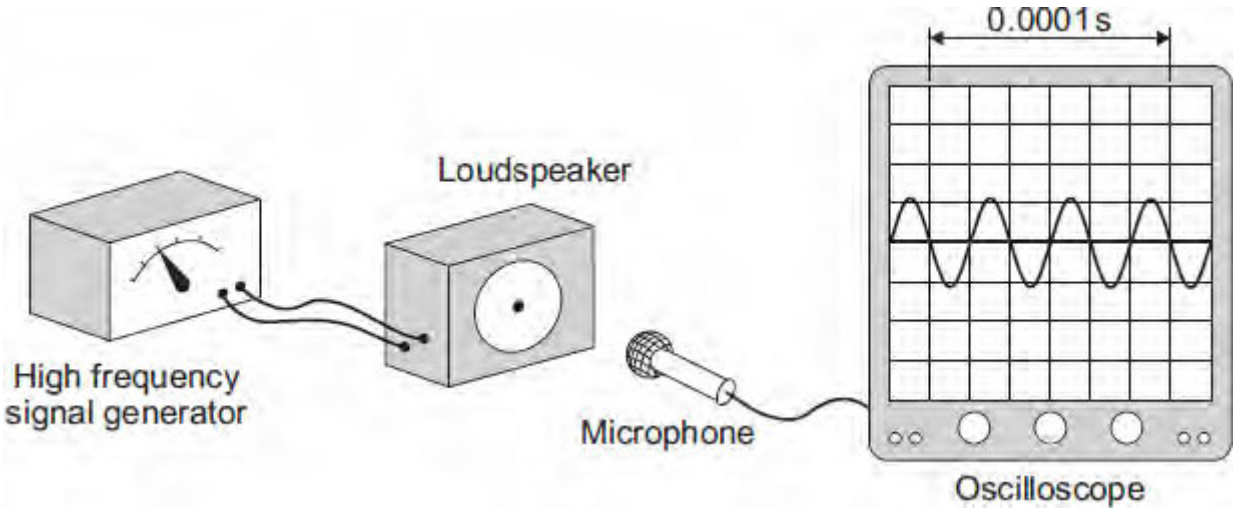
Q1. (a) The diagram shows a microphone being used to detect the output from a loudspeaker.
The oscilloscope trace shows the wave pattern produced by the loudspeaker.



(i) How many waves are produced by the loudspeaker in 0.0001 seconds?

.....

(1)

(ii) How many waves are produced by the loudspeaker every second?
Assume the input to the loudspeaker does not change.

.....

.....

(1)

(iii) A person with normal hearing cannot hear the sound produced by the loudspeaker.

Explain why.

.....

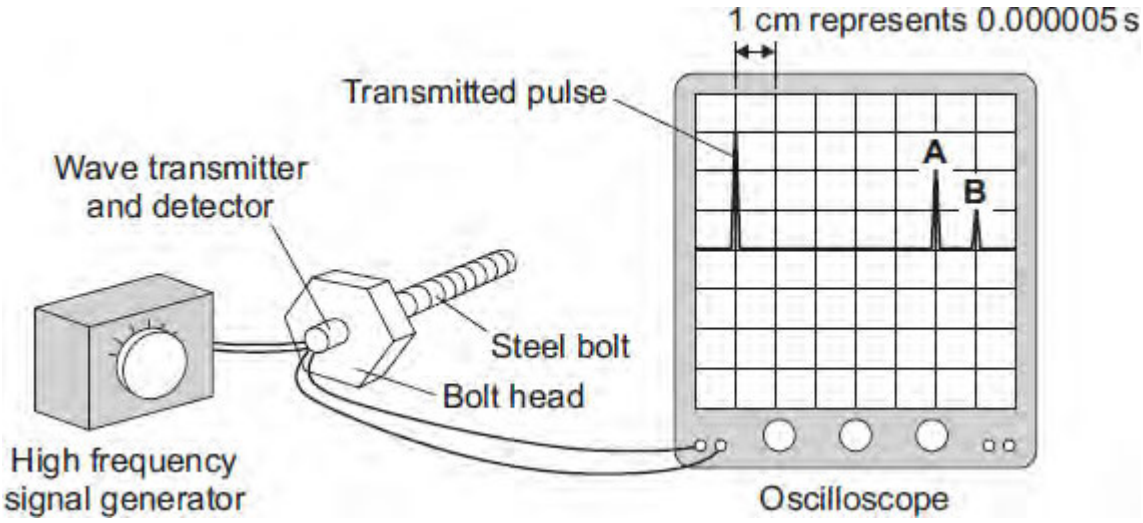
.....

.....

.....

(2)

(b) The diagram shows how a very high frequency sound wave can be used to check for internal cracks in a large steel bolt. The oscilloscope trace shows that the bolt does have an internal crack.



(i) Explain what happens to produce pulse **A** and pulse **B**.

.....

.....

.....

.....

(2)

(ii) Use the information in the diagram and the equation in the box to calculate the distance from the head of the bolt to the internal crack.

distance = speed × time

Speed of sound through steel = 6000 m/s

Show clearly how you work out your answer.

.....

.....

.....

.....

.....

.....

(3)
(Total 9 marks)

Q2. (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)

Q3. 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)

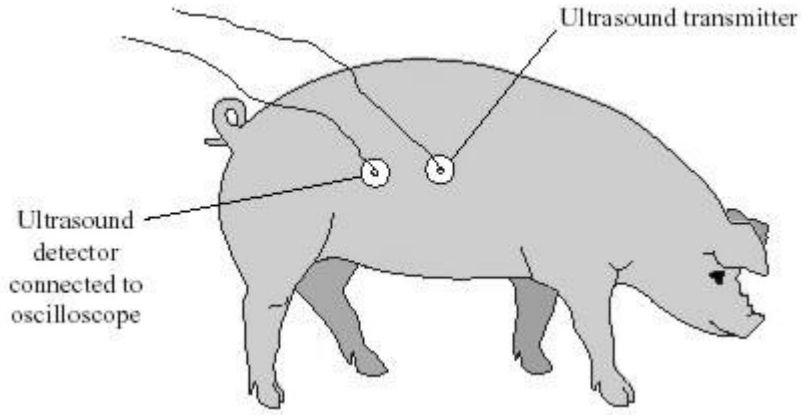
(ii) Give another use for ultrasonic waves.

.....

(1)

(Total 3 marks)

Q4. 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)

Q5. Ultrasound can be used in industry for detecting internal cracks in metals.

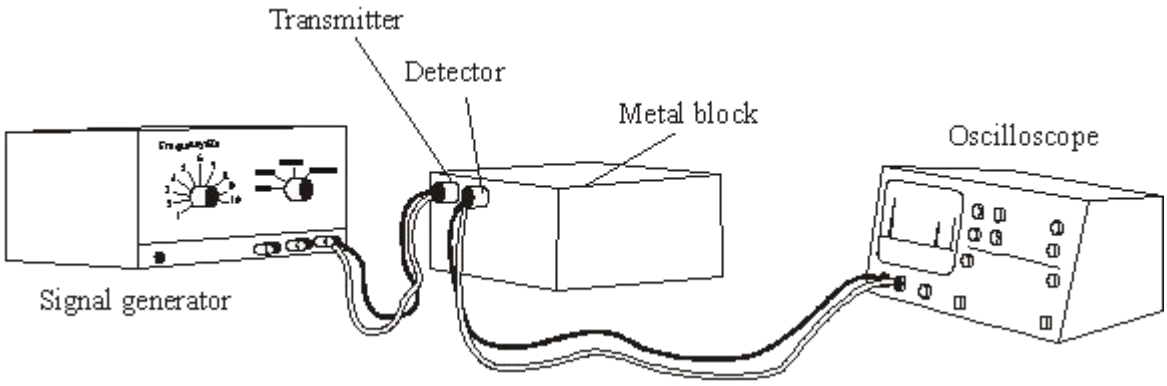
(a) State **two** features of ultrasound.

1 .....

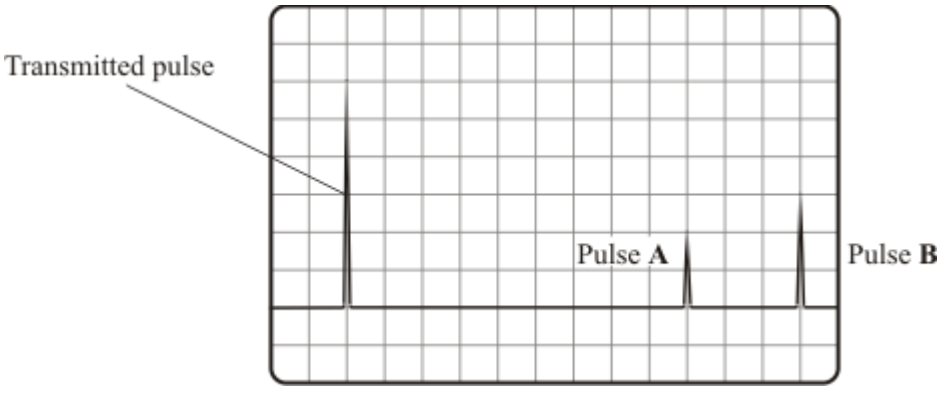
2 .....

(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)

Q6. (a) The diagrams show oscilloscope traces for the same musical note played on two different instruments. The oscilloscope settings are not changed.

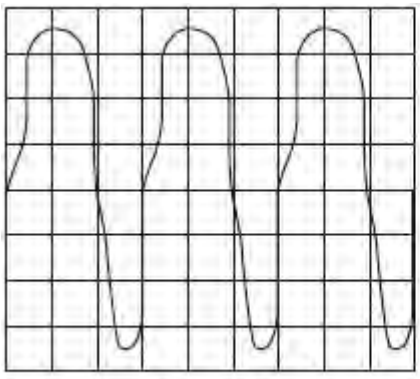


Diagram X

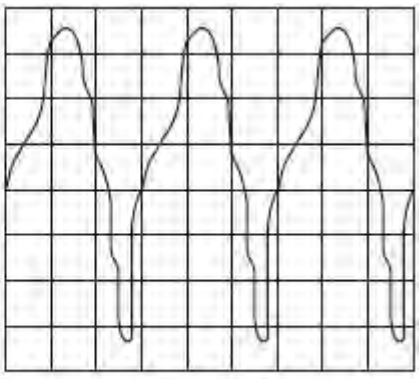


Diagram Y

(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?

.....

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.....

.....

(2)

(Total 6 marks)