Topic 13 Sound

PAPER 1

MULTIPLE-CHOICE QUESTIONS

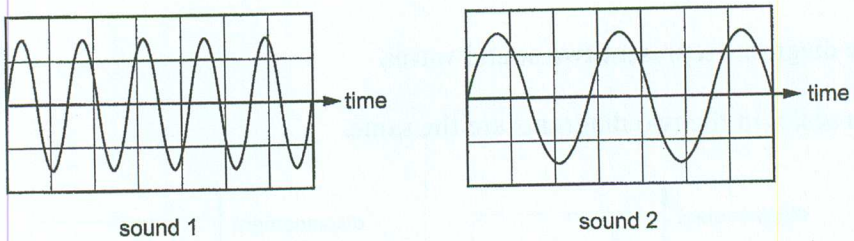
For each question, there are four possible answers. Choose the one you consider correct and record your choice (A, B, C or D) in the brackets provided.

1. A violin produces a note of frequency 256 Hz.

   Which statement about the violin string is correct? (2014/P1/Q15)

   A It is 256 cm long.
   B It has a wavelength of 256 m.
   C It produces sound waves travelling at 256 m/s.
   D It vibrates 256 times each second. ( )

2. The waveform of two different sounds are shown.



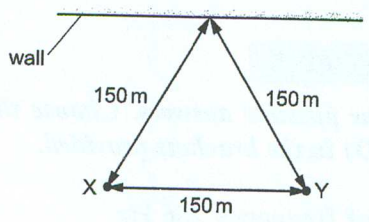
sound 1 sound 2

   The scales are the same in each diagram.

   How does sound 2 compare with sound 1? (2015/P1/Q15)

   A Sound 2 is louder than sound 1.
   B Sound 2 is quieter than sound 1.
   C Sound 2 has a higher pitch than sound 1.
   D Sound 2 has a lower pitch than sound 1. ( )

3. A gun is fired into the air by a man standing at point X.



A man standing at point Y hears the sound twice, once by the direct route and once by the reflection off the wall.

The speed of sound is 300 m/s.

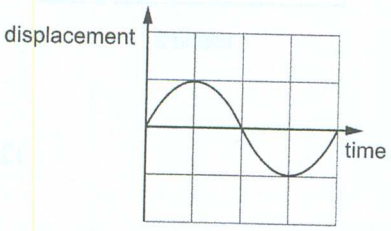
What is the time interval between hearing the two sounds? (2016/P1/Q15)

A 0.25 s
B 0.50 s
C 1.0 s
D 2.0 s

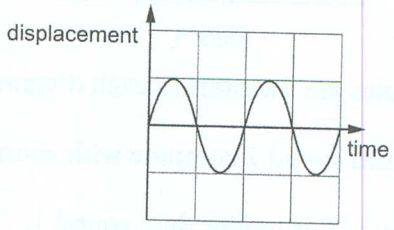
( )

4. The diagrams represent two sound waves.

The scales in the two diagrams are the same.



sound wave 1



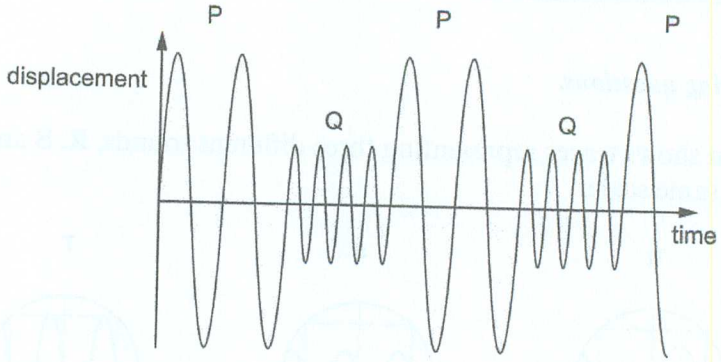
sound wave 2

Which statement describes the waves? (2017/P1/Q16)

A The waves have different loudness and different pitch.
B The waves have different loudness but the same pitch.
C The waves have the same loudness and the same pitch.
D The waves have the same loudness but different pitch.

( )

5. A police car siren emits two different sounds P and Q. These are produced alternately. The diagram represents the sounds emitted.

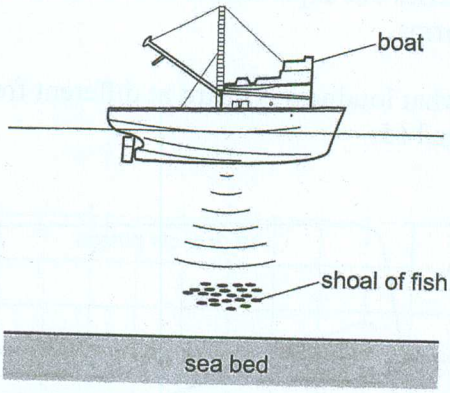


Which sound is the louder and which has the lower pitch? (2018/P1/Q15)

	louder	lower pitch
A	P	P
B	P	Q
C	Q	P
D	Q	Q

( )

6. A fishing boat uses equipment that produces sound to detect shoals of fish below the boat.



The fishing boat receives an echo from a shoal of fish 0.80 s after the sound is sent. If the speed of sound in water is 1500 m/s how deep is the shoal of fish? (2019/P1/Q15)

A 300 m
B 600 m
C 1200 m
D 1875 m

( )

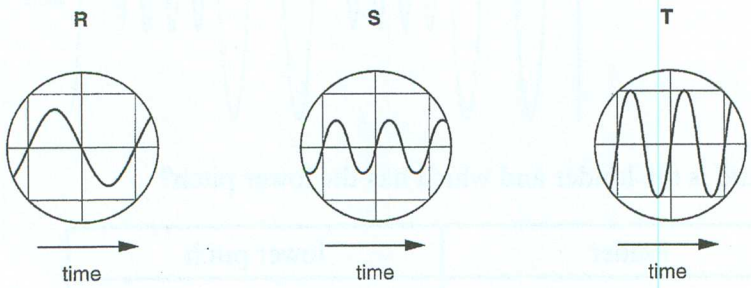
PAPER 2

STRUCTURED QUESTIONS

Section A

Answer the following questions.

1. The diagram shows traces representing three different sounds, **R**, **S** and **T**. The traces all have the same scale.



(a) Which sound **R**, **S** or **T** is the loudest? Explain your answer. [2]

(b) Which sound **R**, **S** or **T** has the lowest pitch? Explain your answer. [2]

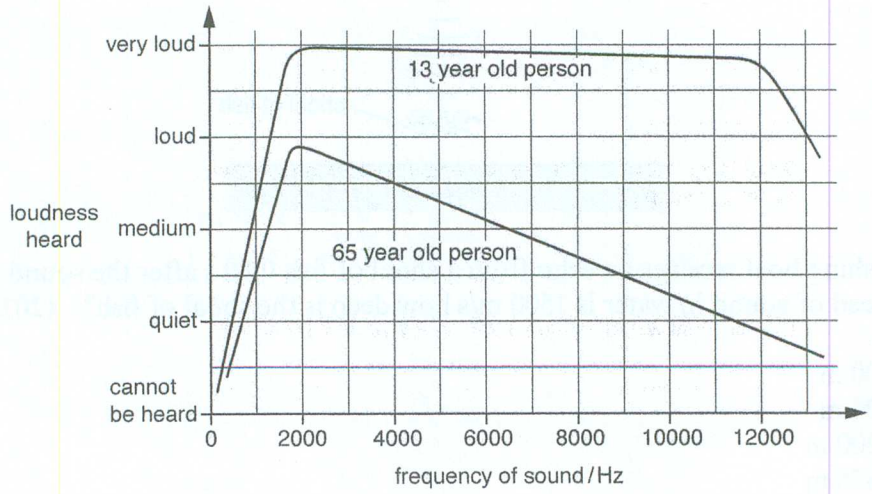
(2016/P2/A3a, b)

2. Smoke alarms are designed to emit a sound when smoke is detected.

(a) Explain how the sound waves produced by the smoke alarm travel through the air to reach the ear of a listener. [2]

(b) A manufacturer carries out experiments to determine the best frequency of sound to use in smoke alarms.

The graph shows what loudness is heard at different frequencies by a person aged 13 and a person aged 65.



Use the information shown in the graph to suggest the best frequency of sound to use in a smoke alarm.

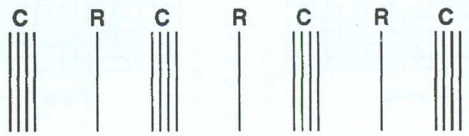
Give a reason for your choice. [2]
(2017/P2/A3)

Section B
Answer the following questions.

1. A loudspeaker emits a note of wavelength 33 cm. The speed of sound in air is 330 m/s.

   Calculate the frequency of vibration of the loudspeaker and give the unit. Show your working. [3]
   (2013/P2/B6c)

2. (a) The diagram represents a sound wave travelling in air.



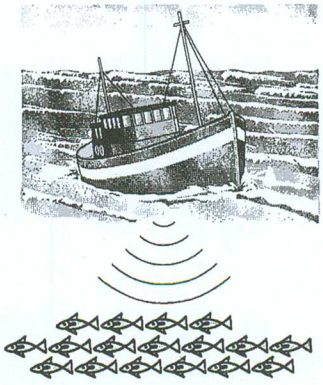
   (i) What do the letters **C** and **R** represent? [1]

   (ii) Explain why a sound wave cannot travel through a vacuum. [1]

   (iii) Sound travels faster in iron than in water. Suggest an explanation for this difference. [1]

   (b) A fishing boat uses sounding equipment to detect shoals of fish below the boat.

   Pulses of sound waves are sent out from the boat and the shoals of fish reflect the sound.



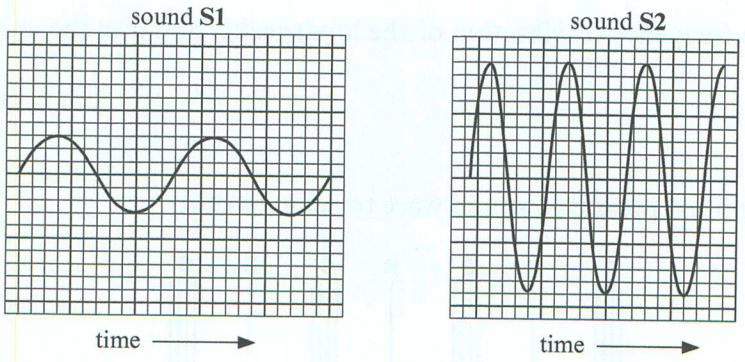
The equipment picks up a reflection of sound from a shoal of fish 0.1 seconds after it leaves the boat.

(i) What name is given to the reflection of sound? [1]

(ii) Sound waves travel through water at a speed of 1500 m/s.

Calculate the distance of the shoal of fish below the boat. [2]

(c) The diagram shows traces of two different sound waves, **S1** and **S2**, drawn to the same scale.



State two ways in which sound **S1** differs from sound **S2**. [2]
(2014/P2/B6)

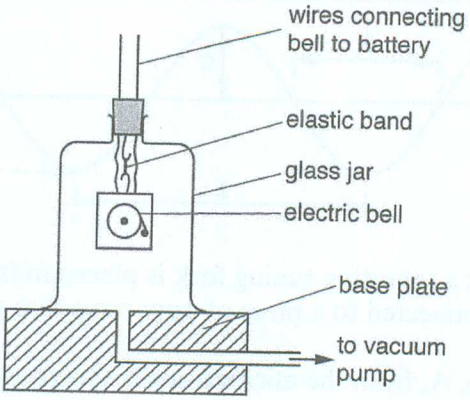
3. A student runs a 100 metre race.

The race is started using a starting pistol.

(a) Explain how the sound from the starting pistol reaches the ears of the people recording the times of the race. [2]

(b) What type of wave is a sound wave? [1]
(2015/P2/B8b)

4. (a) The diagram shows an electric bell in a glass jar. The bell is suspended by an elastic band.



The bell is switched on. A person standing near the glass jar can clearly hear the bell ringing.

(i) The vacuum pump is switched on and is used to remove air from the jar. What happens to the sound of the bell as air is removed from the jar? [1]

(ii) Explain why the bell has been suspended, using an elastic band, rather than being placed on the base plate of the apparatus. [1]

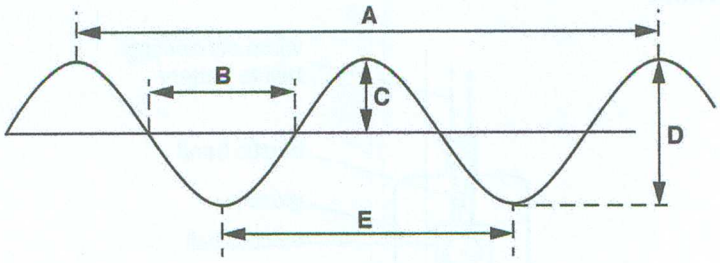
(b) A fishing boat uses sonar equipment to detect a shoal of fish. A pulse of sound waves is emitted from the boat and the echo from the shoal of fish is detected 0.10 s later. Sound waves travel through sea-water at 1500 m/s.

(i) Calculate the distance travelled by the pulse of sound in 0.10 s. [1]

(ii) Calculate the distance of the shoal of fish from the boat. [1]

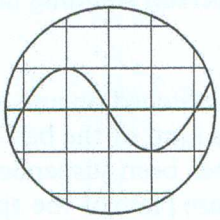
(2018/P2/B7a, c)

5. The diagram represents a wave.



(a) In an experiment a vibrating tuning fork is placed in front of a microphone. The microphone is connected to a piece of apparatus that shows waveforms.

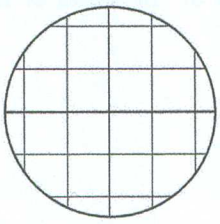
The output trace, A, from the microphone is shown on the screen of the apparatus.



trace A

The controls of the apparatus are not altered throughout the experiment.

(i) The same tuning fork is made to produce a louder sound. Sketch on the diagram the output trace, B, seen on the screen for the louder sound.

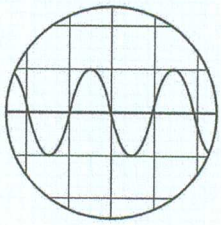


trace B

[1]

(ii) A different tuning fork is placed in front of the microphone. It is made to produce the same volume of sound as that originally produced by the first tuning fork.

The output trace, C, is seen on the screen.



trace C

Explain the difference between trace A and trace C. [1]

(b) The loudness of sound is measured in decibels (dB).

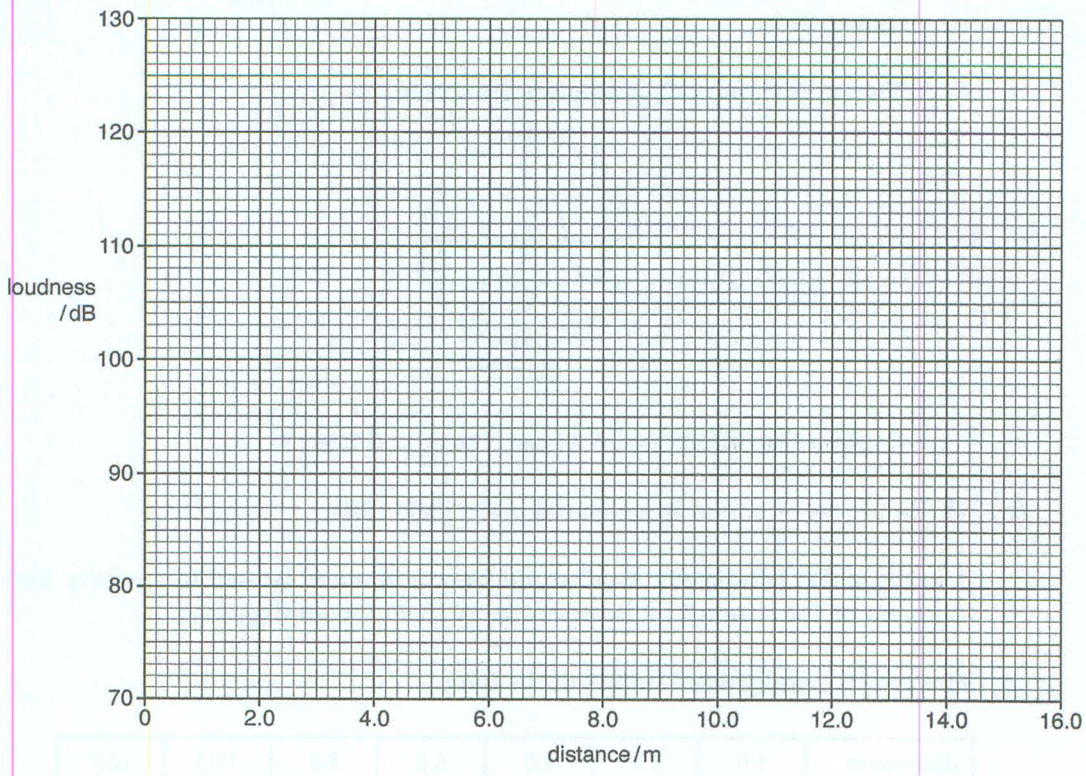
A loudspeaker produces a loud sound. A sound meter is used to measure the loudness of the sound as it is moved away from the loudspeaker.

The results obtained are shown in the table.

distance/m	1.0	2.0	4.0	6.0	8.0	12.0	16.0
loudness/dB	120	110	100	94	90	83	80

(i) Plot a graph of distance against loudness, marking each point with a cross, (✗). [1]

(ii) Draw a curved line of best fit, taking into account all the points. [1]



(iii) A man stands 5.0 m from the loudspeaker.

Use your graph to find how loud the sound is at this distance. [1]

(iv) The table shows the maximum length of time that it is safe for a person to experience a continuous sound.

continuous sound/dB	maximum length of time
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 minutes
100	15 minutes
103	7.5 minutes
106	4 minutes
109	2 minutes
112	1 minute
115	30 seconds
118	15 seconds

Estimate the length of time for which it is safe for the man to stand 5.0 m away from the loudspeaker whilst it is making the sound. [1]

(v) Suggest **one** way in which the man could safely extend this time. [1]

(2019/P2/B7b, c)