110	15 minutes
115	7.5 minutes
120	3.75 minutes

(i) Describe the pattern shown in **Table 3** for increasing loudness from 85 dB.

.....

.....

.....

.....

(2)

(ii) Use data from **Table 2** and **Table 3** to give the maximum time you should listen to a loud personal stereo each day.

.....

(1)

(Total 8 marks)