

AQA GCSE PHYSICS (HIGHER) • 8463

PHYSICS



EXAM QUESTION PACK

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

SCORE

/118

PERCENTAGE

%

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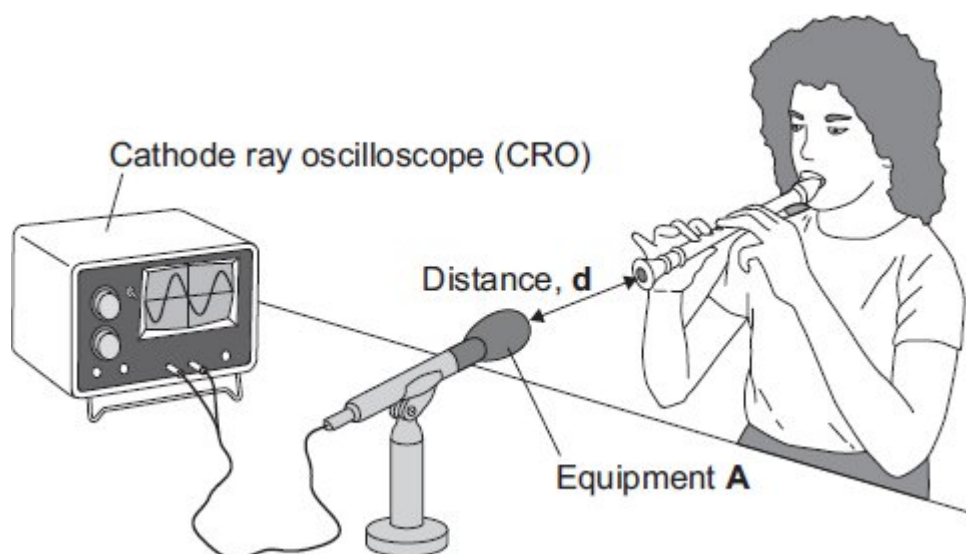
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Q1.

A group of students investigates sound waves.

The diagram shows part of their investigation.



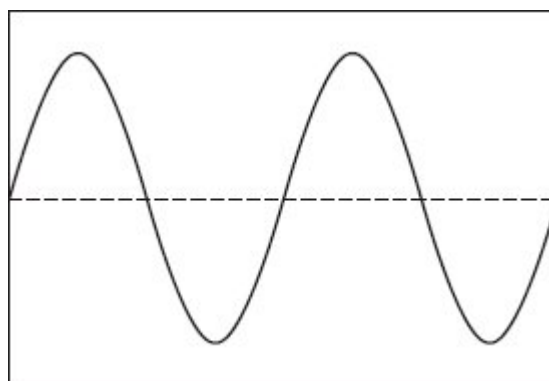
- (a) Identify the equipment labelled **A**.

(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.



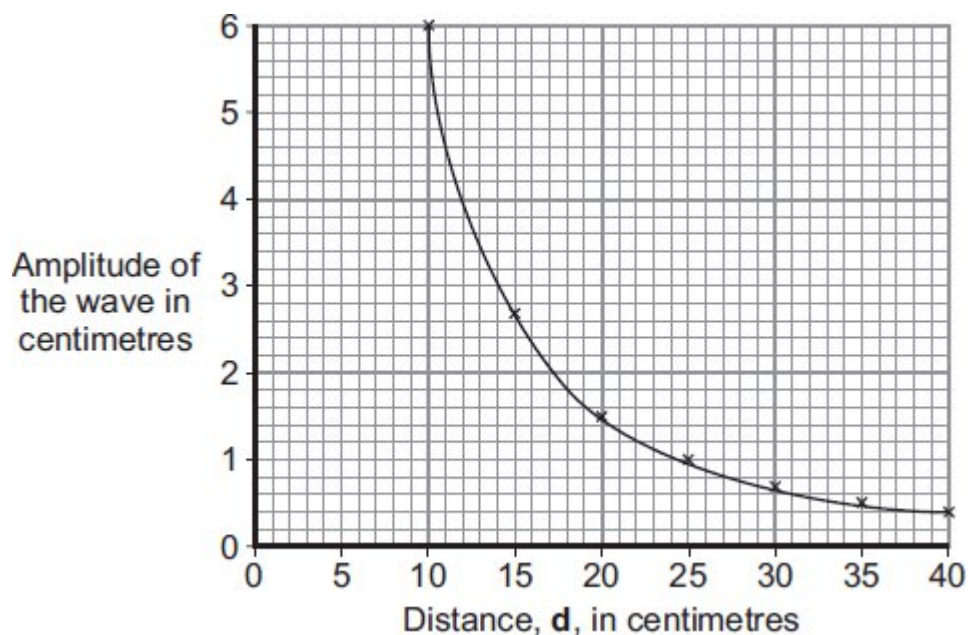
(1)

- (ii) Complete the sentence.

Increasing the amplitude of a sound wave will increase the _____
of the sound.

(1)

- (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.

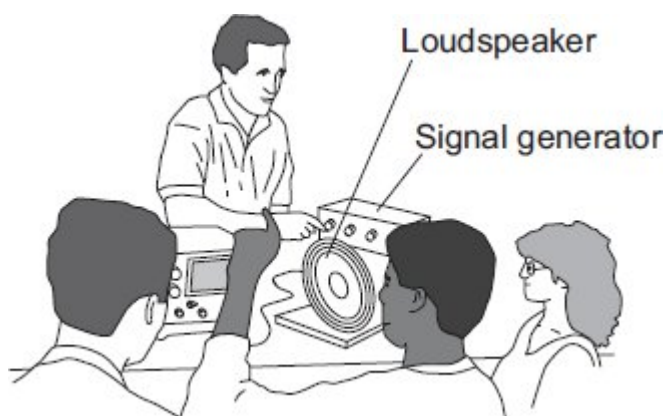
Distance = _____ cm.

(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)

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.

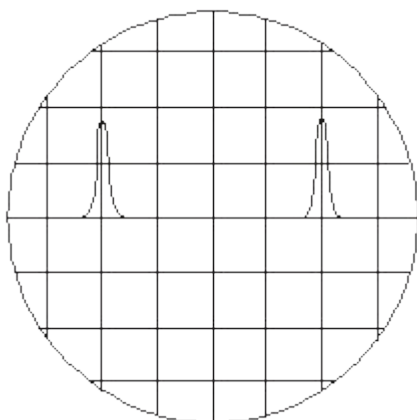
(1)

- (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.

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)

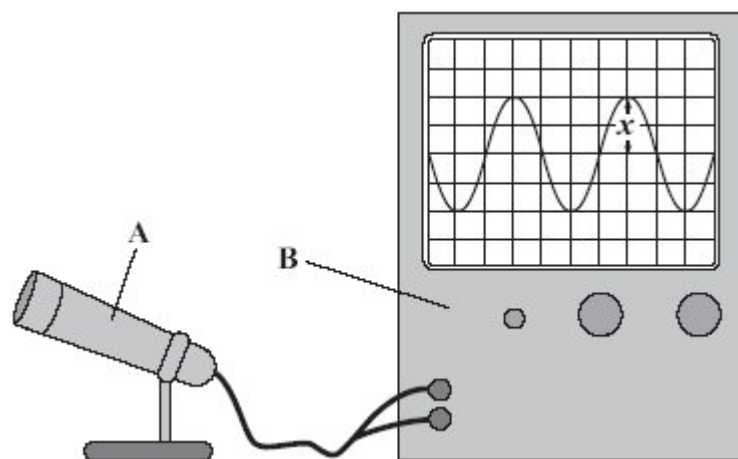
- (f) Explain what action scientists should take if they find evidence that ultrasonic waves may be harmful to human health.

(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)

- (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.

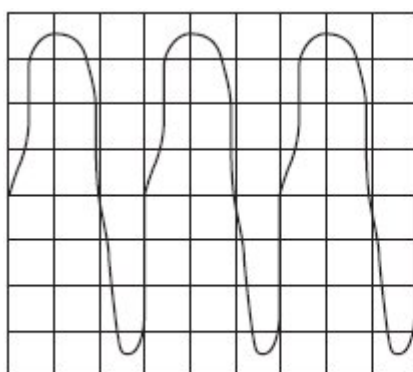


Diagram X

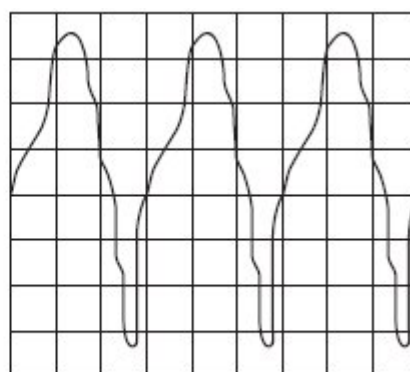


Diagram Y

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

(1)

- (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)

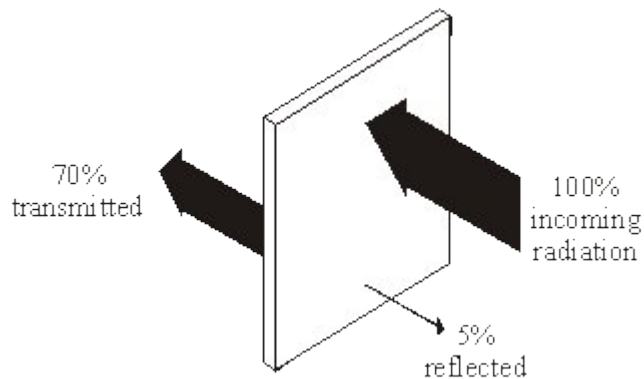
- (iii) What happens to the ultrasound which reaches the boundary between two different media and is **not** reflected?

(2)

(Total 6 marks)

Q5.

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



- (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.

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.

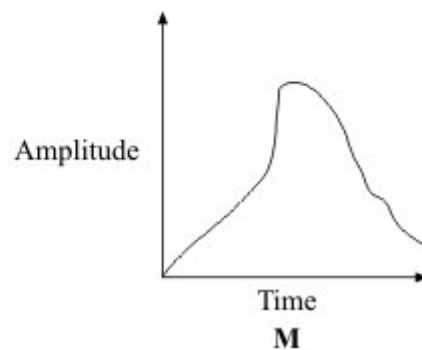
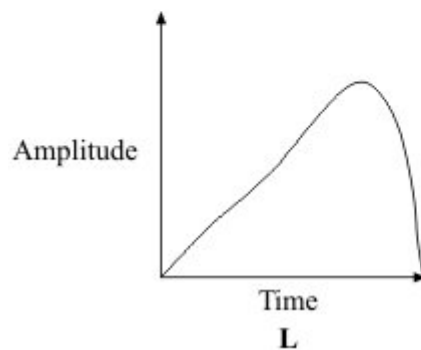
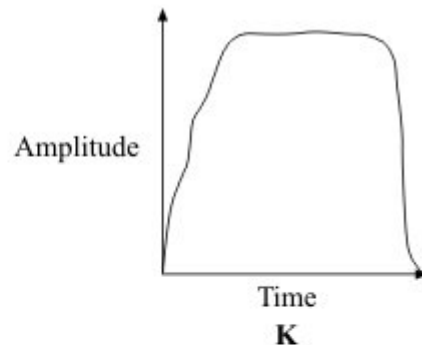
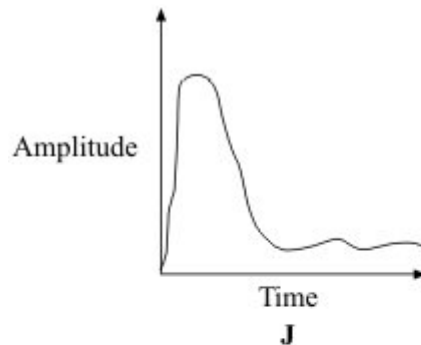
Sound waves are caused by _____

(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 _____

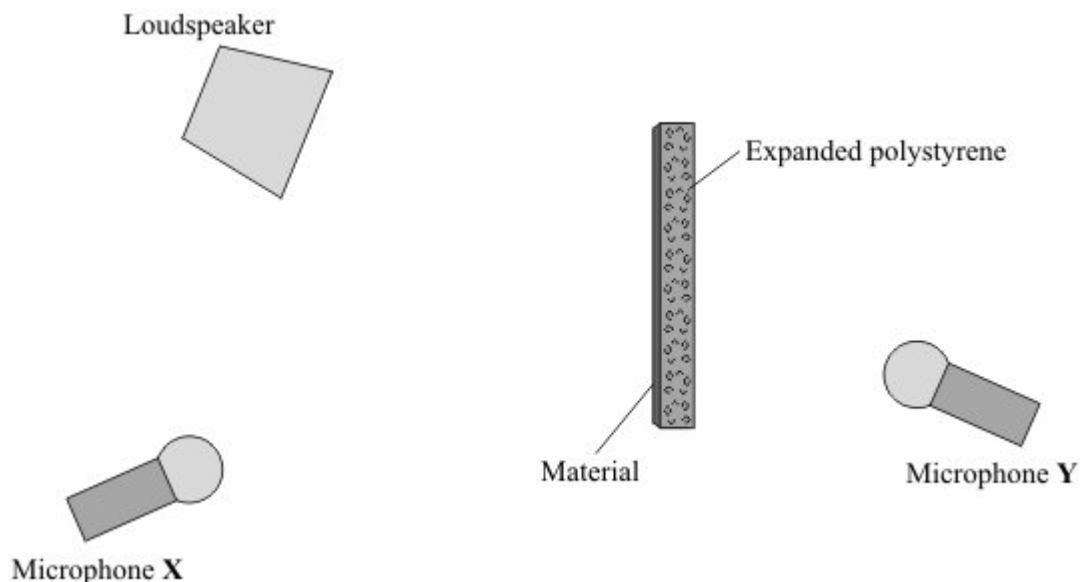
(1)

- (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.



(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.

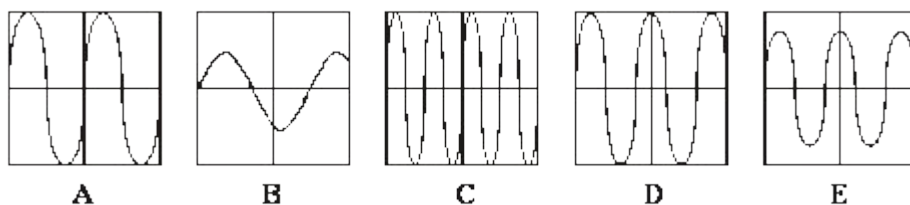
Suggest **one** practical idea to reduce the amount of noise transmitted into the flat through the walls and explain how your idea will work.

(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 _____.

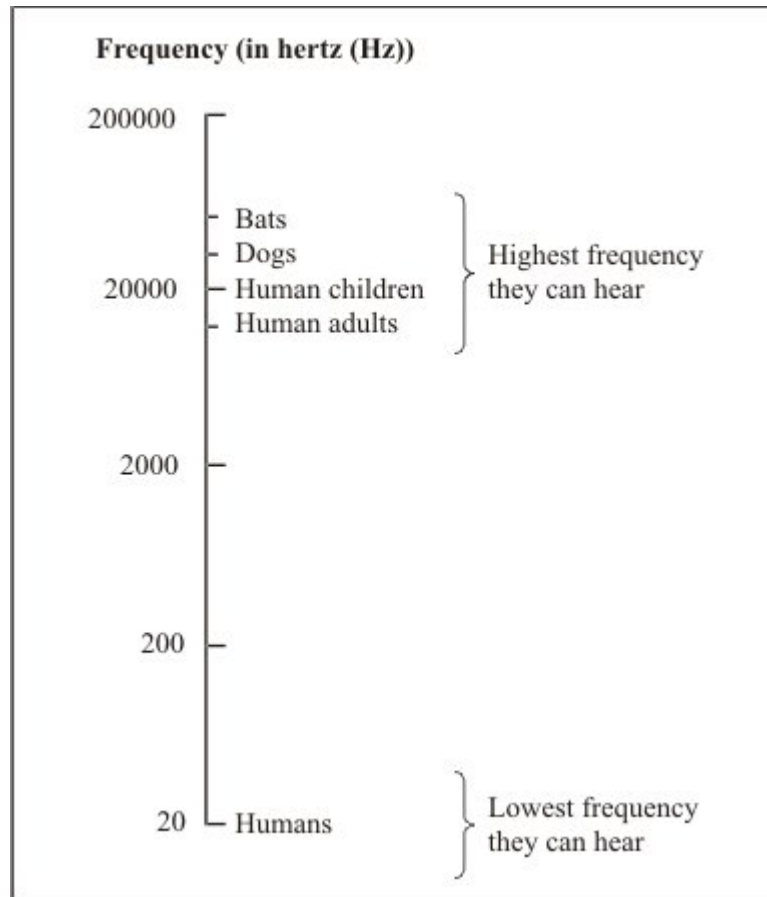
(1)

- (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.



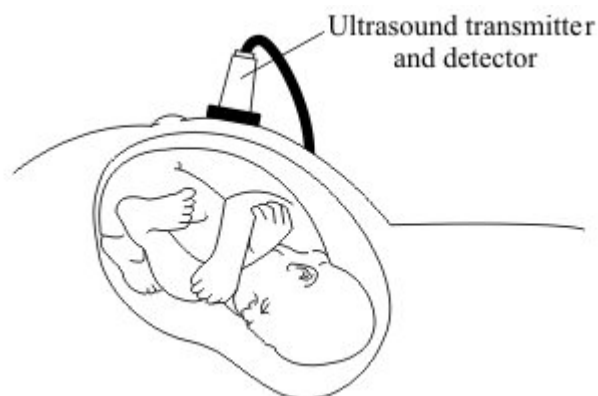
- (i) What is the widest range of frequencies that a human child can hear?

(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.

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.

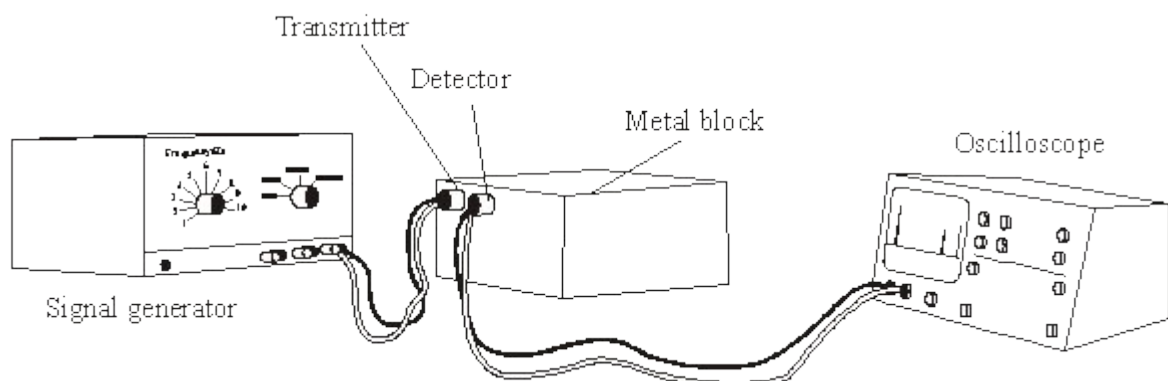
Ultrasound can be used in industry for detecting internal cracks in metals.

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

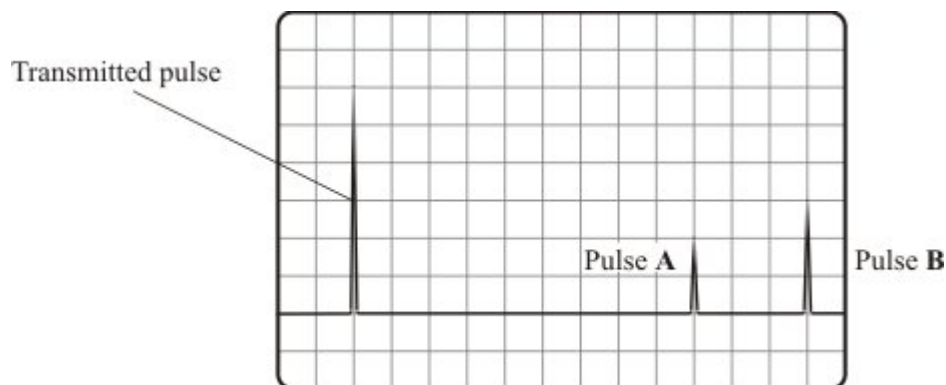
1. _____
2. _____

(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.

(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)

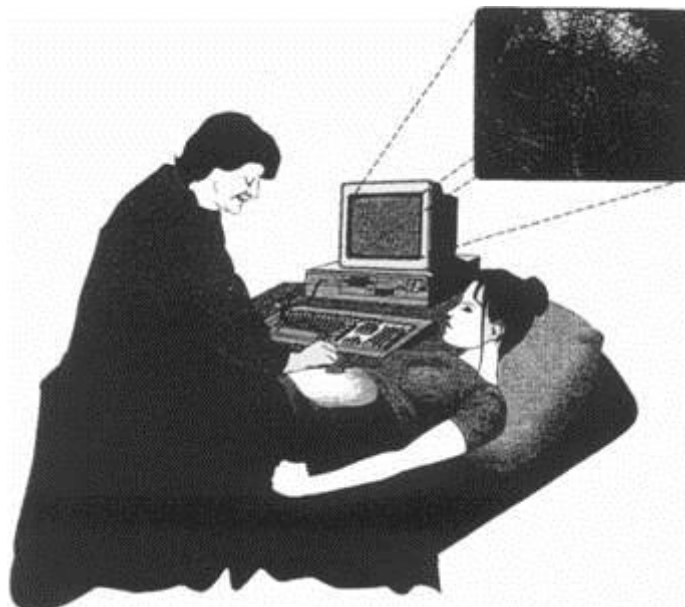
(Total 3 marks)

Q10.

- (a) What is ultrasound?

(1)

- (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.

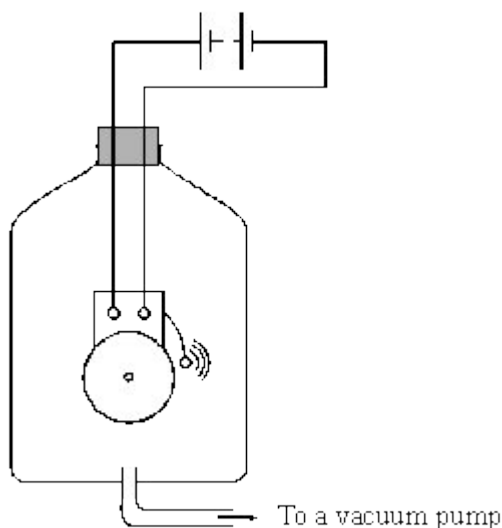
2. _____

(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 to light energy.

☐

A microphone transfers sound energy to electrical energy.

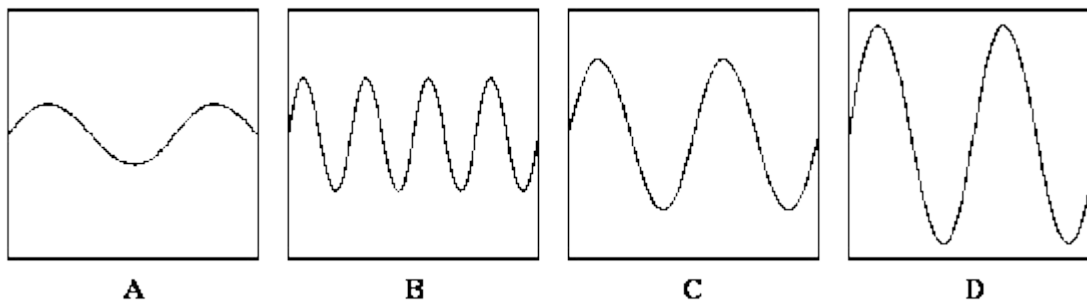
☐

A microphone transfers electrical energy to sound energy.

☐

(1)

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



- (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; _____

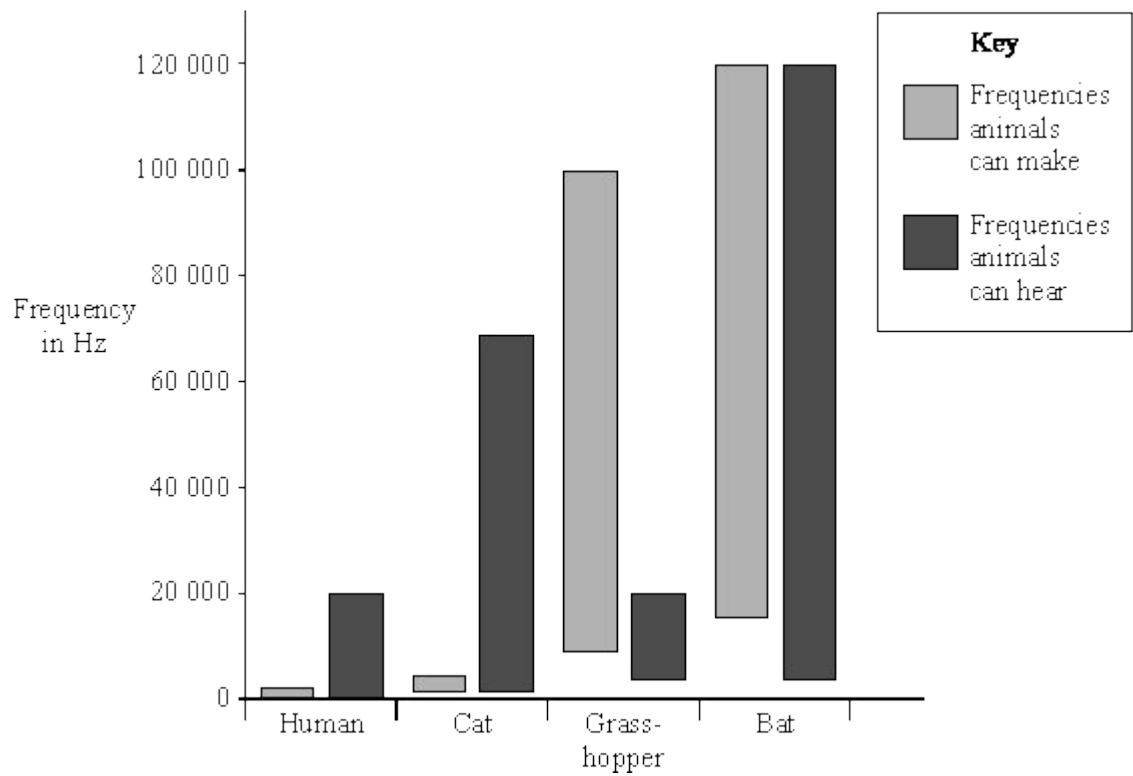
the slowest? _____

(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.



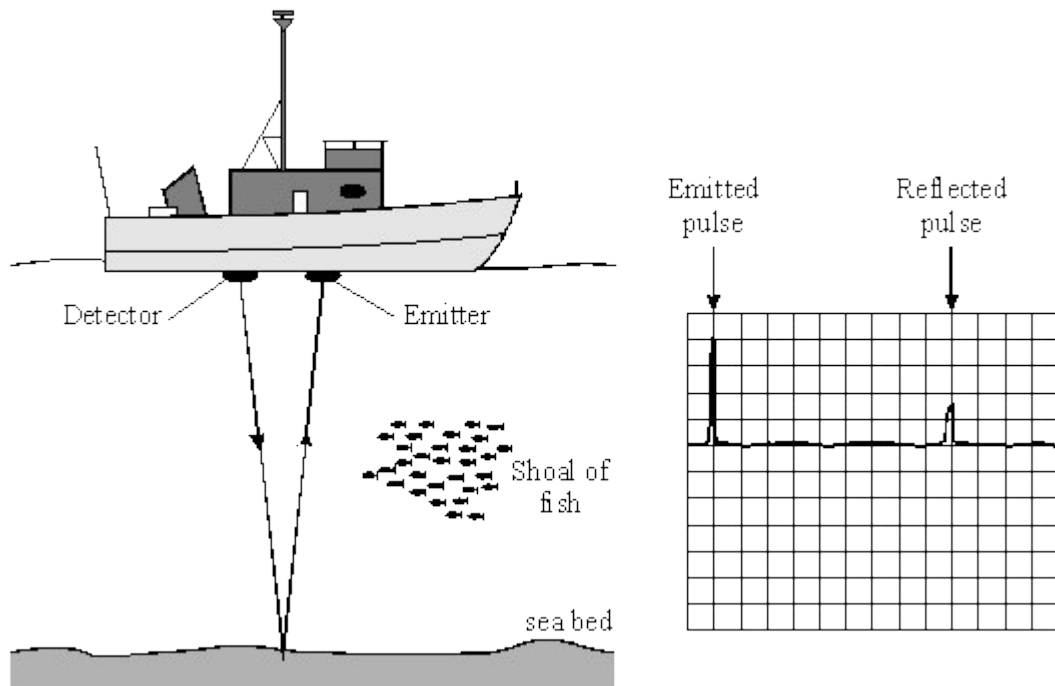
- (i) Which of the animals can make sounds which are beyond their own hearing range?

(1)

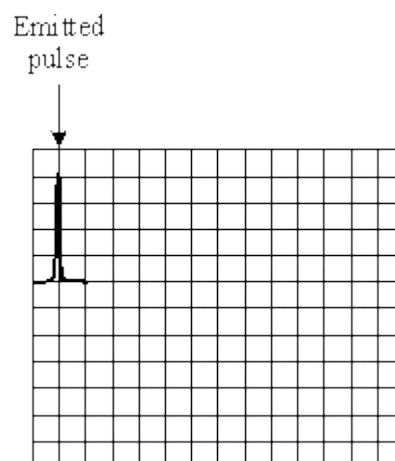
- (ii) What name is given to the sounds which a cat can hear but a human cannot?

(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.



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)

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

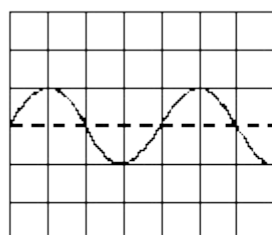


Diagram **X**

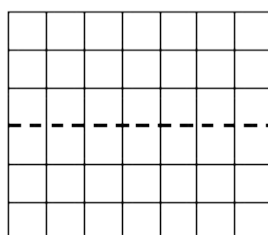


Diagram **Y**

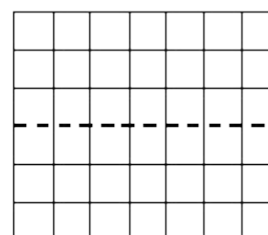


Diagram **Z**

- (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

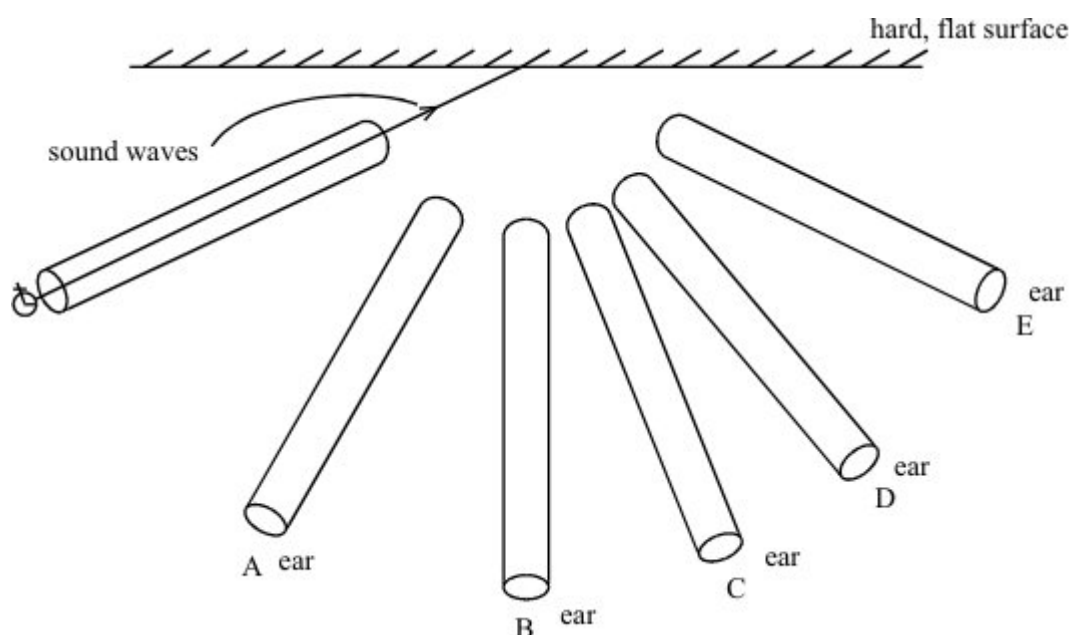
- (i) A musical note with a high frequency sounds _____ than one with a low frequency.
- (ii) A noise of small amplitude sounds _____ than one with large amplitude.

(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?

Choose from positions A-E on the diagram _____

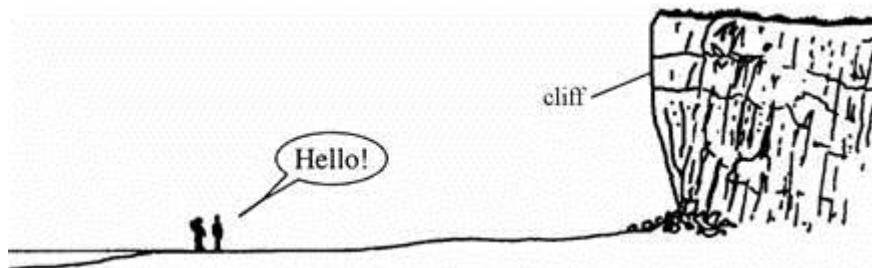
(You may draw on the diagram if you want to.)

(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)

- (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)

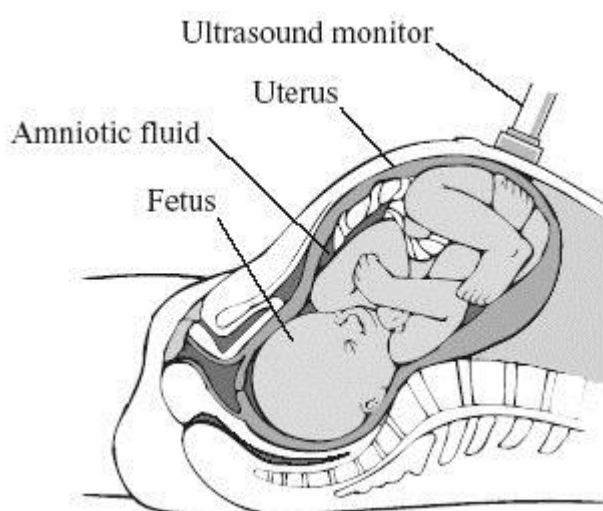
(ii) What change, or changes, would make the sound higher in pitch?

(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.

(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)

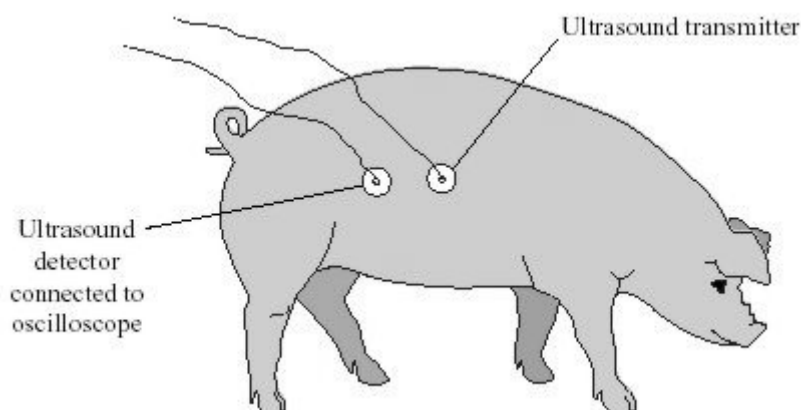
- (ii) Give **one** industrial use of this type of sound.

(1)

(Total 4 marks)

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?

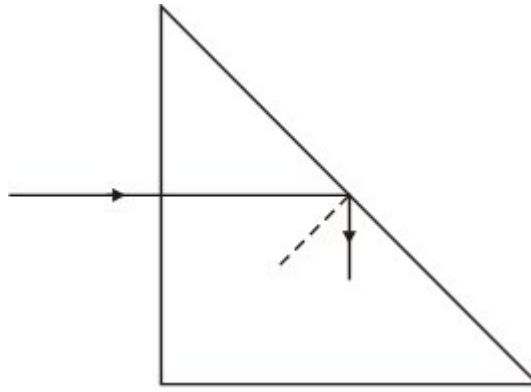
(1)

(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.



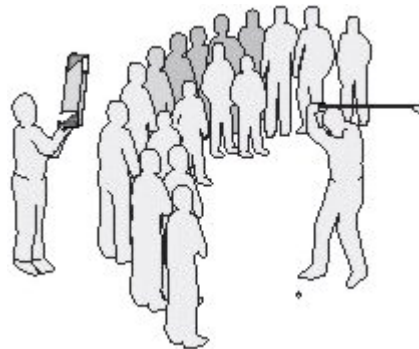
To gain full marks for this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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

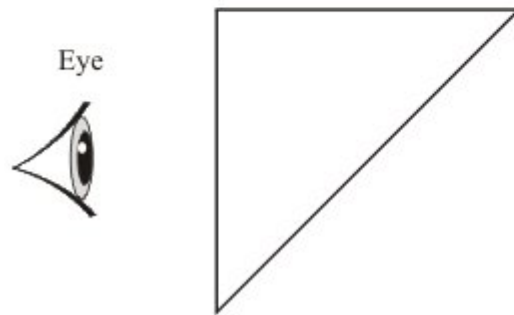
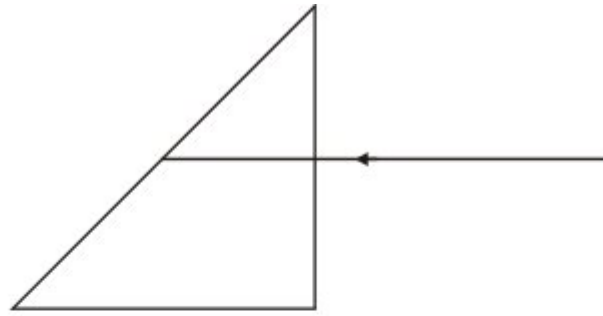
angle	critical	normal
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(3)

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



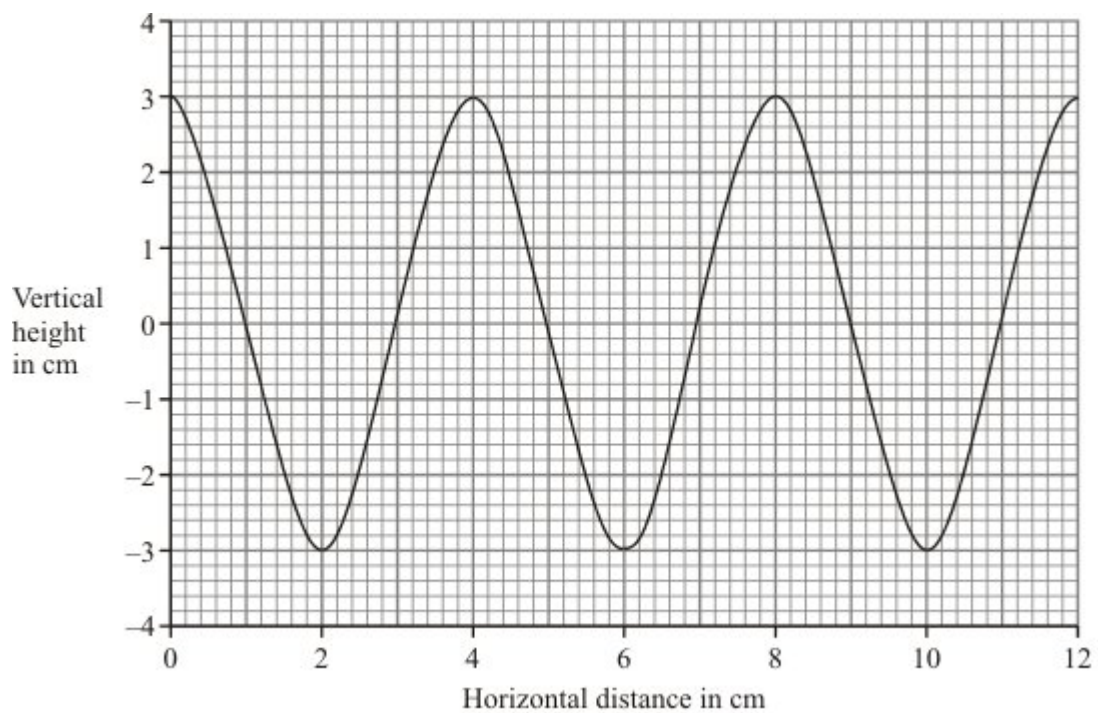
A periscope contains two glass prisms.
Complete the diagram to show the ray of light reaching the person's eye.



(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)

(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)

(Total 6 marks)

Mark schemes

Q1.

- (a) microphone 1
- (c) (i) vertical line from any maxima or minima to axis
do **not** penalise minor errors but
do **not** allow unless intention is clear 1
- (ii) loudness / volume / intensity / energy
do **not** accept noise 1
- (c) 17
this answer only 1
- (d) the greater the distance, the smaller the amplitude
accept volume / intensity / energy / loudness for amplitude
or
there is a (strong) negative correlation between distance and amplitude
or
there is an inverse square relationship between distance and amplitude
do **not** accept distance and amplitude are inversely proportional 1
- (e) 20 Hz
either order 1
- 20,000 Hz
accept 20 kHz provided unit has been clearly changed 1

[7]

Q2.

- (a) 20000
accept any unambiguous indication 1
- (b) kilohertz
credit misspellings
credit '1000 hertz' or '1000 Hz'
accept 1000 oscillations/beats/waves per second 1
- (c) (i) cleaning (e.g. something delicate such as a watch)
or quality control/flaw detection
credit any appropriate extra Specification response
e.g. sonar

- 1
- (ii) pre-natal (scanning)
*do **not** credit just 'scanning'/medical scanning/ scanning a baby*
credit any appropriate extra Specification response
e.g. destruction of (kidney) stones or cleaning teeth
 1
- (d) 8 (μ s)
 1
- (e) distance (1)
 between the boundary and the detector (1)
accept 'between the boundary and the source'
accept any correct use of speed = distance/time
 2
- (f) examples
 publish/tell doctors/the public (1) ... their evidence/results/research/data (1)
 carry out more research/tests (1) ... to make sure/check reliability (1)
allow a wide variety of appropriate responses
valid point (1) appropriate
example/qualification/expansion/etc. (1)
allow just 'stop using them/ultrasonic waves' (1)
allow using them (only) for industrial purposes (1)
 2

[9]

Q3.

- (a) (i)
correct order essential
 (A =) a microphone
 1
 (B =) an oscilloscope
or cathode ray oscilloscope or CRO
 1
- (ii) the amplitude
accept any unambiguous indication
 1
- (iii) quieter / softer
*do **not** accept less (which could refer to the amplitude, frequency or wavelength)*
 1
- (b) sound cannot travel through a vacuum / (empty) space / free space
accept there is no medium for the sound to travel through
 1

(because) there is / are nothing / no particles to vibrate
*accept (because) there is / are nothing / no particles
 between them and the source (of the sound)*

1

[6]

Q4.

- (a) (i) same frequency / period / pitch / wavelength

ignore references to amplitude

1

- (ii) differences in waveform / shape / quality

accept the diagrams are not identical

1

- (b) (i) 20 000 Hz / hertz

or 20 kHz / kilohertz

*in both cases, if the **symbol** rather than the name is used, it
 must be correct in every detail*

1

- (ii) material(s) / substance(s) (through which sound travels)

1

- (iii) is absorbed

*accept (some) sound (energy) is transformed / transferred as
 heat / thermal energy*

1

is transmitted

accept is refracted

accept changes speed

accept changes velocity

*do **not** accept is diffracted*

*do **not** accept is diffused*

*do **not** accept is dissipated*

1

[6]

Q5.

- (a) (i) 25 (%)

*do **not** accept $\frac{1}{4}$*

1

- (ii) increases

1

- (b) tick (✓) in top and bottom box

both required

1

- (c) SHINY surfaces are good reflectors of infra-red radiation

accept white for shiny

- or black surfaces are POOR reflectors of infra-red radiation
accept bad for poor
accept insertion of 'not' before 'good' in statement
- or black surfaces are good EMITTERS of infra-red radiation
- or black surfaces are good ABSORBERS of infra red radiation

1

[4]

Q6.

- (a) (mechanical) vibration(s)

not just 'particles knocking into each other'
not reference to 'sound particles'

1

- (b) K

1

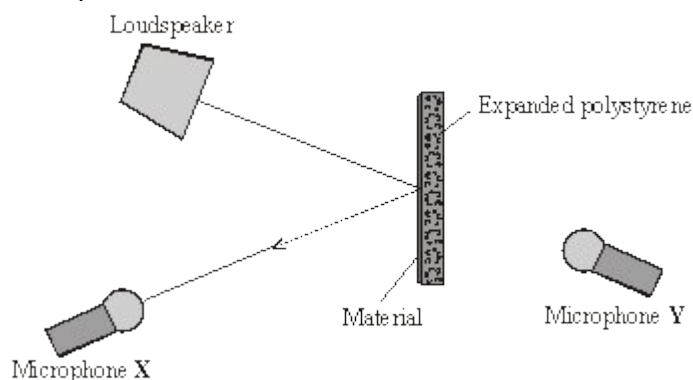
- (c) (i) reflected by the material from loudspeaker to microphone X

1

shown by straight lines with angle of incidence = angle of reflection
 (by eye) **and** at least one arrow in the correct direction

do not credit if the direction is contradicted by any incorrect arrow / may be shown by waves / wavefronts in the direction of straight lines

ignore any sound to Y or which 'misses' the material
example



1

- (ii) any **one** from:

- so (the student) can compare results
- so only one (independent) variable
- to get reliable / accurate results
- because (the expanded) polystyrene absorbs some of the sound
do not credit just 'so it's a fair test'

1

- (iii) **[A]** wood

1

[B] either 0.25 or 1/4 or 25 % or 15/60 or 1: 3

do not credit 1 : 4

1

- (d) practical suggestion

1

appropriate reason / explanation

example line / panel the walls with wood / plasterboard /
increase the thickness of the plaster (on the walls) (1)
(this) will absorb / reflect (back) (most / some of) the sound
(1)

credit legal suggestions for attempting to limit the noise
made by the neighbours

example ask the neighbours to make less noise (1)
by limiting the time(s) music played (1)

do not credit reference to 'sound particles' for second mark

1

[9]

Q7.

- (a) (i) **A, C and D**

any order but all three required and no others

1

- (ii) **D and E**

either order but both required and no others

1

- (b) (i) 20000 (Hz) to 20 (Hz)

accept '19980 (Hz)'

or vice-versa

1

- (ii) frequency (of dog whistle) too high (for humans to hear) / frequency
above 20000 Hz

accept 'it is ultrasound'

accept 'sound from the whistle is ultrasonic'

1

- (c) (i) substance

1

reflection

correct order essential

1

- (ii) detector

1

[7]

Q8.

- (a) any **two** points:

*do **not** credit features which are true of sound in general eg longitudinal waves*

- humans cannot hear ultrasound
- it has a very high frequency / pitch
*do **not** credit just 'has a high frequency / pitch'*
- above the (upper) limit for humans / above 20 000 Hz

2

- (b) (i) ultrasound / waves are reflected
*...are bounced is insufficient, but
...echo is acceptable*

1

Pulse **A** indicates / is the crack

Pulse **B** indicates / is the back (of the block or crack)
need to mention both A and B to get this mark

1

- (ii) 90 (mm)
accept any answer in the range 88 – 92 (mm)

1

[5]

Q9.

- (i) (partly) reflected when they hit a (boundary between two) different media or substance or tissue
*accept named substances
do **not** accept bounce back*

1

time taken for reflected wave (to return) is used to produce the image

1

- (ii) any **one** from:
- cleaning a delicate mechanism / jewellery
*do **not** accept cleaning*
 - welding plastics
 - cutting textiles
 - mixing emulsion paints
 - sonar
 - motion sensors (in burglar alarms)
*do **not** accept burglar alarms*
 - removing dental plaque
 - industrial quality control

breaking up kidney stones

treating injuries

1

[3]

Q10.

- (a) sound with a frequency above audible

do not accept answer in terms of λ

do not accept sound which cannot be heard unless obvious from context

accept above 20 kHz

1

- (b) (i) to show detail **or** to give a clear image/picture

*accept the generators **or** transducers can be small*

accept so the beam does not spread out/beam in focus

***not** 'good picture'*

1

- (ii) (much) smaller wavelength

allow higher frequency/pitch

1

- (iii) no damage to living cells (provided low power)

accept the converse

*accept no damage to baby **or** not dangerous to baby*

1

- (iv) any **two** forms

sex

stage of development

or specific examples

abnormalities

general health

potential problems (at birth)

accept specific examples e.g. umbilical cord around neck

size of head

accept multiple births

2

[6]

Q11.

- (a) stop

accept any indication

cannot travel

- (b) middle box ticked

*accept a tick next to the statement even if not in the box
do **not** accept two ticks*

1

- (c) (i) B

highest frequency

*accept most waves (in box)
accept 'squashed together'
do **not** accept 'squashed'
accept 'close (together)'
accept shortest wavelength*

2

- (ii) D

largest amplitude

*accept tallest **or** highest wave
do **not** accept biggest wave
do **not** accept 'high' wave*

2

[7]

Q12.

- (a) glass

1

air

must be in correct order

1

closer the particles faster the speed

answer must show a comparison

or

particles in glass closest in air furthest apart

accept the denser the material the faster the sound travels

or

sound travels faster in solids than gases

incorrect explanation negates credit

1

- (b) (i) grasshopper

- (ii) ultrasound

accept ultrasonic

1

- (c) all of reflected pulse closer than given in original diagram

accept a cluster of pulses ignore a reflected pulse in original position any pulse drawn to right of original negates credit

1

reflected pulse smaller than emitted but greater than 1 square high
accept cluster of pulses provided one part fulfils height criteria

2

[7]

Q13.

- (a) number of complete vibrations per second
for 1 mark

1

- (b) (i) correct trace (more waves), *ignore amplitude*
for 1 mark

1

- (ii) correct trace (higher amplitude), *ignore frequency*
for 1 mark

1

- (c) (i) higher
for 1 mark

1

- (ii) quieter
for 1 mark

1

[5]

Q14.

D

gains 1 mark

but E ($D + E = 1$)

gains 2 marks

[2]

Q15.

- idea that (in words or on diagram)
- sound reflects / bounces off cliff
- returns the way it came / produces an echo
each for 1 mark

[2]

Q16.

- (a) changes the sound wave(s)

to a varying **or** changing (electric) potential difference **or** p.d. **or** voltage
or current **or** to an irregular alternating current or a.c. **or** transfers
 sound energy to electrical energy (1) mark is vibrations **or** pulses **or** of
 sound **or** in air become electrical waves

*do not credit just 'to electricity' **or** 'to a.c'*

2

- (b) (i) decrease **or** reduce the amplitude

accept less amplitude nothing else added

1

- (ii) increase the frequency **or** decrease
 wavelength

accept higher frequency nothing else added

1

[4]

Q17.

Quality of written communication

correct use of **three** scientific terms from speed / velocity, reflection,
 density, time, boundary

1

any **three** from:

different tissues have different densities

ultrasound travels at different speeds / velocities in different tissues

reflection

accept bouncing back

from tissue boundaries

time taken to return

3

[4]

Q18.

- (a) (i) cat

1

- (ii) tuna

1

- (b) (i) ultrasound

allow ultrasonic

1

- (ii) cleaning / quality control / flaw detection / medical scanning /
 animal scaring / sonar

1

[4]

Q19.

- (a) (ultrasound) waves reflected
accept 'bounce off'

1

at boundary / from muscle

1

- (b) (i) time

1

- (ii) speed of (ultrasound) waves

1

[4]

Q20.

- (a) Quality of written communication:
Correct use of 2 of the words, angle, critical, normal and reflection

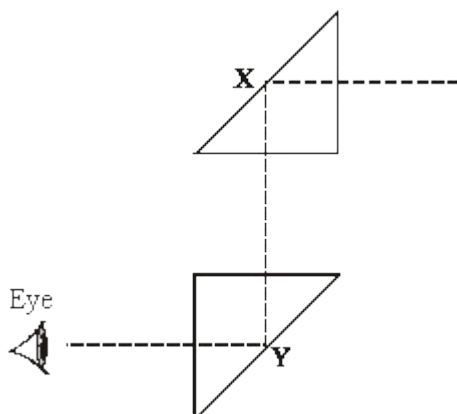
1

any **two** from

- light is reflected / bounces off
- if angle between ray and normal angle of incidence
- is greater than critical angle
- idea that no refraction bending if ray at 90°

2

- (b)



1 mark for reflection at X if ray would reach the lower prism

1 mark for subsequent reflection at Y

1 mark for subsequent ray emerging from prism in direction of front of eye

accept dotted or dashed lines

ignore any arrows

3

[6]

Q21.

(a) 4

1

(b) 3

1

(c) 3

correct answer with no working = 2
allow 1 mark for $f = \text{number} \div \text{time}$
or correct working i.e., $12 \div 4$
N.B. correct answer from incorrectly
recalled relationship / substitution = 0

2

Hz / hertz

accept HZ, hz, hZ
allow waves / cycles per second
allow wps, w/s, cps, c/s

1

[5]**Q22.**

(a) vibrates (owtte)

for one mark

1

(b) (i) higher

for one mark

1

(ii) louder

for one mark

1

(c) (i) ultrasonic (ultrasound)

for one mark

1

(ii) different frequency / wavelength / pitch

*gains 1 mark***but**

high frequency / pitch, higher frequency /pitch (lower frequency / pitch wrong)

gains 2 marks

2

[6]