Ultrasound

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

The frequency of ultrasound is

(1)

- ☒ **A** less than 20 Hz
- ☒ **B** between 20 Hz and 2000 Hz
- ☒ **C** between 2000 Hz and 20 000 Hz
- ☒ **D** more than 20 000 Hz

(b) Describe how bats use ultrasound to locate prey.
You may add to the diagram to help with your answer.

(2)



bat



moth

.....

.....

.....

.....

*(c) Ultrasound and X-

Compare and contrast the advantages of using ultrasound and X-rays for medical scans.

(6)

(d) Ultrasound is used to scan metal pipes to measure their thickness.



The ultrasound wave travels through the metal and is reflected at the inner surface of the metal.
The reflected wave is detected after 0.003 ms (0.000 003 s).
The speed of the ultrasound in the metal is 5000 m/s.

Calculate the thickness of the metal.

(3)

distance = speed × time

thickness of metal = ... m

(Total for Question 5 = 12 marks)

Earthquakes and seismic waves

2 (a) Earthquakes produce seismic waves and infrasound waves.

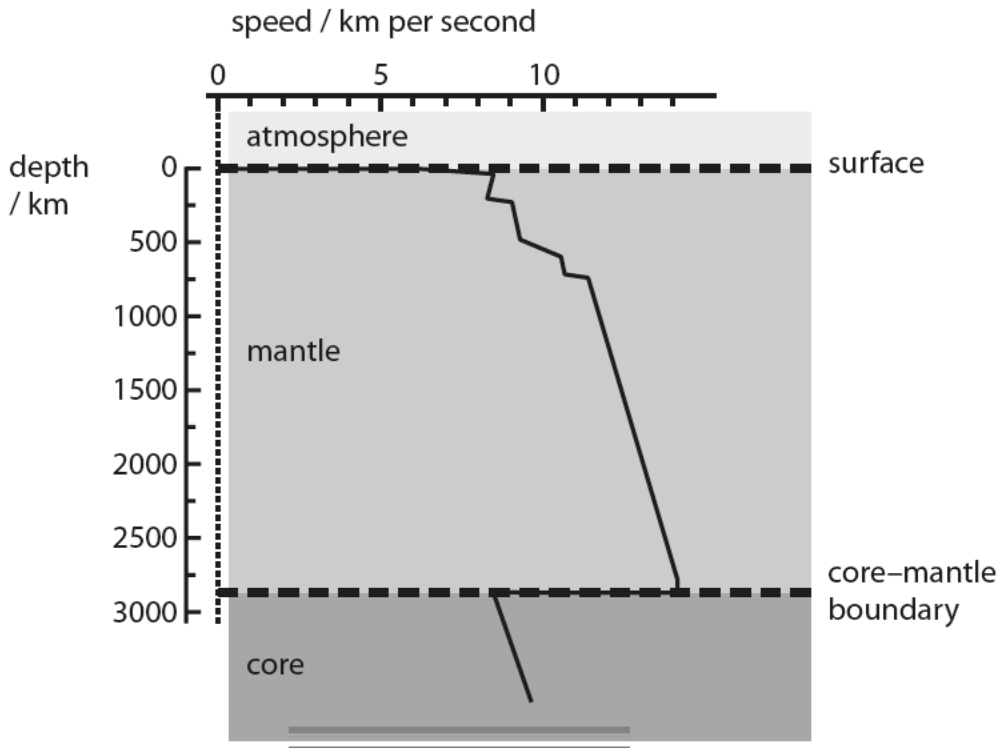
Which row of the table is correct for these waves?

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

(1)

	seismic waves are	infrasound waves are
☐ **A**	longitudinal only	longitudinal and transverse
☐ **B**	longitudinal only	longitudinal only
☐ **C**	longitudinal and transverse	longitudinal and transverse
☐ **D**	longitudinal and transverse	longitudinal only

(b) The chart shows how the speed of P-waves varies with the depth in the Earth's mantle.



(i) State what happens to a P-wave when it crosses from the mantle into the core.

(1)

.....

.....

(ii) Describe how the speed of a P-wave changes between a depth of 1000 km and 2500 km.

(2)

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.....

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.....

(iii) The average speed of a P-wave in the mantle is 12 km/s.
A P-wave travels vertically down from the surface and reflects from the core–mantle boundary back to the surface.
It travels a total distance of 5800 km.

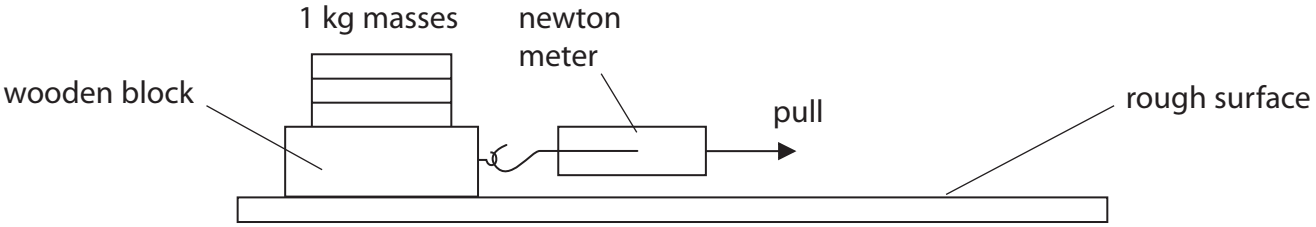
Calculate the total time of travel for the wave.

(3)

time = ... s

(c) A class investigates the force needed to start a wooden block moving on a rough surface.

They use the apparatus shown.



Each student repeats the experiment five times.

A set of results for one student is shown in the table.

attempt	force needed to start block moving / N
1	30
2	57
3	26
4	48
5	39

All the students in the class get a similar wide range of results.

Explain what the results show about predicting earthquakes.

(2)

.....

.....

.....

.....

(Total for Question 2 = 9 marks)

3 (a) Dolphins emit sounds at many different frequencies.



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

A dolphin can produce sounds with a frequency of more than 20 kHz.

These sounds are called

(1)

☒ **A** infrasound waves

☒ **B** microwaves

☒ **C** supersonic waves

☒ **D** ultrasound waves

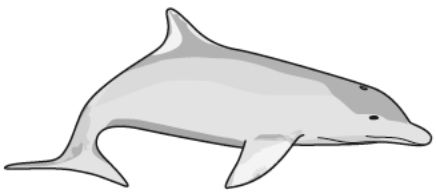
(ii) A dolphin is near to a group of fish.

Describe how a dolphin uses high frequency sound to locate the position of the fish.

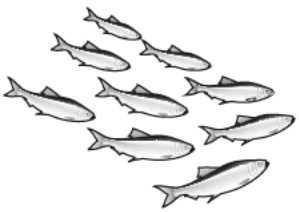
You may add to the diagram to help with your answer.

(3)

DOLPHIN



FISH



.....

.....

.....

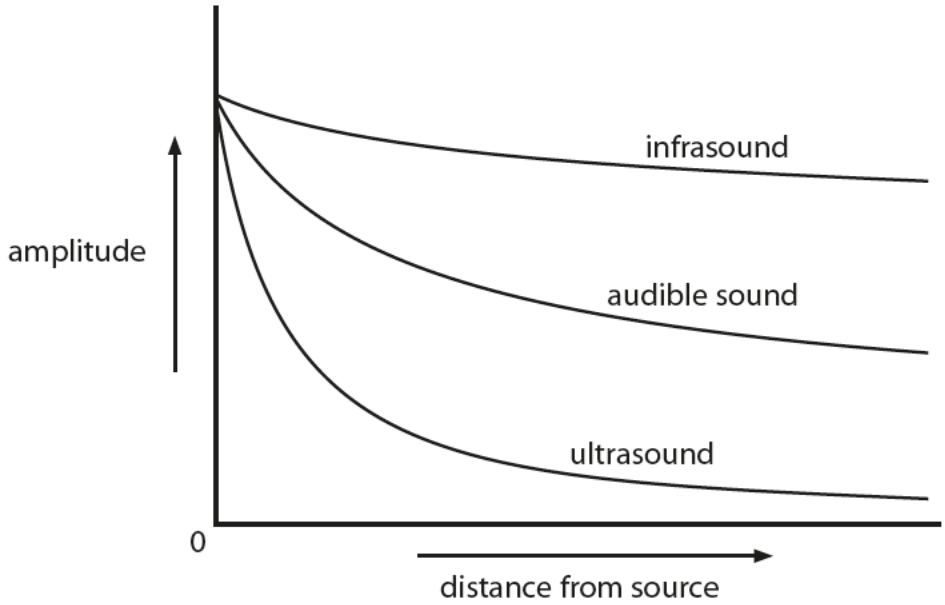
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(b) As a sound wave travels through water its amplitude gets smaller.

This graph shows how the amplitude of different types of sound waves decreases as they travel through water.



Whales use sound to communicate over long distances.

Explain which is the best type of sound wave for whales to use when communicating over long distances.

(2)

.....

.....

.....

(c) Geologists use sound waves from a small explosion to search for oil underground.

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

(i) These sound waves are called

(1)

☒ **A** cosmic waves

☒ **B** seismic waves

☒ **C** volcanic waves

☒ **D** tectonic waves

(ii) A small explosion is triggered at the Earth's surface.
The waves reflect back from the top of the oil field.

Suggest why the waves are reflected from the oil field.

(1)

.....

(d) A wave has a frequency of 15 Hz.
Its wavelength is 125 m.

Calculate the speed of the wave.

State the unit.

(3)

speed of wave = ...

unit = ...

(Total for Question 4 = 11 marks)

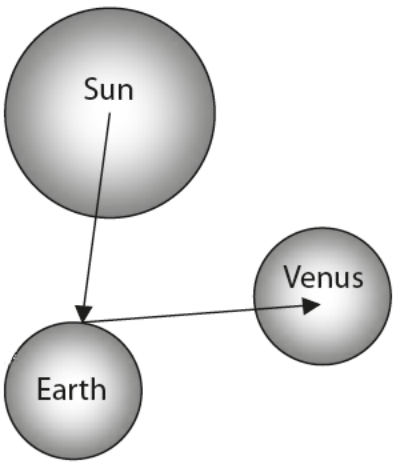
4 (a) Galileo was one of the first scientists to use a telescope to study Venus.

(i) Which of these diagrams best shows how light waves enable us to see Venus?

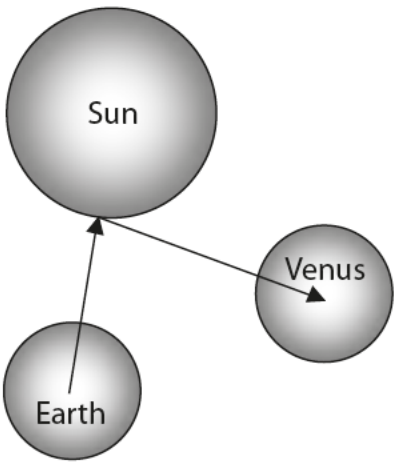
Put a cross (☒) in the box next to your answer.

(1)

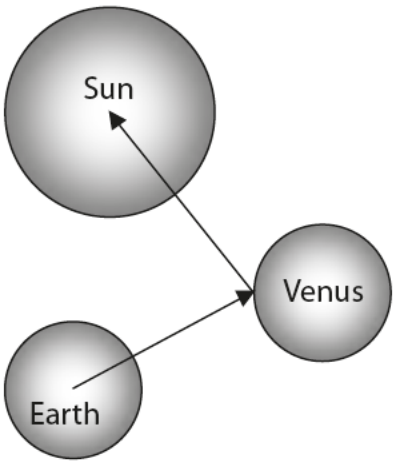
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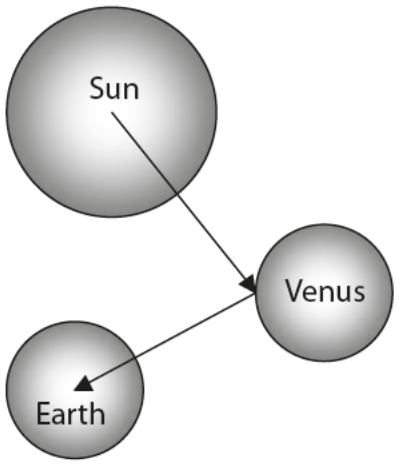
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(ii) Use words from the box to complete the sentences.

(2)

asteroids	comets	geocentric	heliocentric
moons	particle	stars	

Galileo also used his telescope to observe the ..... of Jupiter.

His observations provided evidence to support the ..... model of the Solar System.

(iii) Describe how a reflecting telescope is different from the simple telescope which Galileo used.

(2)

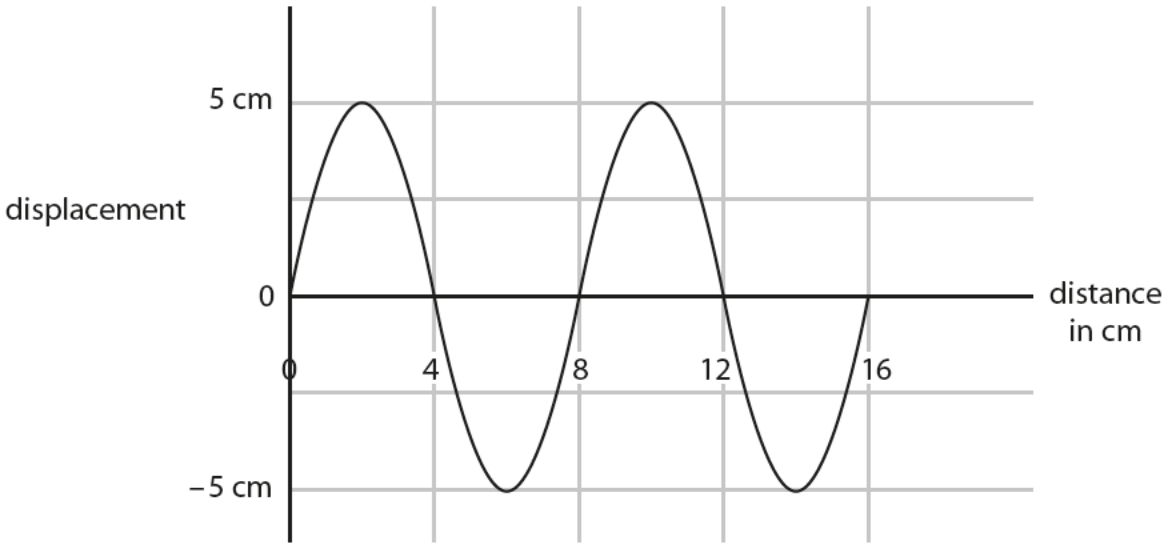
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(b) (i) The diagram represents a wave.



State the amplitude and wavelength of the wave.

(2)

amplitude of the wave = ... cm

wavelength of the wave = ... cm

(ii) 20 waves are sent out in 4 seconds.

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

The frequency of the wave is

(1)

☐ **A** 0.2 Hz

☐ **B** 5 Hz

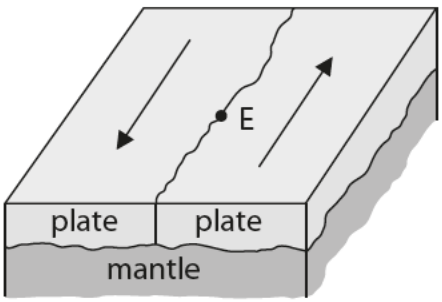
☐ **C** 20 Hz

☐ **D** 80 Hz

(Total for Question 1 = 8 marks)

Earthquakes

5 (a) The diagram shows part of the boundary between two tectonic plates.



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

The plates are being steadily pushed in opposite directions by

(1)

☒ **A** convection currents in the mantle

☒ **B** reflection of waves from the Earth's core

☒ **C** tsunami waves in the ocean

☒ **D** volcanic eruptions on the surface

(ii) An earthquake occurs.
Its epicentre is at the place marked E on the diagram.
Describe what happens at the plate boundary to cause this earthquake.

(2)

.....

.....

.....

.....

(b) The earthquake causes seismic waves.

(i) S waves are one type of seismic wave. They travel at 0.65 km/s.
There is a seismometer 80 km away from point E.
Show that it takes about 2 minutes for the S waves from the earthquake to reach the seismometer.

(2)

(ii) P waves are another type of seismic wave.
They travel about 10 times more quickly than S waves.

Describe how scientists can use seismometer records of P and S waves to locate the epicentre.

(3)

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(iii) Seismic waves have a frequency of about 15 Hz.
P waves have a much smaller amplitude than S waves.

Some people claim that animals can detect an earthquake before people are aware of it.
Suggest an explanation for this.

(2)

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.....

.....

.....

(Total for Question 4 = 10 marks)