Earthquake waves

1 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

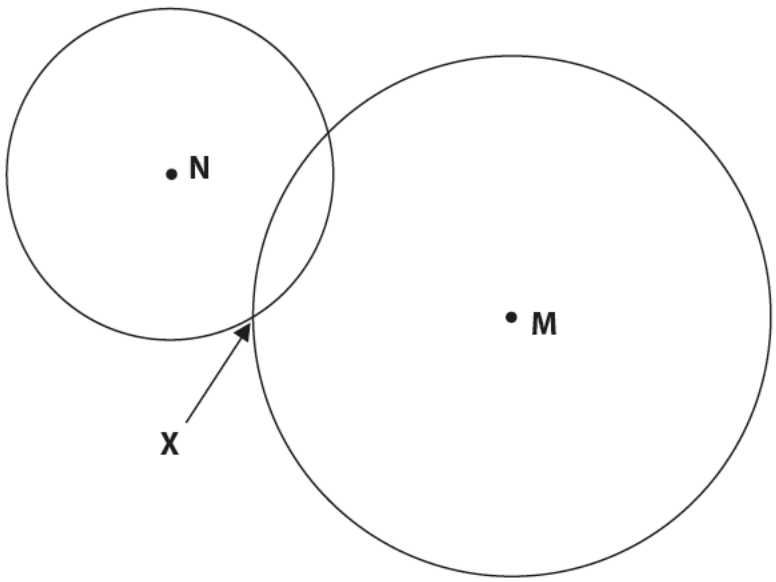
Earthquakes can produce infrasound waves.

Compared to normal sound waves, infrasound waves always have a **smaller**

(1)

- ☒ **A** amplitude
- ☒ **B** energy
- ☒ **C** frequency
- ☒ **D** wavelength

(b) The diagram shows circles drawn around two research stations, **M** and **N**.
The stations are for detecting earthquakes.
Each circle shows the distance of the earthquake from that station.



(i) Two students discuss the diagram.
Student A said: the earthquake **must** have been at X.
Student B said: the earthquake **might** have been at X.

Explain why the statement from student B is better.

(2)

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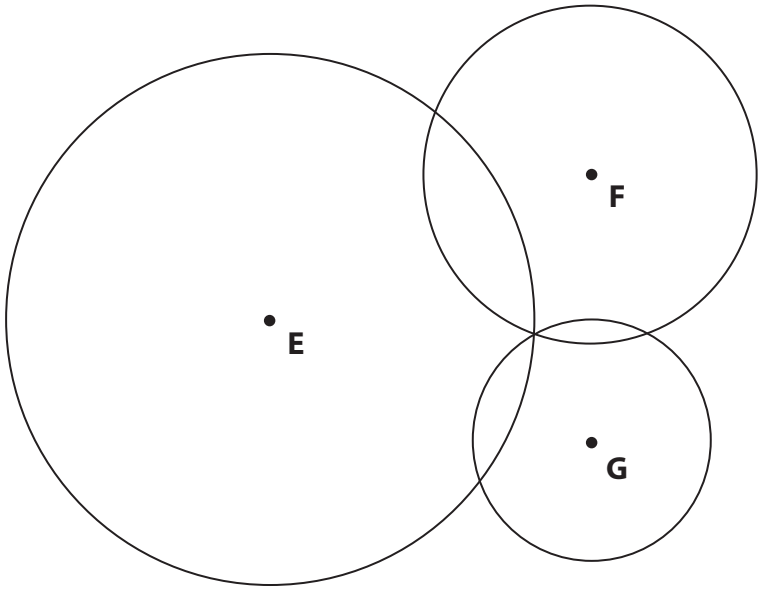
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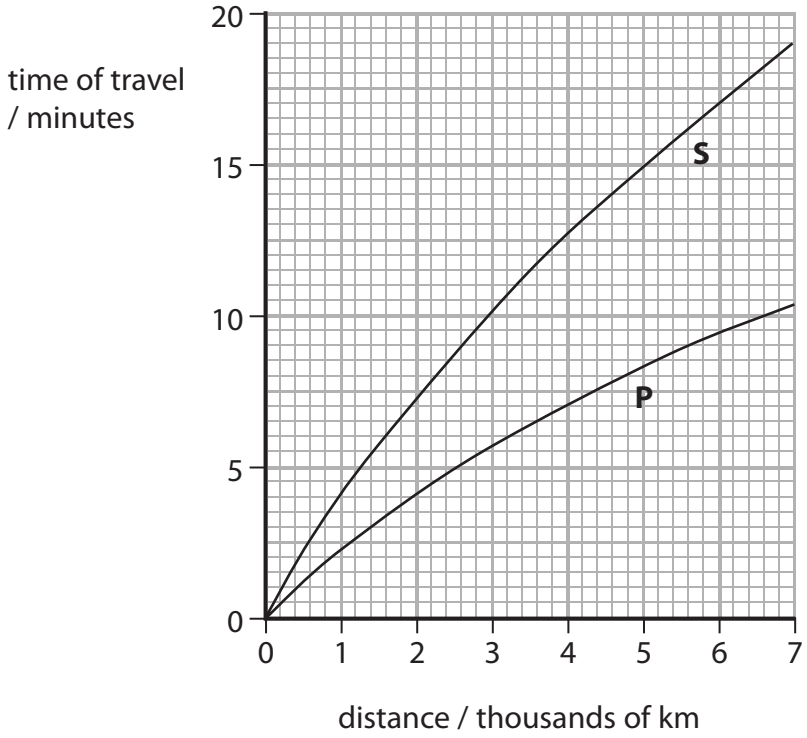
(ii) The diagram shows circles drawn round three research stations, **E**, **F** and **G**, for another earthquake.

Draw an arrow on the diagram to show where this earthquake probably happened.

(1)



(c) The graph shows an earthquake.



An earthquake station is 6000 km from an earthquake.
The P-wave reaches the earthquake station before the S-wave.

Use the graph to find the difference in the arrival time of the S-wave and P-wave.

(2)

difference in arrival time = ... minutes

(d) P-waves are longitudinal.

Describe how particles in the ground move when P-waves pass through it.

(2)

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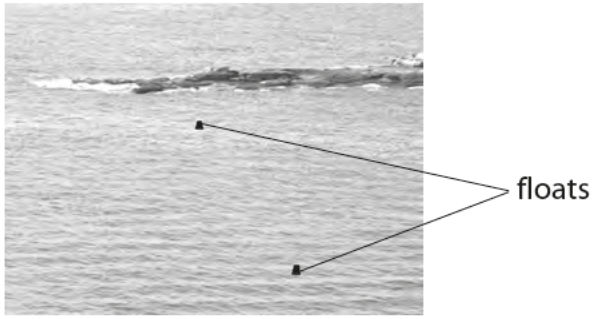
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(Total for Question 2 = 8 marks)

2 The photograph shows a wave in a bay.
The wave was made by a passing boat.



(a) Which of these best describes what is transferred by the water wave?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** energy only

☐ **B** water only

☐ **C** both water and energy

☐ **D** neither water nor energy

(b) The diagram shows the wave as it passes by the two floats.



(i) The wavelength of the wave is 0.8 m.

Calculate the distance between the floats.

(2)

distance = ... m

(ii) The frequ

How many complete wavelengths pass each float in 20 s?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 0.02

☒ **B** 0.8

☒ **C** 8

☒ **D** 50

(iii) A man on the shore observes the wave.

Suggest **one** piece of information the man could gain about the boat by observing the wave that made it.

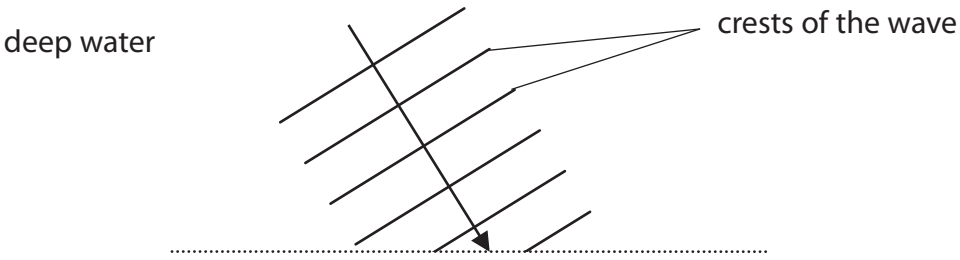
(1)

.....

.....

(c) The wave reaches shallow water before it reaches the shore.
Water waves travel more slowly in shallow water.

The diagram shows the wave as it reaches the shallow water.



Complete the diagram to show how the wave travels in the shallow water.

(3)

(Total for Question 1 = 8 marks)

Infrasound and earthquakes

3 (a) Which row of the table is correct for both infrasound radiation and infrared radiation?

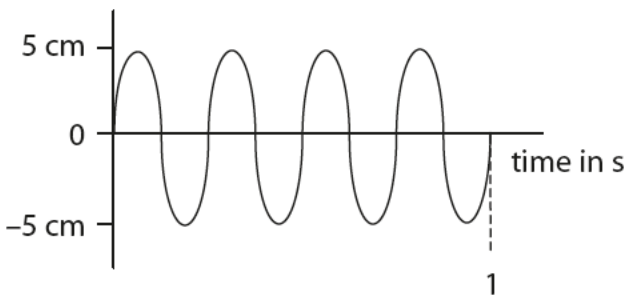
Put a cross (☒) in the box next to your answer.

(1)

	infrasound	infrared
☒ **A**	transverse	transverse
☒ **B**	transverse	longitudinal
☒ **C**	longitudinal	transverse
☒ **D**	longitudinal	longitudinal

(b) State the amplitude of this sound wave.

(1)



amplitude = ...

(c) Describe how infrasound differs from ultrasound.

(2)

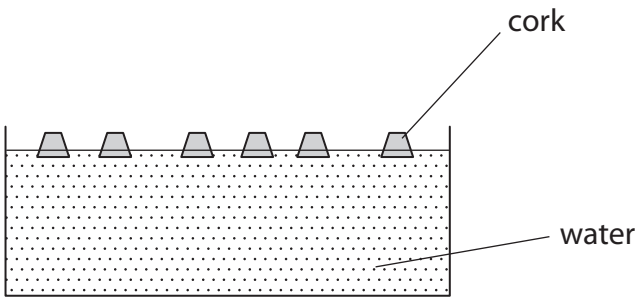
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(d) Earthquakes are sometimes caused when plates in the Earth's crust move.
The diagram shows some corks floating on water.



Explain how this model of corks on water could be used to demonstrate what causes the Earth's plates to move.
You may add to the diagram to help with your answer.

(3)

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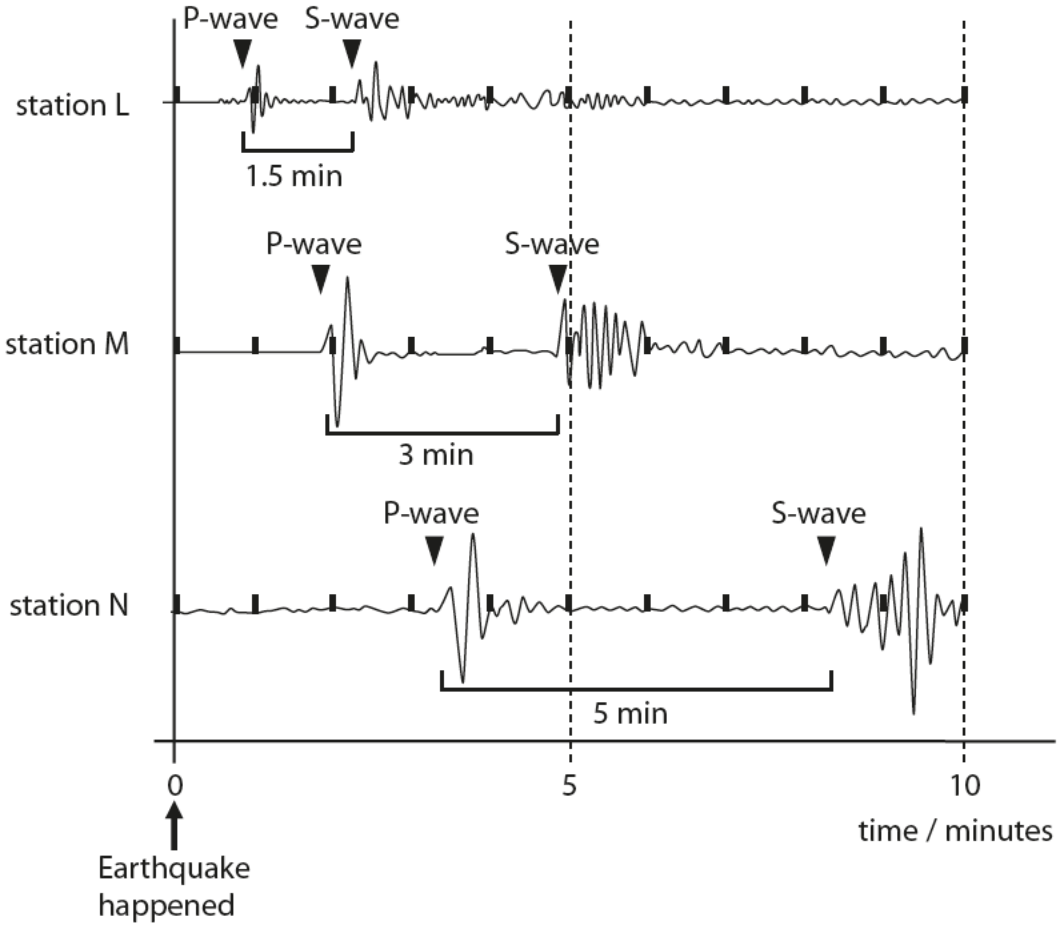
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(e) The movement
The charts show
earthquake.

me



A student suggested that the time between the arrival of the P-wave and the S-wave was proportional to the distance of the station from the earthquake.

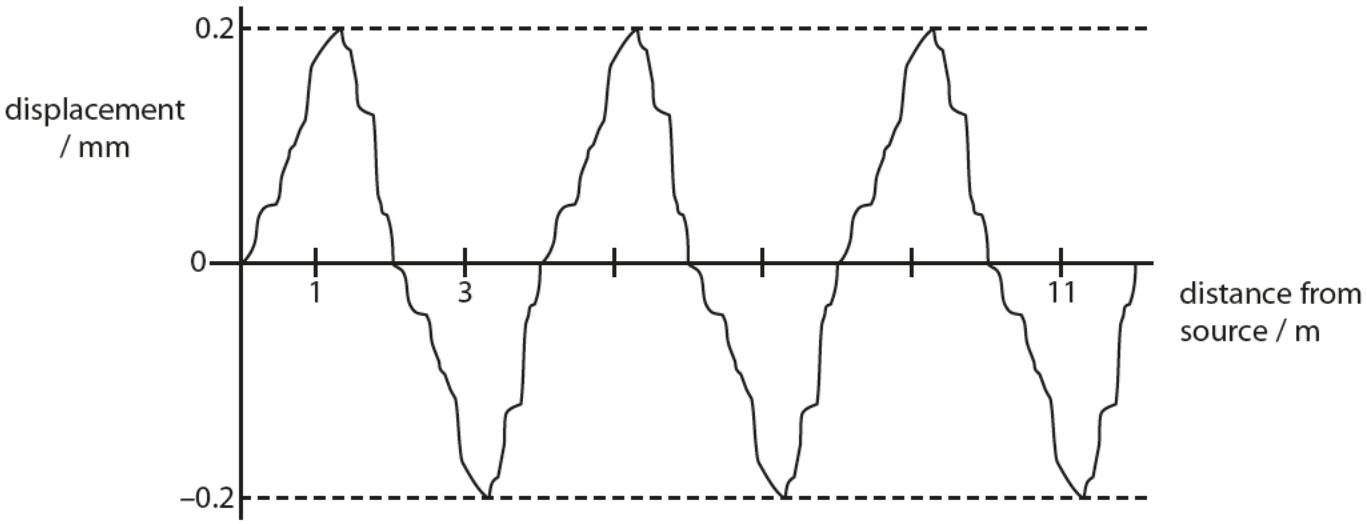
Use the charts to evaluate whether this is correct or not.

(3)

(Total for Question 4 = 10 marks)

Sound waves and music

4 (a) Here is a graph of a sound wave.



(i) Calculate the wavelength of this sound wave.

(2)

wavelength = ... m

(ii) A second sound wave has a longer wavelength but a smaller amplitude.

Sketch a graph of this second wave, on the axes above.

(2)

(b) (i) Sound is a longitudinal wave.

State another example of a longitudinal wave.

(1)

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(ii) Explain how a longitudinal wave is different from a transverse wave.

You may draw a diagram to help with your answer.

(2)

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(c) Musical notes can be made by rubbing the top of a drinking glass with a wet finger.

The photographs show four different amounts of water in the glass.

The frequencies of the musical notes produced with three amounts of water are shown.



1047 Hz



1174 Hz



1245 Hz



f Hz

(i) Which of these numbers could be the frequency, **f**, if it follows the same pattern?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** 960

☐ **B** 1109

☐ **C** 1200

☐ **D** 1290

(ii)

wavelength = speed / frequency

The speed of sound in air is 340 m/s.

A student listens to the sound from the glass when it contains the largest amount of water.

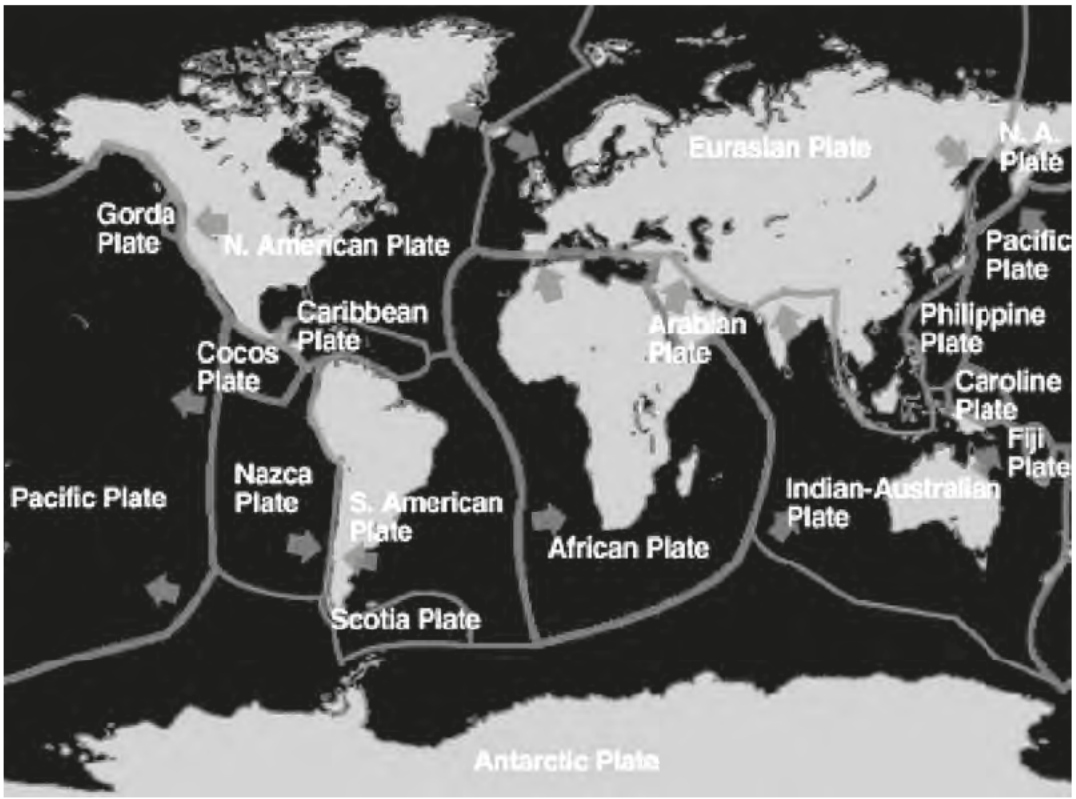
Show that the wavelength of the wave he hears is about 30 cm.

(3)

(Total for Question 3 = 11 marks)

Earthquakes

5 The diagram shows the plates which make up the Earth's outermost layer.



(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Earthquakes happen when plates

(1)

- ☒ **A** float on the mantle
- ☒ **B** rub against each other
- ☒ **C** move away from each other
- ☒ **D** erupt from volcanoes

(ii) Explain what causes the plates to move.

(2)

.....

.....

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.....

The instrument used to detect earthquakes is a

(1)

- ☒ **A** hydrometer
- ☒ **B** manometer
- ☒ **C** seismometer
- ☒ **D** thermometer

(c) Earthquakes produce P-waves and S-waves.

(i) Describe what can happen to these waves when they reach the boundary between the crust and the mantle.

(2)

(ii) A P-wave takes 200 s to travel a distance of 1200 km.

Calculate its speed in km/s.

(2)

speed of P-wave = ... km/s

(d) Explain why scientists find it difficult to predict when a tsunami may happen.

(2)

(Total for Question 4 = 10 marks)