AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.6.1 WAVES IN AIR, FLUIDS AND SOLIDS (PACK 2)

SCORE	PERCENTAGE
/118	%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

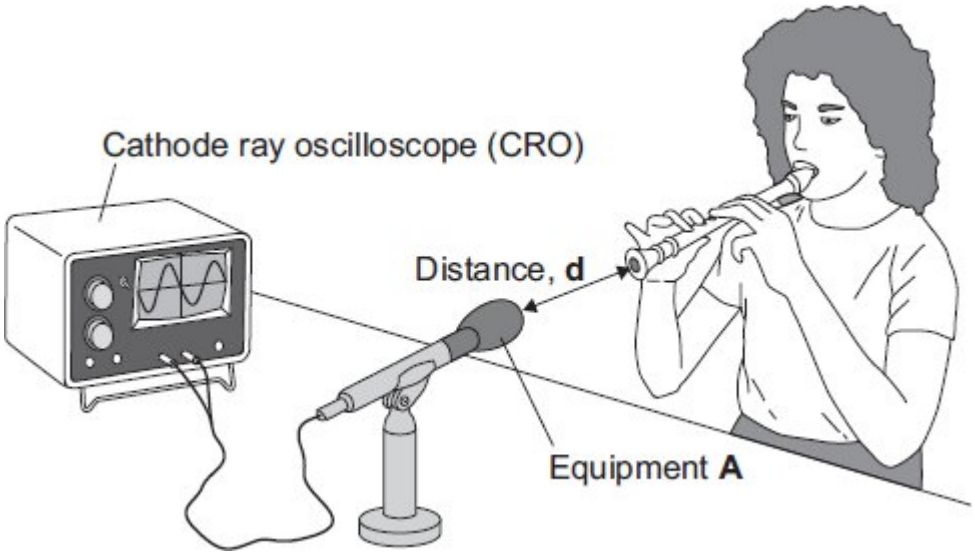
AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

A group of students investigates sound waves.

The diagram shows part of their investigation.



(a) Identify the equipment labelled **A**.

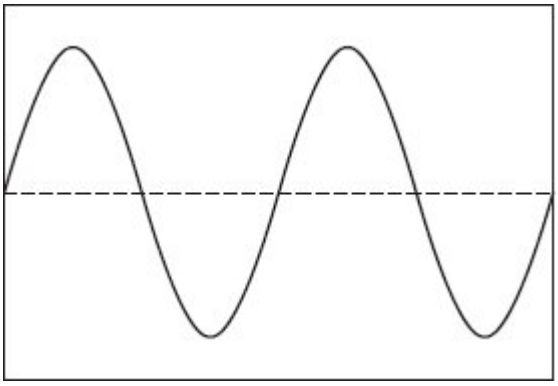
_____

(1)

(b) The student plays the same note in the same way at different distances from equipment **A**.

Another student records the amplitude of the wave shown on the cathode ray oscilloscope (CRO).

(i) Label this wave to show its amplitude.



(1)

(ii) Complete the sentence.

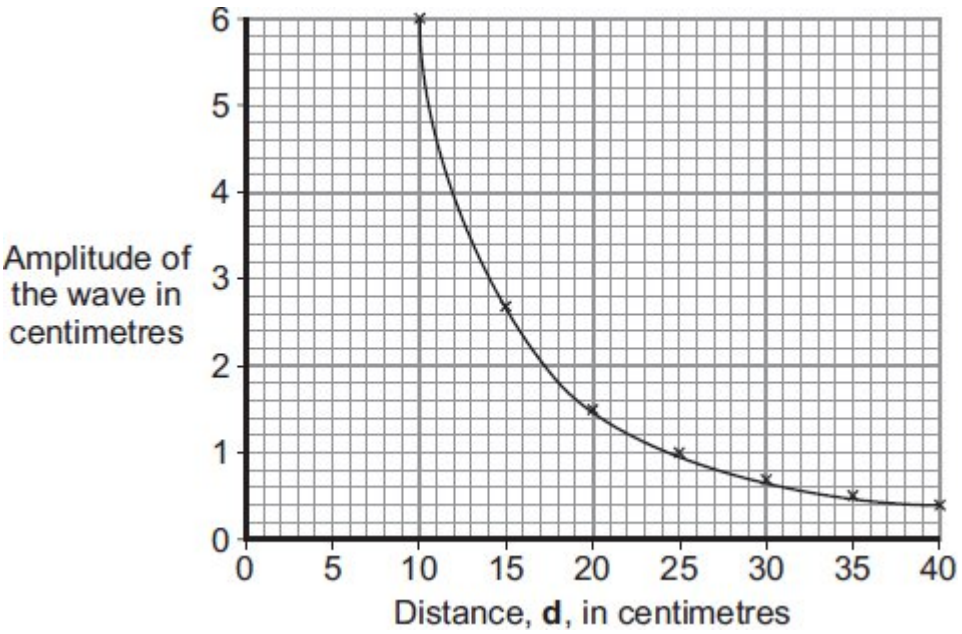
Increasing the amplitude of a sound wave will increase the _____

of the sound.

(1)

STEMUP.CO.UK

(c) The graph shows the students' average results from several sets of measurements.



Use the graph to find the distance, **d**, in centimetres, at which the average amplitude is likely to be 2 centimetres.

Distance = _____ cm.

(1)

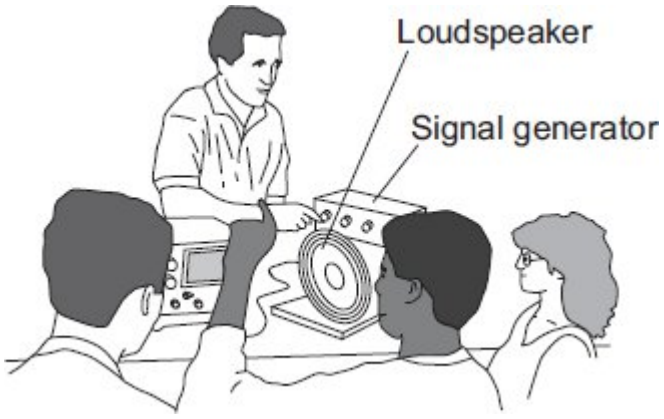
(d) Write a conclusion for this investigation.

_____

_____

(1)

(e) A physics teacher uses a signal generator and a loudspeaker to demonstrate the range of hearing of a group of students.



What is the range of frequencies most humans can hear?

Most humans can hear from _____ Hz to _____ Hz.

(2)

(Total 7 marks)

STEMUP.CO.UK

Q2.

(a) This information is from a science magazine.

> Electronic systems can be used to produce ultrasonic waves.
>
> These waves have a frequency higher than the upper limit for hearing in humans.

Complete the sentence by choosing the correct number from the box.

20	**2000**	**20 000**	**200 000**

The upper limit for hearing in humans is a frequency of _____ Hz.

(1)

(b) An electronic system produces ultrasound with a frequency of 500 kHz.

What does the symbol kHz stand for?

_____

(1)

(c) (i) State **one** industrial use for ultrasound.

_____

(1)

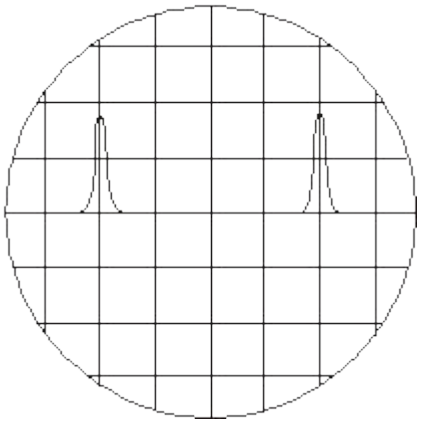
(ii) State **one** medical use for ultrasound.

_____

(1)

(d) An ultrasound detector is connected to an oscilloscope.

The diagram shows centimetre squares on an oscilloscope screen. Each horizontal division represents 2 microseconds.



Calculate the time, in microseconds, between one peak of one ultrasound pulse and the peak of the next.

STEMUP.CO.UK

_____

Time = _____ microseconds

(1)

(e) Ultrasounds are partially reflected when they reach a boundary between two different media.

The time taken for the reflection from the boundary to reach the detector can be seen
from the screen.

What can be calculated from this time interval?

_____

_____

(2)

(f) Explain what action scientists should take if they find evidence that ultrasonic waves may be harmful to human health.

_____

_____

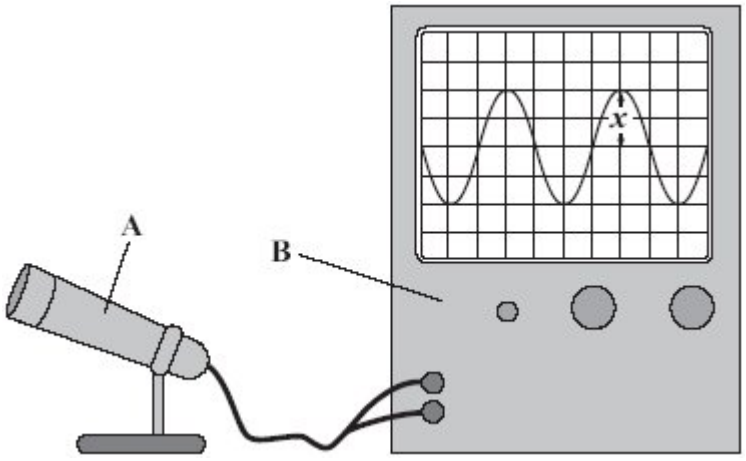
_____

(2)

(Total 9 marks)

Q3.

(a) A student uses two pieces of equipment, **A** and **B**, to display a sound wave.



(i) Use words from the box to complete the sentence.

a loudspeaker	**a microphone**	**an oscilloscope**	**a screen**

A is _____ and **B** is _____ .

(2)

STEMUP.CO.UK

(ii) Use words from the box to complete the sentence.

the amplitude	half the amplitude	the frequency	half the frequency

The distance ***x*** marked on the diagram measures _____ of the sound wave.

(1)

(iii) Complete the sentence.

The distance ***x*** becomes smaller. This is because the sound has

become _____ .

(1)

(b) There is no air in space.

Astronauts in space cannot hear sounds from outside their spacesuits.

Explain this.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q4.

(a) The diagrams show oscilloscope traces for the same musical note played on two different instruments. The oscilloscope settings are not changed.

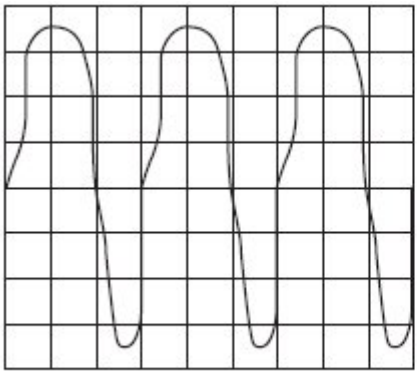


Diagram X

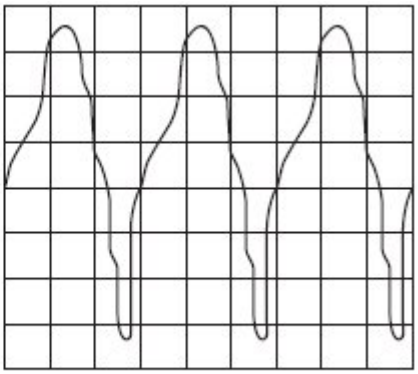


Diagram Y

(i) How can you tell, from the diagrams, that it is the same musical note?

_____

_____

(1)

STEMUP.CO.UK

(ii) How can you tell, from the diagrams, that the musical note has been played on different instruments?

_____

_____

(1)

(b) This passage is from an electronics magazine.

> *Electronic systems can be used to produce ultrasound waves. These waves have a higher frequency than the upper limit for hearing in humans.*
> *Ultrasound waves are partially reflected when they meet a boundary between two different media.*

(i) Approximately what is the highest frequency that humans can hear?

State the number and the unit.

_____

(1)

(ii) What does the word *media* mean when it is used in this passage?

_____

_____

(1)

(iii) What happens to the ultrasound which reaches the boundary between two different media and is **not** reflected?

_____

_____

_____

_____

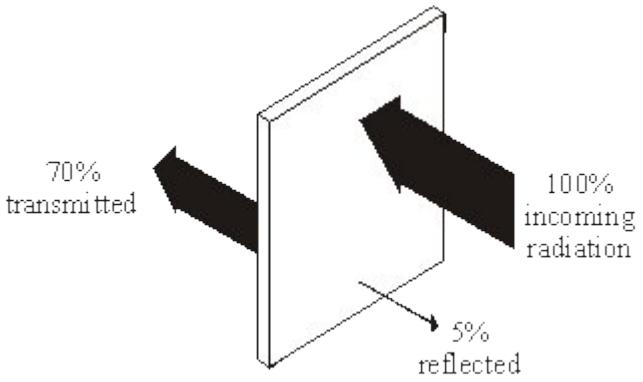
(2)

(Total 6 marks)

Q5.

(a) Infra red radiation can be reflected, absorbed and transmitted by glass.

STEMUP.CO.UK



(i) What percentage of infra red is absorbed by the glass?

_____

(1)

(ii) Complete the following sentence by drawing a ring around the correct word or phrase.

The absorbed infra red | increases / does not change / decreases | the temperature of the glass.

(1)

(b) **Two** of the following statements are true. **One** of the statements is false.

Tick (✓) the boxes next to the **two** true statements.

All objects absorb infra red radiation.	
Black surfaces are poor emitters of infra red radiation.	
A hot object emits more infra red than a cooler object.	

(1)

(c) The following statement is false.

Black surfaces are good reflectors of infra red radiation.

Change **one** word in this statement to make it true.

Write down your **new** statement.

_____

_____

(1)

(Total 4 marks)

Q6.

STEMUP.CO.UK

When sound waves reach a material, some of the energy of the sound is reflected and some is transmitted through the material.

(a) Complete the sentence.

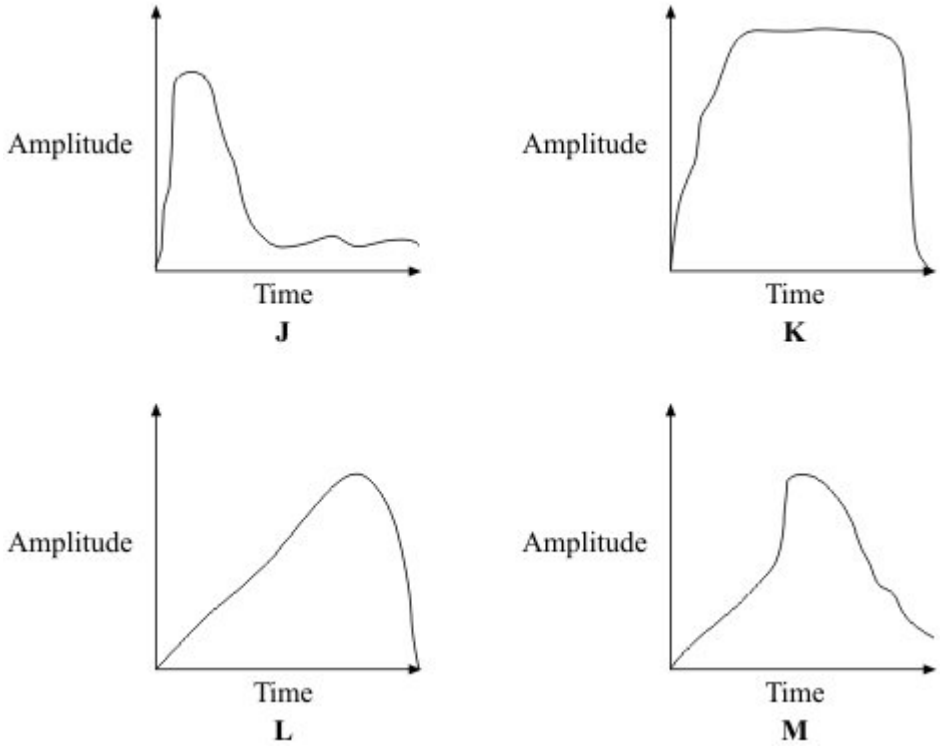
Sound waves are caused by _____

(1)

(b) The graphs **J**, **K**, **L** and **M** represent the sound energy reflected from a surface.

The graphs are all drawn to the same scale.

Which graph shows the greatest total sound energy output from the surface?



Graph _____

(1)

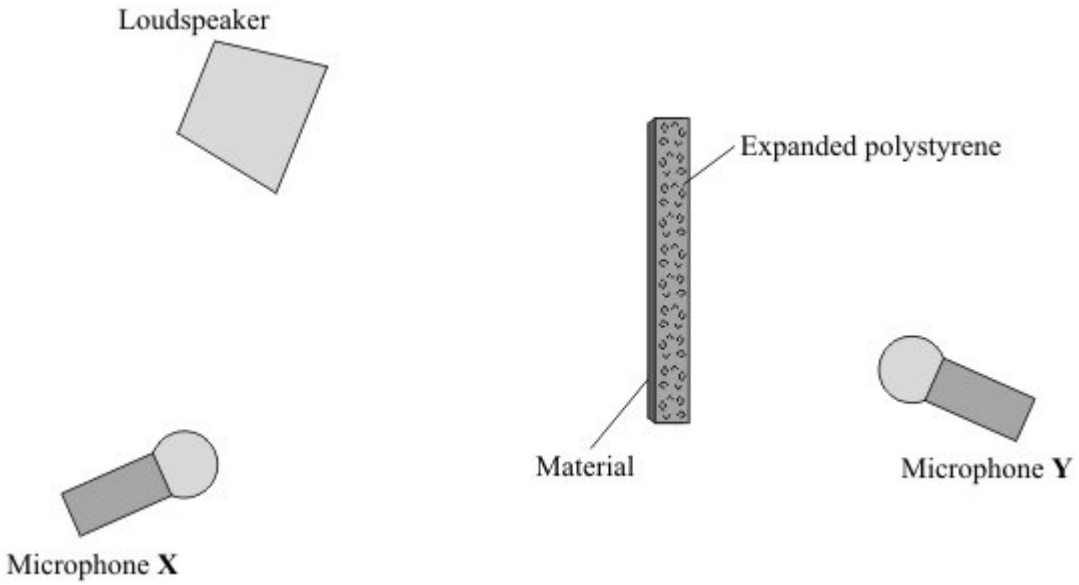
(c) The proportion of the sound energy which is reflected or transmitted depends on the material which receives the sound.

A student investigates different materials.

The diagram shows how a student sets up her equipment.

(i) Using a pencil and ruler to draw on the diagram, show how microphone **X** receives reflected sound.

STEMUP.CO.UK



(2)

(ii) The student tests four materials. Each sheet of material is 1 mm thick. This has been glued onto a block of expanded polystyrene.

Why does the student use the same size of expanded polystyrene block and the same sound level for each test?

_____

_____

(1)

(iii) The table shows the readings for the sound level transmitted to microphone **Y**.

Soundlevel from loudspeaker in arbitrary units	**Surface material**	**Soundlevel transmitted to microphone Y in arbitrary units**
60	paper	39
60	plaster	18
60	cloth	31
60	wood	15

[A] Which surface material transmits the smallest proportion of the sound?

_____

(1)

[B] What proportion is this?

_____

(1)

(d) People living in a flat have very noisy neighbours who are always playing loud music.

STEMUP.CO.UK

Suggest **one** practical idea to reduce the amount of noise transmitted into the flat through the walls and explain how your idea will work.

_____

_____

_____

_____

_____

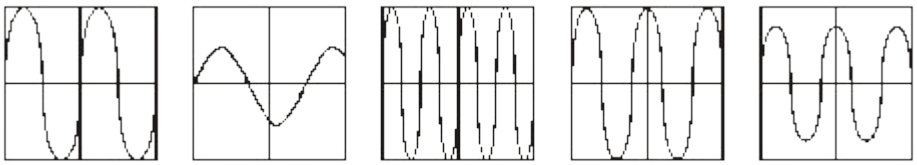
_____

(2)

(Total 9 marks)

Q7.

(a) A student uses a microphone to send different sounds to an oscilloscope. The diagrams show five traces, **A**, **B**, **C**, **D** and **E**, on the oscilloscope. All the traces are drawn to the same scale.



(i) Which **three** diagrams show traces with the same amplitude?

Diagrams _____ , _____ and _____ .

(1)

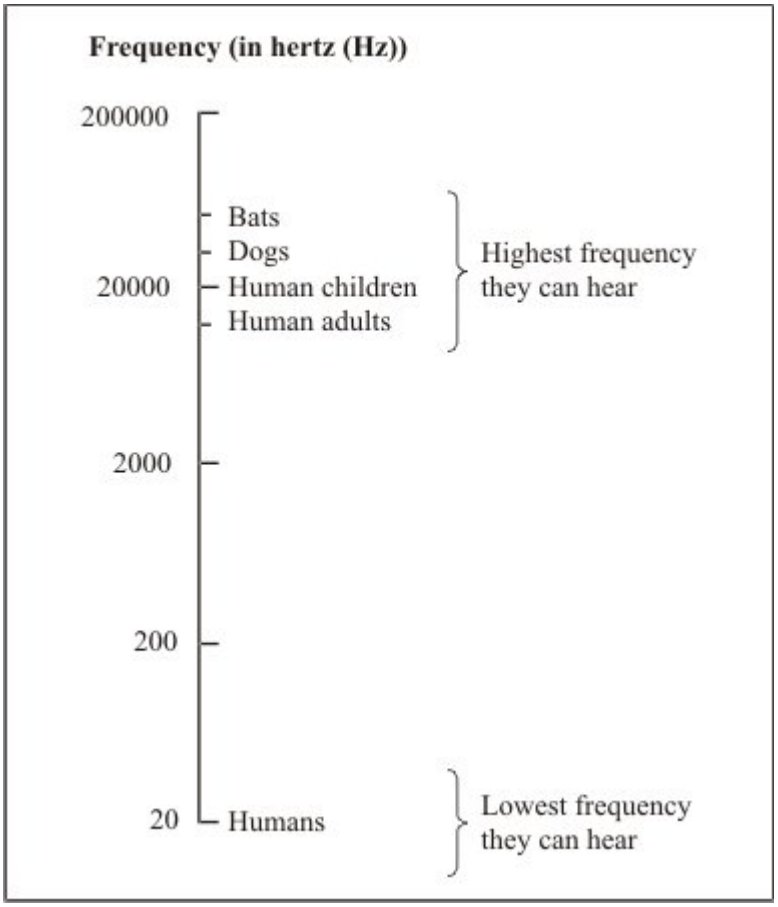
(ii) Which **two** diagrams show traces with the same frequency?

Diagrams _____ and _____ .

(1)

(b) The diagram shows the sound frequencies which some living things can hear.

STEMUP.CO.UK



(i) What is the widest range of frequencies that a human child can hear?

_____

(1)

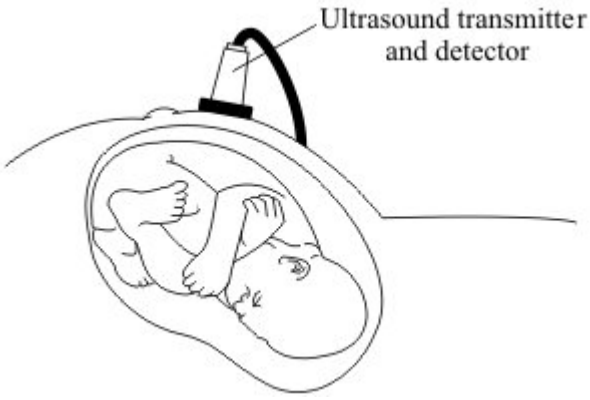
(ii) Why can some dog whistles be heard by dogs but not by humans?

_____

_____

(1)

(c) An ultrasound scan can be used to make a picture of a baby in its mother's womb. An ultrasound transmitter and detector are placed above the mother's womb. Ultrasound goes into the body of the mother and into the body of the baby.



Use the correct words from the box to complete the sentences.

STEMUP.CO.UK

detector	reflection	refraction	sound	substance	transmitter

(i) When the ultrasound crosses from one _____ to another, some ultrasound becomes an echo caused by _____ .

(ii) This information is collected by the ultrasound _____ and made into a picture on a screen.

(3)

(Total 7 marks)

Q8.

Ultrasound can be used in industry for detecting internal cracks in metals.

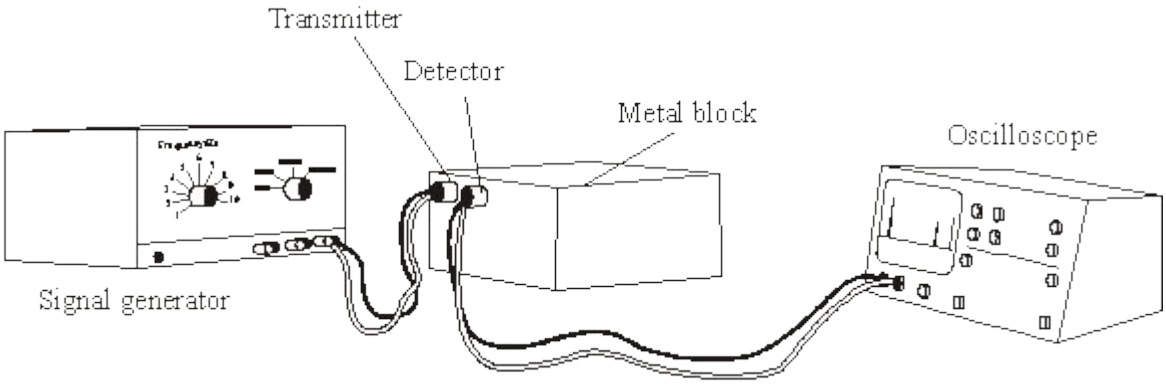
(a) State **two** features of ultrasound.

1. _____

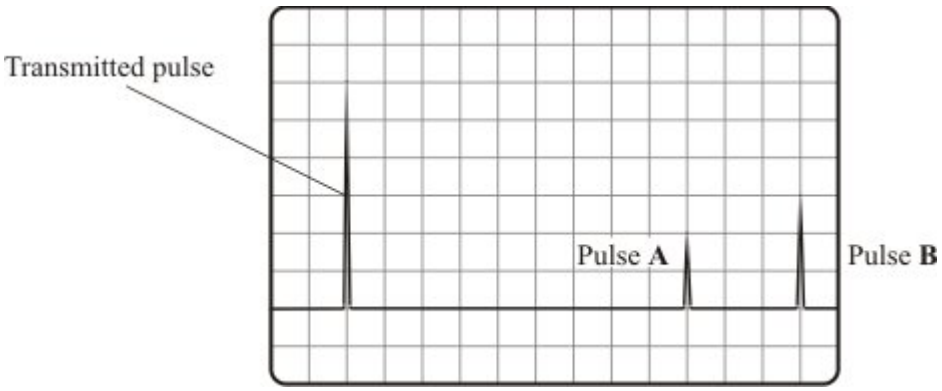
2. _____

(2)

(b) The diagram shows an ultrasound transmitter and detector fixed to the front of a metal block. The block has an internal crack.



The diagram below shows the screen of the oscilloscope connected to the detector.



(i) Explain why pulse **A** and pulse **B** occur.

STEMUP.CO.UK

_____

_____

_____

(2)

(ii) The metal block is 120 mm from front to back. What is the distance, in mm, from the front of the block to the internal crack?

Distance = _____ mm

(1)

(Total 5 marks)

Q9.

The picture shows a pre-natal scan obtained using ultrasonic waves.



(i) Explain how ultrasonic waves are used to produce the image of an unborn baby.

_____

_____

_____

_____

(2)

(ii) Give another use for ultrasonic waves.

_____

(1)

(Total 3 marks)

Q10.

(a) What is ultrasound?

_____

_____

(1)

STEMUP.CO.UK

(b) The picture shows a pregnant woman having an ultrasound scan and the image produced by the scan.



To produce the image, a very narrow beam of ultrasound pulses is fired into the mother's body. The reflected pulses are used to build up the image of the unborn baby.

(i) Why is it important to have a very narrow beam of ultrasound waves?

_____

_____

(1)

(ii) Why is it possible to produce a very narrow beam with ultrasound but not with normal sound waves?

_____

_____

(1)

(iii) The image produced by ultrasound is not as clear as an image produced by X-rays. Why is ultrasound used for looking at unborn babies rather than X-rays?

_____

_____

(1)

(iv) Give **two** important pieces of information about an unborn baby which can be gained from the image produced by an ultrasound scan.

1. _____

_____

STEMUP.CO.UK

2. _____

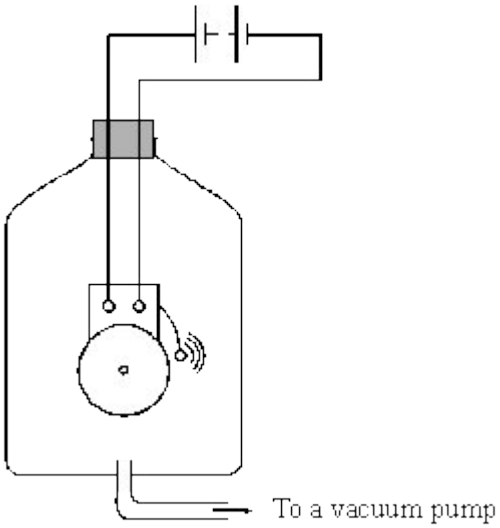
_____

(2)

(Total 6 marks)

Q11.

(a) The diagram shows an electric bell inside a glass jar. The bell can be heard ringing.



In the following sentences, cross out the **two** lines that are wrong in each box.

When all the air has been taken out of the glass jar, the ringing sound will

stop.
get louder.
get quieter.

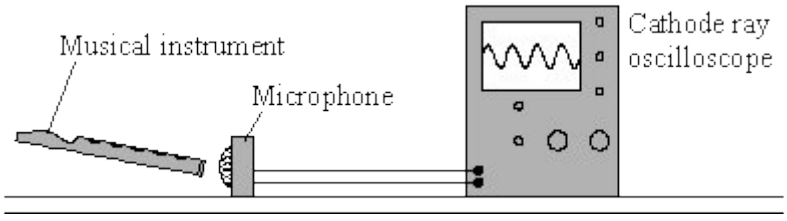
This is because sound

travels faster
travels slower
cannot travel

through a vacuum.

(2)

(b) The microphone and cathode ray oscilloscope are used to show the sound wave pattern of a musical instrument.



One of the following statements describes what a microphone does. Tick the box next to the correct statement.

A microphone transfers sound energy tolight energy. ☐

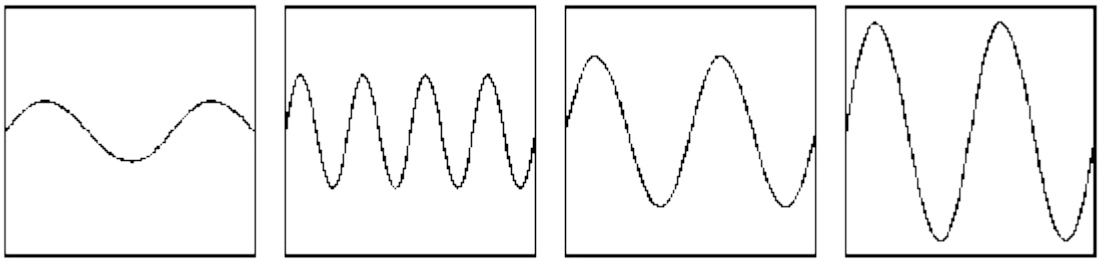
A microphone transfers sound energy toelectrical energy. ☐

A microphone transfers electrical energy tosound energy. ☐

(1)

STEMUP.CO.UK

(c) Four different sound wave patterns are shown. They are all drawn to the same scale.



A B C D

(i) Which sound wave pattern has the highest pitch?

_____

Give a reason for your answer.

_____

(2)

(ii) Which sound wave pattern is the loudest?

_____

Give a reason for your answer.

_____

_____

(2)

(Total 7 marks)

Q12.

(a) Sound travels through air, water and glass at different speeds. Through which of these materials does sound travel:

the fastest; _____

the slowest? _____

(2)

Give a reason for your choice of answers.

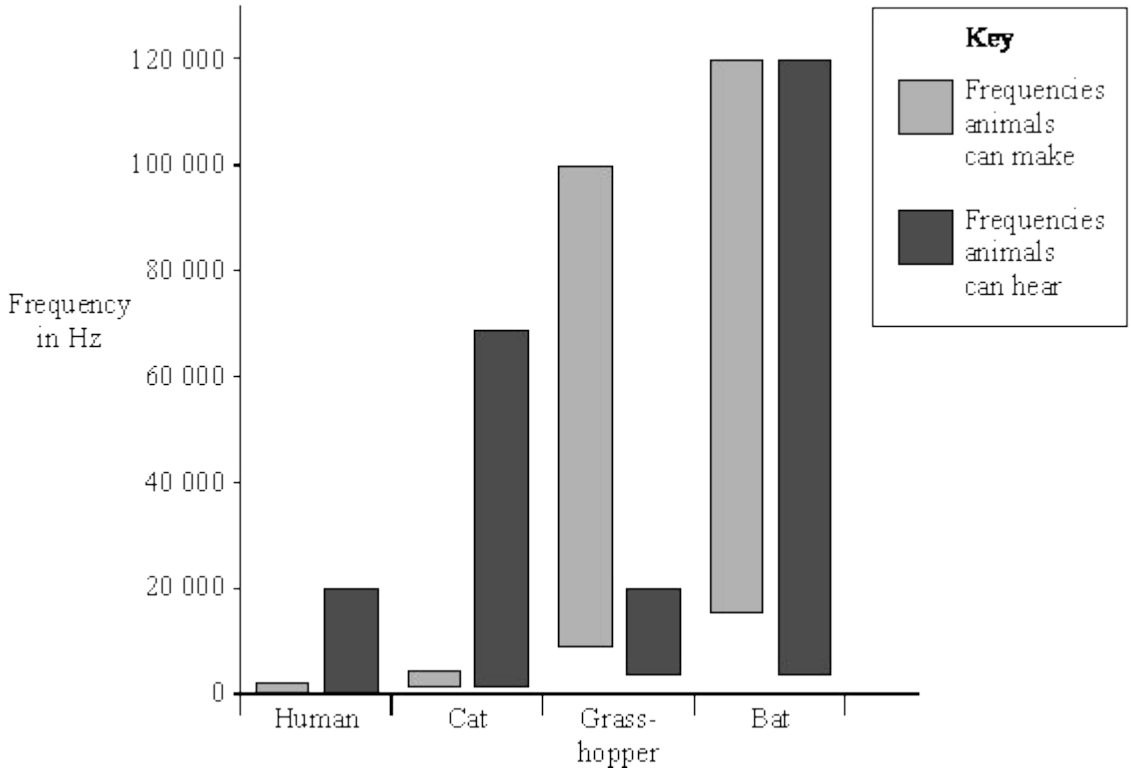
_____

_____

(1)

(b) The bar chart shows the frequencies of sound which different animals can make and can hear.

STEMUP.CO.UK



(i) Which of the animals can make sounds which are beyond their own hearing range?

_____

(1)

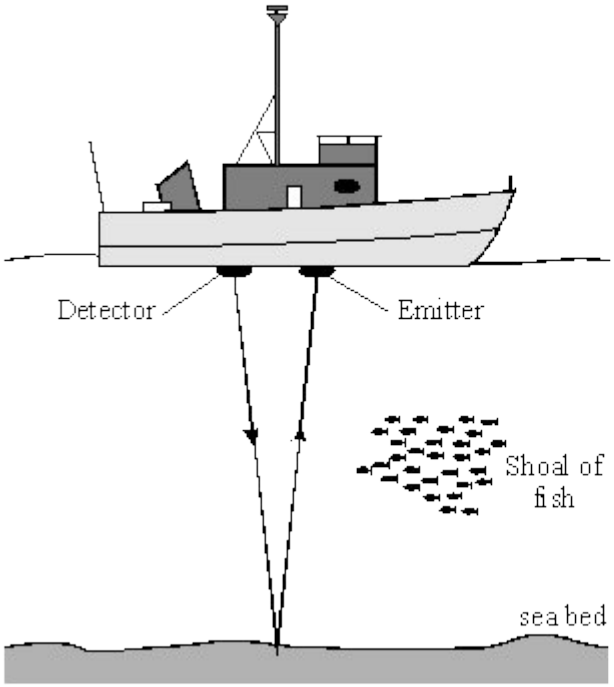
(ii) What name is given to the sounds which a cat can hear but a human cannot?

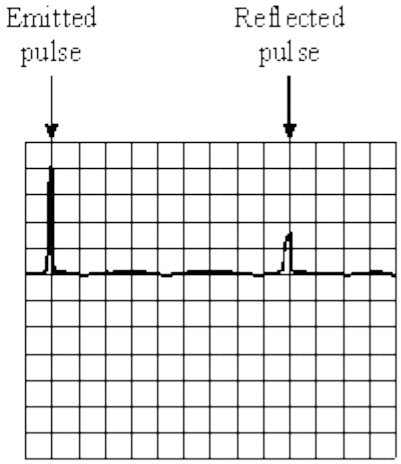
_____

(1)

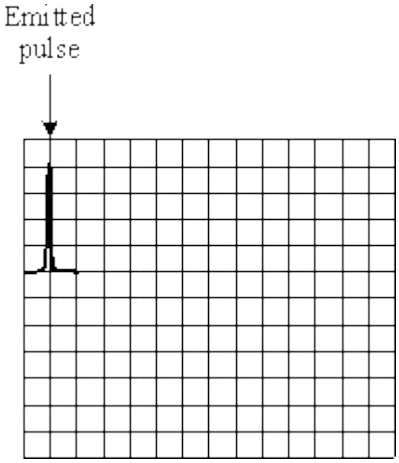
(c) The diagram shows a trawler searching for a shoal of fish. Pulses of high frequency sound emitted from the trawler are reflected back to the trawler. The pulses are displayed on a cathode ray oscilloscope.

STEMUP.CO.UK





Complete the diagram below to show the pattern seen on the cathode ray oscilloscope as the trawler passes over the shoal of fish.



(2)

(Total 7 marks)

Q13.

Most young people can hear sounds in the frequency range 20 Hz to 20 000 Hz.

(a) Tick the box beside the statement which best describes frequency.

the maximum disturbance caused by a wave ☐

the number of complete vibrations per second ☐

the distance between one crest of a wave and the next one ☐

the distance travelled by a wave in 1 second ☐

(1)

STEMUP.CO.UK

(b) Diagram **X** shows a trace on an oscilloscope screen.

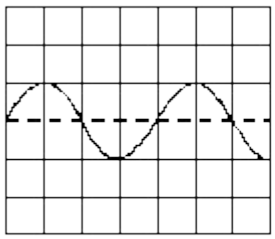


Diagram **X**

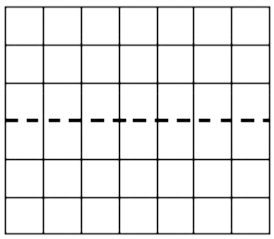


Diagram **Y**

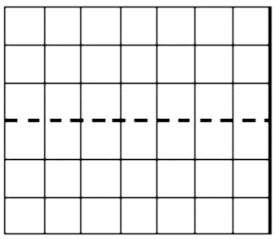


Diagram **Z**

(i) Draw a trace on diagram **Y** which has a higher frequency than that shown in diagram **X**.

(ii) Draw a trace on diagram **Z** which has a larger amplitude than that shown in diagram **X**.

(2)

(c) Choose words from the list below to complete the following sentences.

higher **louder** **lower** **quieter**

(i) A musical note with a high frequency sounds _____ than one with a low frequency.

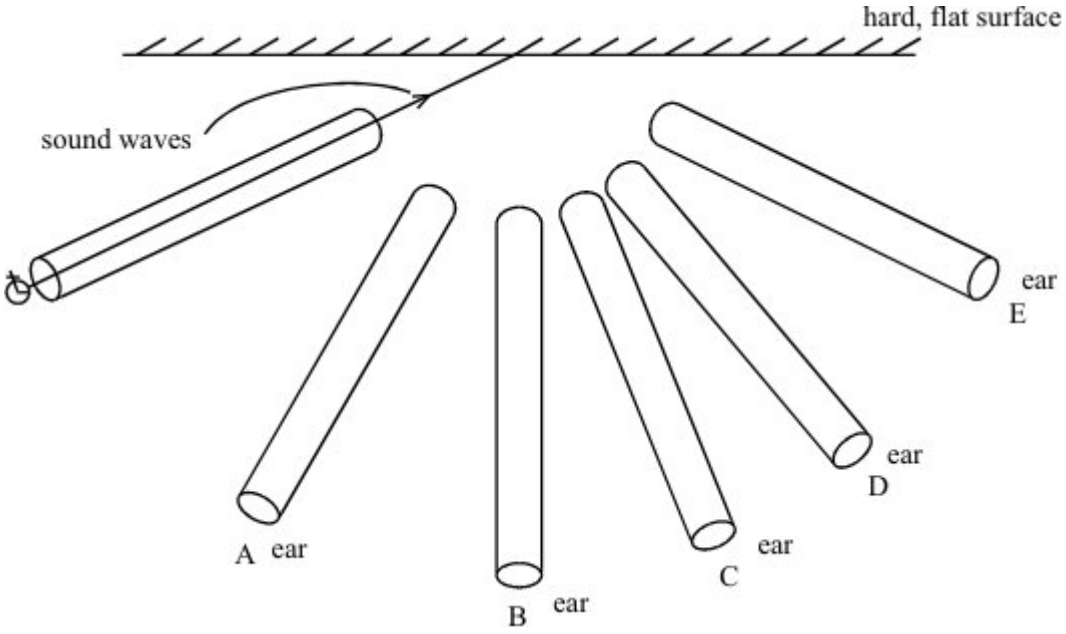
(ii) A noise of small amplitude sounds _____ than one with large amplitude.

(2)

(Total 5 marks)

Q14.

A hard, flat surface reflects sound just like a plane (flat) mirror reflects light.



You want to hear the reflection (echo) of the ticking watch through a tube.

Which is the best position to put the tube?

STEMUP.CO.UK

Choose from positions A-E on the diagram _____

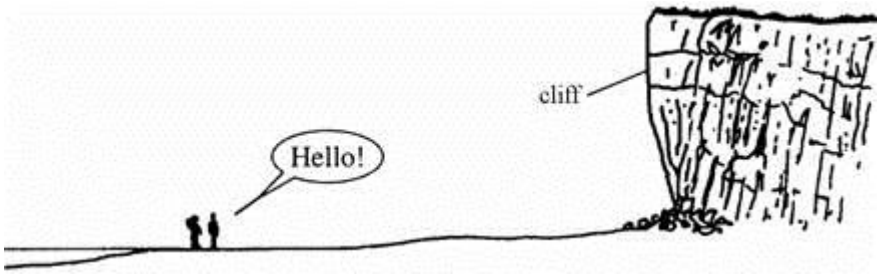
(You may draw on the diagram if you want to.)

(Total 2 marks)

Q15.

Two friends are standing on a beach.

When they shout they can hear themselves a second later.



Explain, as fully as you can, why this happens.
(You may answer on the diagram if you want to.)

_____

_____

(Total 2 marks)

Q16.

(a) The student is using a microphone connected to a cathode ray oscilloscope (CRO).



The CRO displays the sound waves as waves on its screen. What does the microphone do?

_____

_____

_____

(2)

STEMUP.CO.UK

(b) The amplitude, the frequency and the wavelength of a sound wave can each be either increased or decreased.

(i) What change, or changes, would make the sound quieter?

_____

(1)

(ii) What change, or changes, would make the sound higher in pitch?

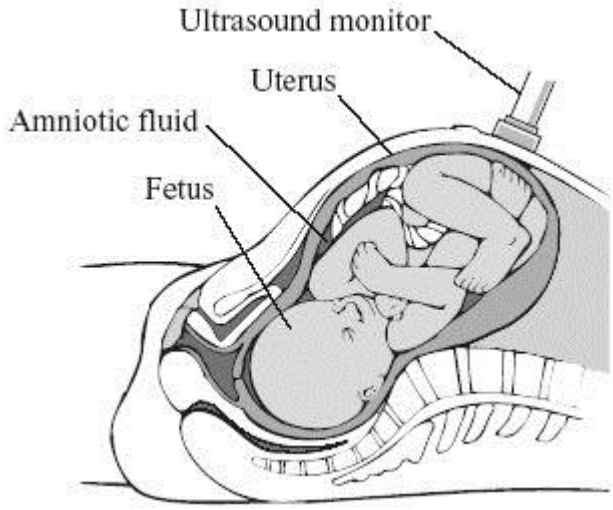
_____

(1)

(Total 4 marks)

Q17.

The diagram shows an ultrasound monitor being used to scan a fetus.



The table shows the velocity of ultrasound waves in different tissues of the fetus.

Tissue	Velocity of ultrasound in m/s
Amniotic fluid (liquid surrounding fetus)	1540
Bone	3080
Kidney	1561
Liver	1549
Muscle	1585

Explain why we are able to see the different parts of the fetus in an ultrasound scan. You may use information from the table in your answer.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

STEMUP.CO.UK

_____

_____

_____

_____

_____

(Total 4 marks)

Q18.

The table gives the frequencies of sound that different animals can hear.

Animal	Lowest frequency it can hear in Hz	Highest frequency it can hear in Hz
Human	64	23 000
Dog	67	45 000
Mouse	1 000	91 000
Rat	200	76 000
Cat	45	64 000
Tuna	50	1 100
Canary	250	8 000
Chicken	125	2 000

(a) (i) Which animal can hear the lowest sound frequency?

_____

(1)

(ii) Which animal can hear the smallest range of frequencies?

_____

(1)

(b) (i) What is the name given to sound frequencies higher than those that humans can hear?

_____

(1)

(ii) Give **one** industrial use of this type of sound.

_____

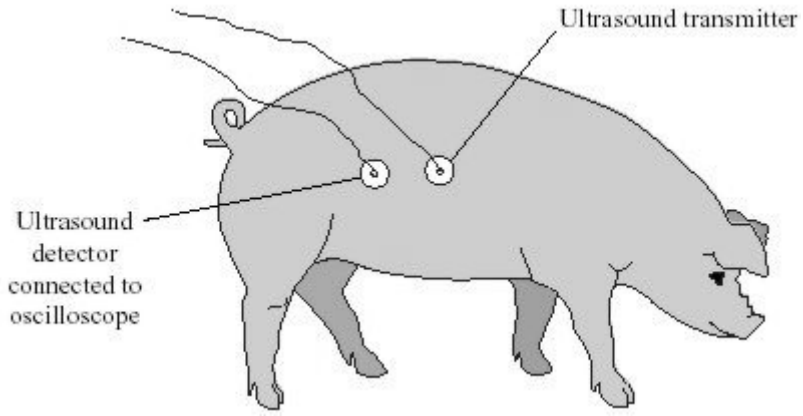
(1)

(Total 4 marks)

STEMUP.CO.UK

Q19.

Pigs have a layer of fat in their skin. Underneath the fat is a layer of muscle. Ultrasonic waves are used to measure the thickness of the layer of fat. An ultrasound transmitter and detector are attached to the skin of the pig.



(a) Explain why ultrasound can be used to measure the thickness of the layer of fat.

_____

_____

_____

_____

(2)

(b) The oscilloscope does not measure distance directly.

(i) What does the oscilloscope measure in this case?

_____

_____

(1)

(ii) What other information is needed to calculate the thickness of the layer of fat in a pig?

_____

_____

(1)

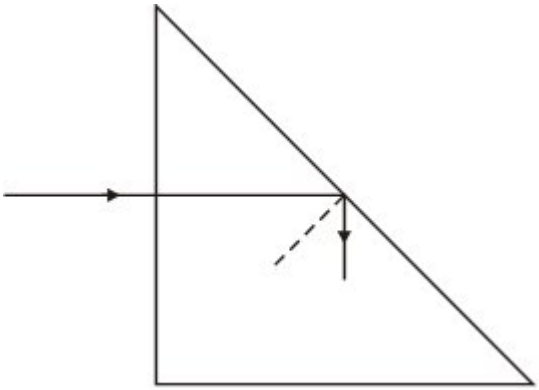
(Total 4 marks)

Q20.

Glass prisms are used in many optical devices.

(a) The diagram shows what happens to a ray of light as it travels through a glass prism.

STEMUP.CO.UK



To gain full marks for this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

Use the words in the box to help you to explain why the ray behaves in this way.

angle	critical	normal

_____

_____

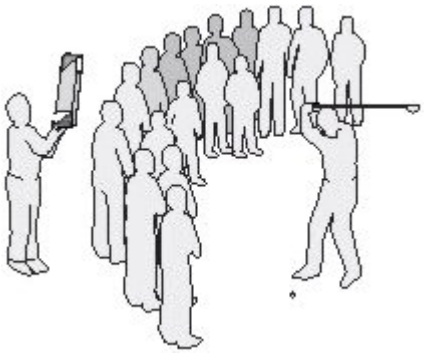
_____

_____

_____

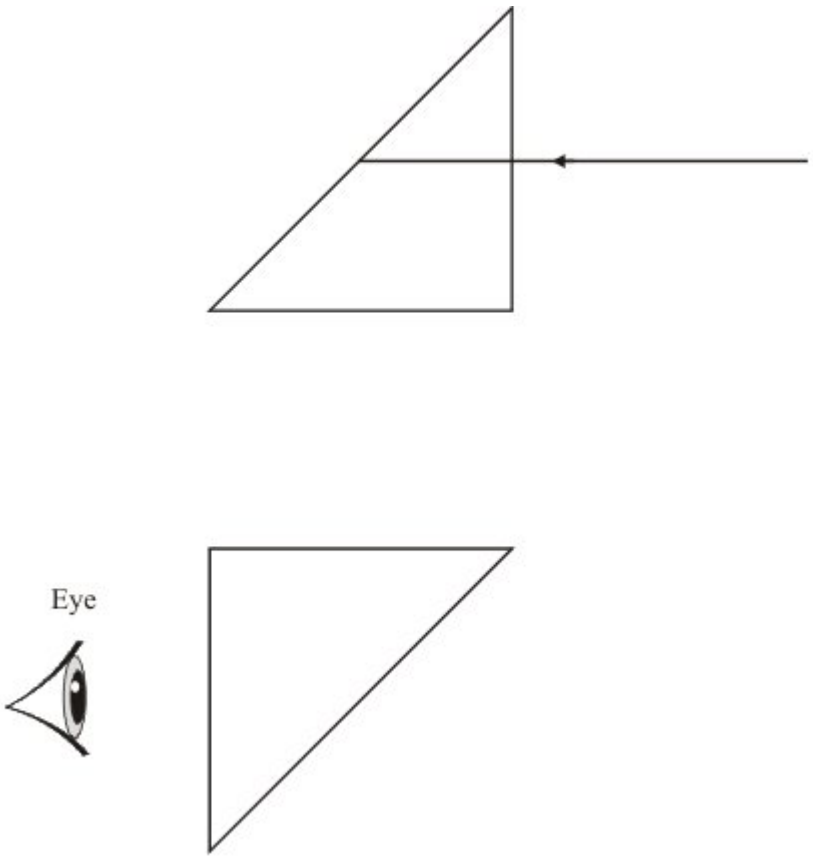
(3)

(b) Periscopes can be used to look over the heads of other people.



A periscope contains two glass prisms.
Complete the diagram to show the ray of light reaching the person's eye.

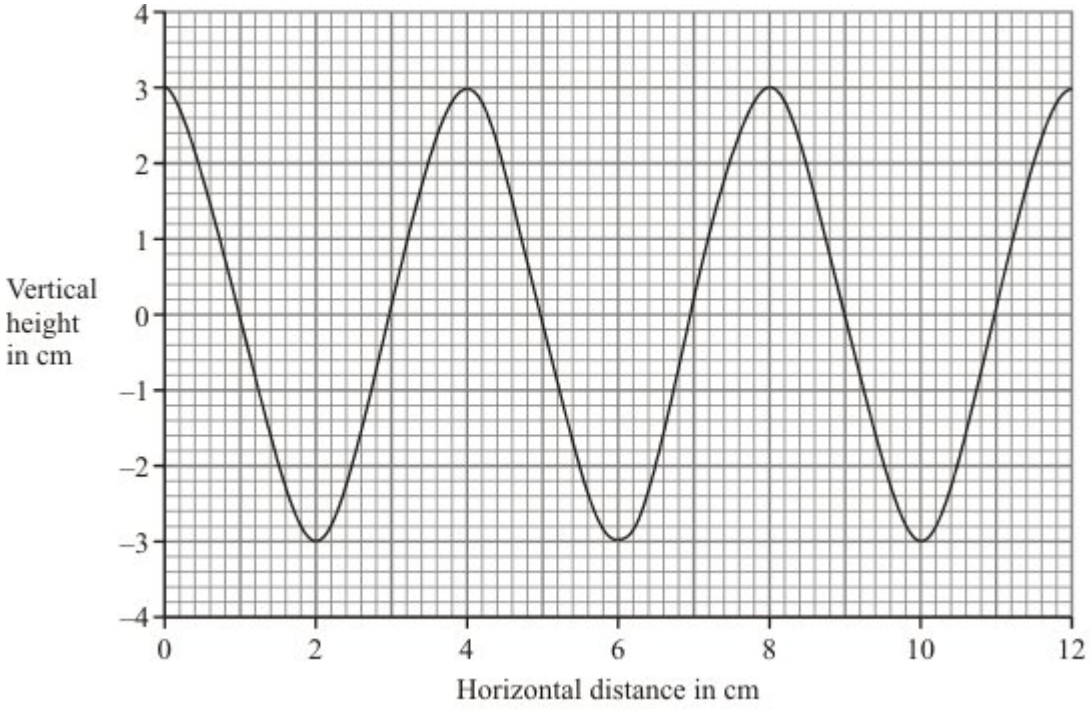
STEMUP.CO.UK



(3)
(Total 6 marks)

Q21.

The diagram shows a water wave drawn to scale.



(a) What is the wavelength of this water wave? _____ cm

(1)

STEMUP.CO.UK

(b) What is the amplitude? _____ cm

(1)

(c) Twelve waves pass an observer in four seconds.

What is the frequency of the waves? Show clearly how you work out your answer and give the unit.

_____

_____

Frequency = _____

(3)

(Total 5 marks)

Q22.

(a) Complete the following sentence:

Sound is produced when an object _____

(1)

(b) Choose words from the list to complete the following sentences:

higher **louder** **lower** **quieter**

(i) If the frequency is increased, the pitch of the sound becomes

_____

(ii) If its amplitude is increased, the sound becomes

_____

(2)

(c) The diagram shows a pre-natal scan.



(i) What type of waves are used for pre-natal scanning?

_____

(1)

(ii) Explain why we cannot hear these waves.

_____

(2)

STEMUP.CO.UK

(Total 6 marks)

STEMUP.CO.UK