

# Ultrasound

## Question Paper

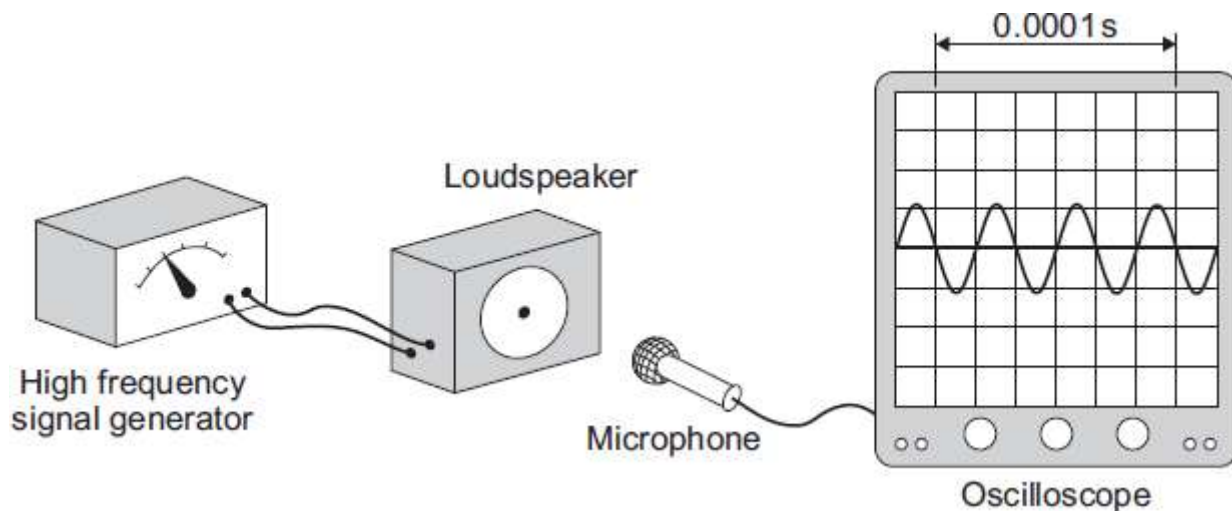
Level	GCSE
Subject	Physics
Exam Board	AQA
Unit	P3
Topic	Ultrasound
Difficulty Level	Gold Level
Booklet	Question Paper

**Time Allowed:** 27 minutes

**Score:** /27

**Percentage:** /100

- 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?

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(1)

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

.....  
.....

(1)

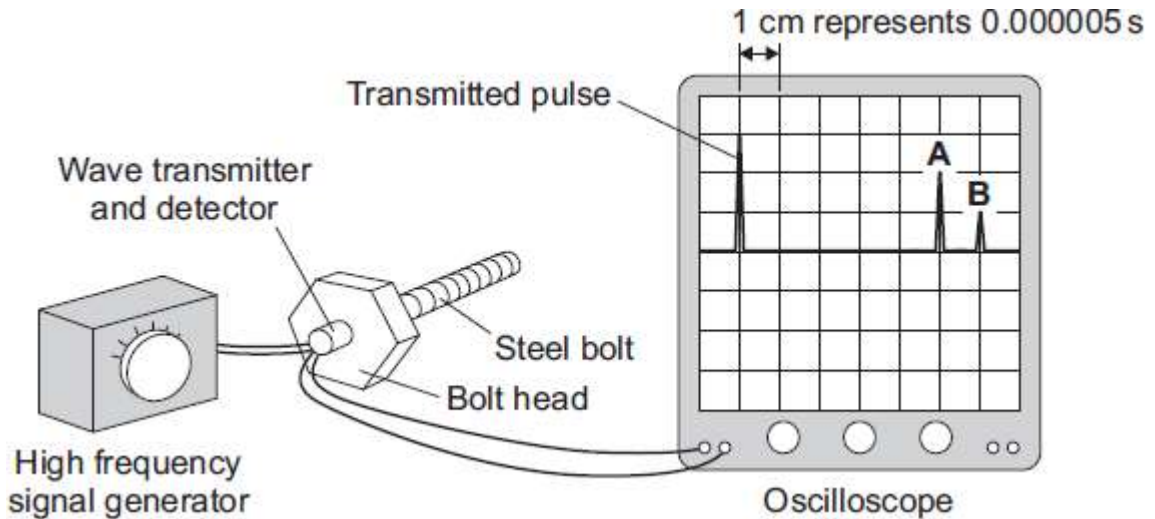
- (iii) A person with normal hearing cannot hear the sound produced by the loudspeaker.

Explain why.

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.....  
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(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**.

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(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.

$\text{distance} = \text{speed} \times \text{time}$
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Speed of sound through steel = 6000 m/s

Show clearly how you work out your answer.

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(3)  
(Total 9 marks)

- Q2.** (a) The diagrams show oscilloscope traces for the same musical note played on two different instruments. The oscilloscope settings are not changed.

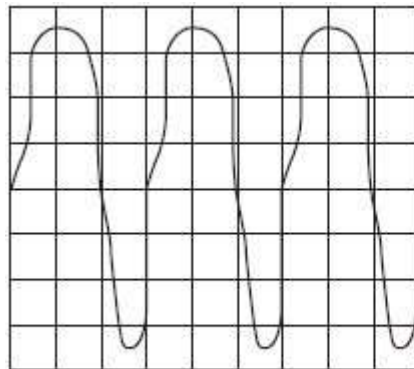


Diagram X

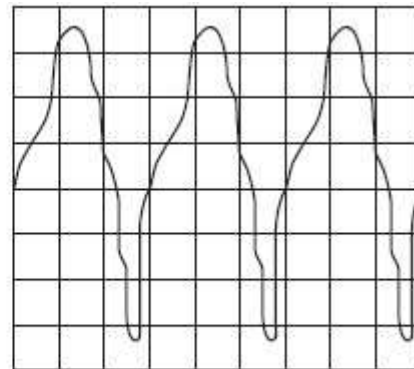


Diagram Y

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

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(1)

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

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(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?

.....

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(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)

**Q3.** Ultrasound can be used in industry for detecting internal cracks in metals.

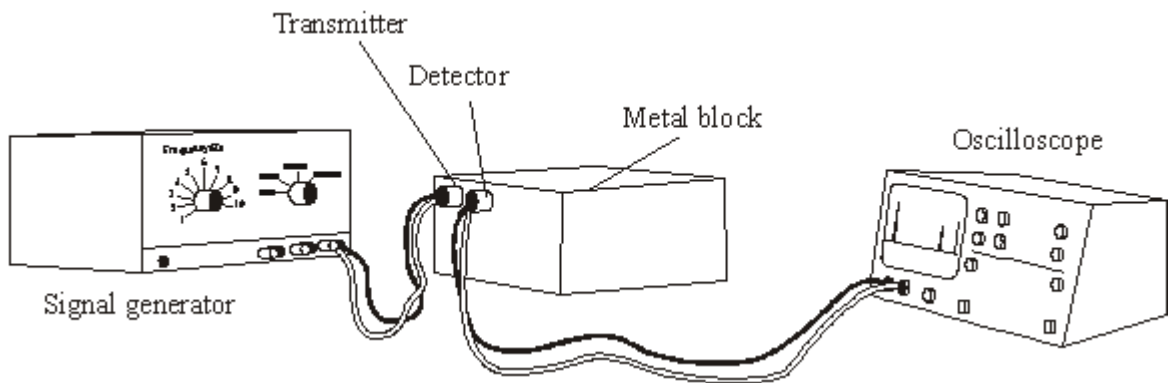
(a) State **two** features of ultrasound.

1 .....

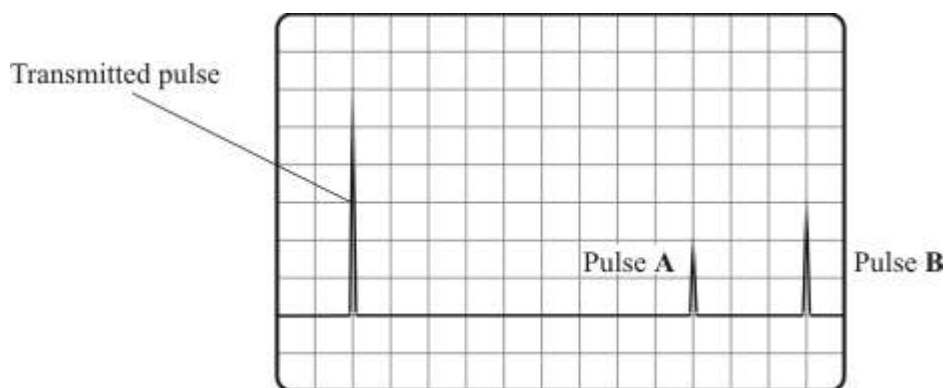
2 .....

(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)

**Q4.** 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.

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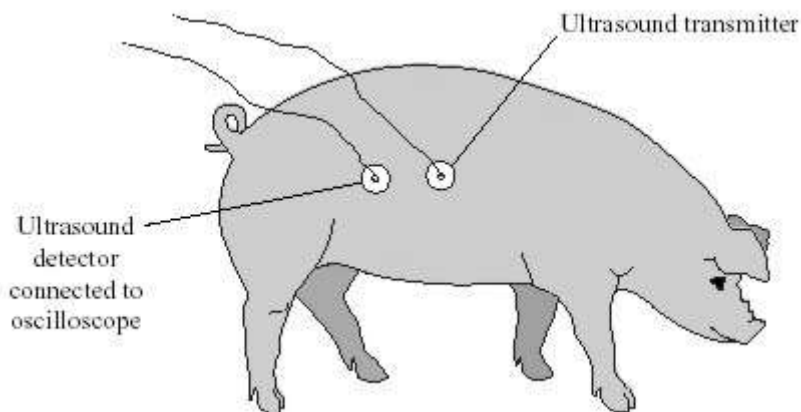
(2)

- (ii) Give another use for ultrasonic waves.

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(1)  
(Total 3 marks)

- Q5.** 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.

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(2)

- (b) The oscilloscope does not measure distance directly.



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

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**(1)**

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

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**(1)**

**(Total 4 marks)**