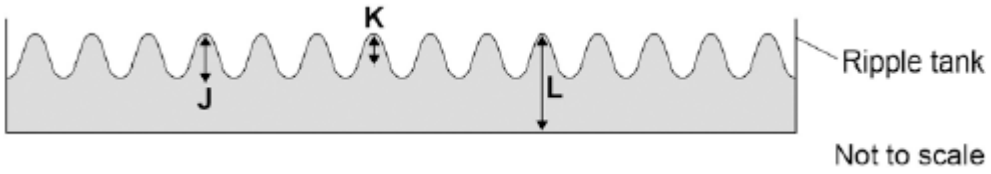
**Q1.** Small water waves are created in a ripple tank by a wooden bar. The wooden bar vibrates up and down hitting the surface of the water.

The figure below shows a cross-section of the ripple tank and water.




(a) Which letter shows the amplitude of a water wave?

Tick **one** box.

**J** ☐

**K** ☐

**L** ☐

**(1)**

(b) The speed of the wooden bar is changed so that the bar hits the water fewer times each second.

What happens to the frequency of the waves produced?

Tick **one** box.

Increases ☐

Does not change ☐

Decreases ☐

**(1)**

(c) Describe how the wavelength of the water waves in a ripple tank can be measured accurately.

.....

.....

.....

.....

.....

**(2)**

(d) The speed of a wave is calculated using the following equation.

wave speed = frequency × wavelength

The water waves in a ripple tank have a wavelength of 1.2 cm and a frequency of 18.5 Hz.

How does the speed of these water waves compare to the typical speed of a person walking?

.....

.....

.....

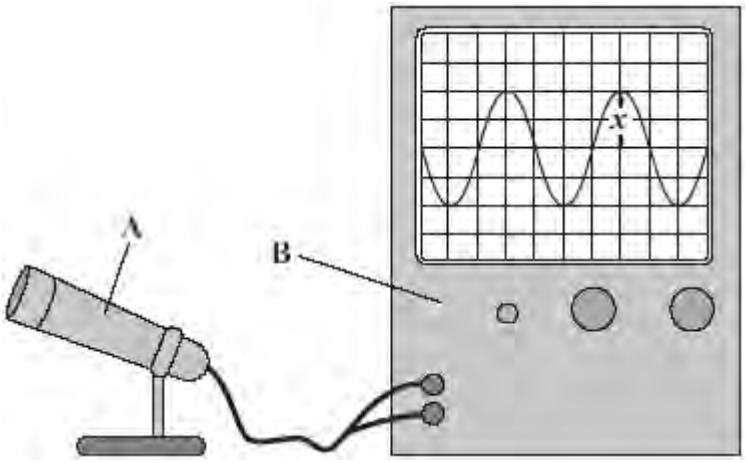
.....

.....

.....

**(4)**
**(Total 8 marks)**

**Q2.** (a) A student uses two pieces of equipment, **A** and **B**, to display a sound wave.




(i) Use words from the box to complete the sentence.

| **a loudspeaker** | **a microphone** | **an oscilloscope** | **a screen** |
|---|---|---|---|

**A** is ..... and **B** is ..... .

**(2)**

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

| **the amplitude** | **half the amplitude** | **the frequency** | **half the frequency** |
|---|---|---|---|

The distance ***x*** marked on the diagram measures ..... of the sound wave.

**(1)**

(iii) Complete the sentence.

The distance ***x*** becomes smaller. This is because the sound has

become ..... .

**(1)**

(b) There is no air in space.

Astronauts in space cannot hear sounds from outside their spacesuits.

Explain this.

.....

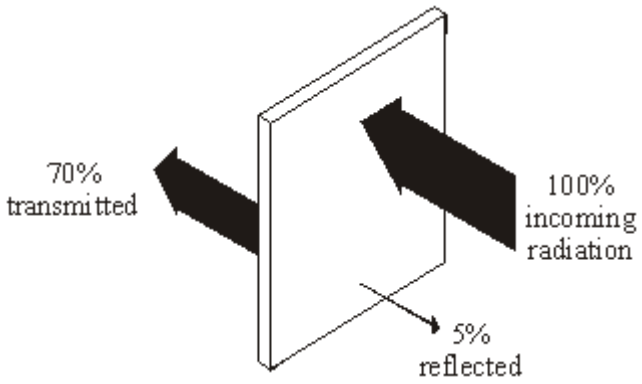
.....

.....

.....

**(2)**
**(Total 6 marks)**

**Q3.** (a) Infra red radiation can be reflected, absorbed and transmitted by glass.




(i) What percentage of infra red is absorbed by the glass?

.....

**(1)**

(ii) Complete the following sentence by drawing a ring around the correct word or phrase.

| | | |
|---|---|---|
| Theabsorbed infra red | increases<br>does not change<br>decreases | the temperature of the glass. |

**(1)**

(b) **Two** of the following statements are true. **One** of the statements is false.

Tick (✓) the boxes next to the **two** true statements.

| | |
|---|---|
| All objectsabsorb infra red radiation. | |
| Blacksurfaces are poor emitters of infra red radiation. | |
| A hot objectemits more infra red than a cooler object. | |

**(1)**

(c) The following statement is false.

| |
|---|
| Blacksurfaces are good reflectors of infra red radiation. |

Change **one** word in this statement to make it true.

Write down your **new** statement.

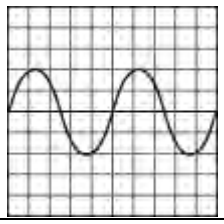
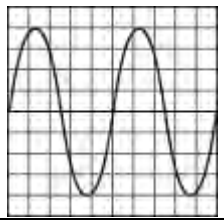
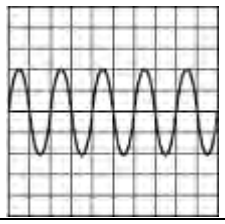
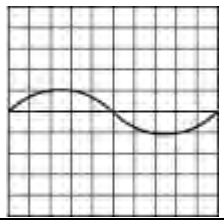
.....

.....

**(1)**
**(Total 4 marks)**

**Q4.**(a) The diagram shows four sound waves, **J**, **K**, **L** and **M**, represented on an oscilloscope screen.

They are all drawn to the same scale.

|  |  |  |  |
|---|---|---|---|
| **J** | **K** | **L** | **M** |

(i) Which **two** of the waves have the same amplitude?

Wave ..... and wave .....

**(1)**

(ii) Which of the waves would sound the loudest?

Wave .....

**(1)**

(iii) Only **one** of the waves is an ultrasound wave.

Which **one** is the ultrasound wave?

Wave .....

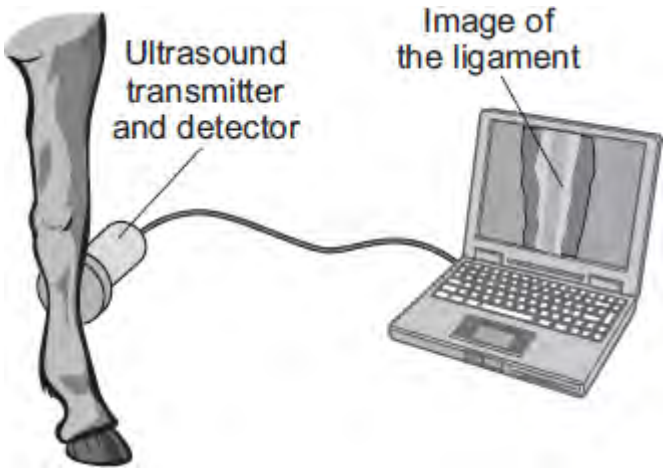
Give a reason for your answer.

.....

.....

**(2)**

(b) The diagram shows ultrasound being used to examine the ligament inside the leg of a horse.




Use words from the box to complete the following sentences.

| | | |
|---|---|---|
| **computer** | **detector** | **transmitter** |

The ..... sends pulses of ultrasound into the leg. When the ultrasound meets the ligament, some is reflected back to the ..... The reflected pulses are converted by a ..... into an image that can be seen on the screen.

**(2)**
**(Total 6 marks)**

**Q5.** Ultrasound waves are very high frequency sound waves. They cannot be heard by humans.

(a) Ultrasound waves can be used to clean jewellery.

The jewellery is put into a container of cleaning fluid.

Complete each sentence to explain how ultrasound can clean jewellery.

The ultrasound generator makes the molecules of the cleaning fluid

..... . The molecules knock particles of .....

from the surface of the jewellery.

**(2)**

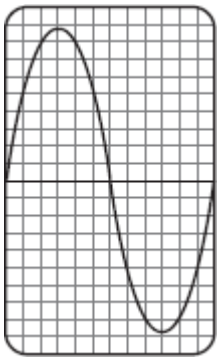
(b) Give a medical use for ultrasound.

.....

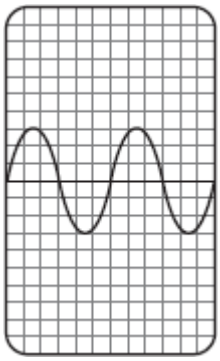
**(1)**

(c) Ultrasound waves can be represented on the screen of a cathode ray oscilloscope (CRO).

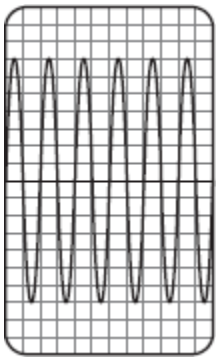
The diagrams show three ultrasound waves.
Each wave is represented on an identical CRO screen, **A**, **B** and **C**.



Screen **A**



Screen **B**



Screen **C**

(i) How many complete waves are shown on screen **B**? .....

**(1)**

(ii) Which screen shows the waves with the highest frequency?

Screen .....

**(1)**

**(Total 5 marks)**

**Q6.**(a) The table gives information about the frequencies in the hearing ranges of six different mammals.

| Name of mammal | Frequencies in hearing range |
|---|---|
| Bat | 20 Hz → 160 kHz |
| Dog | 20 Hz → 30 kHz |
| Dolphin | 40 Hz → 110 kHz |
| Elephant | 5 Hz → 10 kHz |
| Human | 20 Hz → 20 kHz |
| Tiger | 30 Hz → 50 kHz |

(i) Which mammal in the table can hear the highest frequency?

.....

**(1)**

(ii) Give **one** example of a frequency which an elephant can hear but which a tiger **cannot** hear.

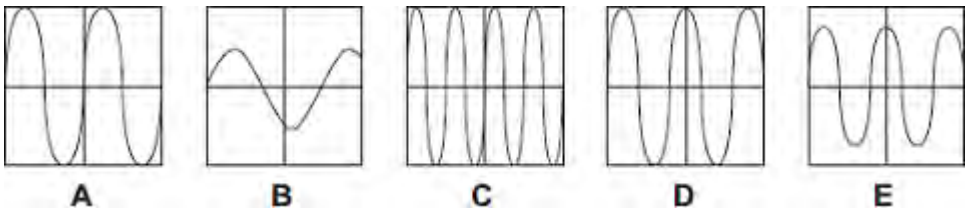
Include the unit in your answer.

Frequency .....

**(1)**

(b) A sound wave can be represented as a trace on the screen of an oscilloscope.

The diagrams show five traces, **A**, **B**, **C**, **D** and **E**, on the oscilloscope. All the traces aredrawn to the same scale.




(i) Which **three** diagrams show traces with the same amplitude?

Diagrams ..... , ..... and ..... .

**(1)**

(ii) Which **two** diagrams show traces with the same frequency?

Diagrams ..... and ..... .....

**(1)**

(c) There is no air in space.

Astronauts in space cannot hear sounds from outside their spacesuits.

Explain this.

.....

.....

.....

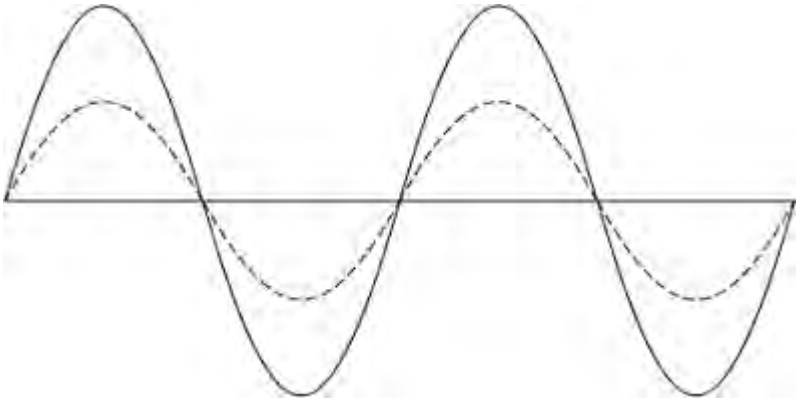
.....

**(2)**

**(Total 6 marks)**

**Q7.**(a) **Diagram 1** shows two waves.

**Diagram 1**



(i) Name **one** wave quantity that is the same for the two waves.

.....

**(1)**

(ii) Name **one** wave quantity that is different for the two waves.

.....

**(1)**

(iii) The waves in **Diagram 1** are transverse.

Which **one** of the following types of wave is **not** a transverse wave?

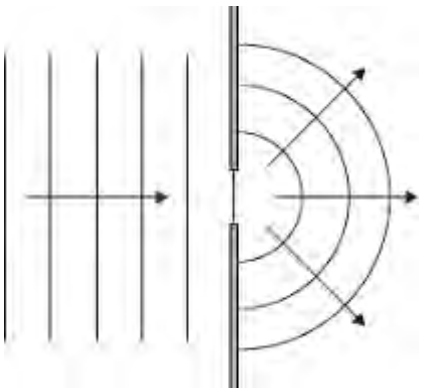
Draw a ring around the correct answer.

**gamma rays** **sound** **visible light**

**(1)**

(b) **Diagram 2** shows water waves in a ripple tank moving towards and passing through a gap in a barrier.

**Diagram 2**



Every second, 8 waves pass through the gap in the barrier. The waves have a wavelength of 0.015 metres.

Calculate the speed of the water waves and give the unit.

.....

.....

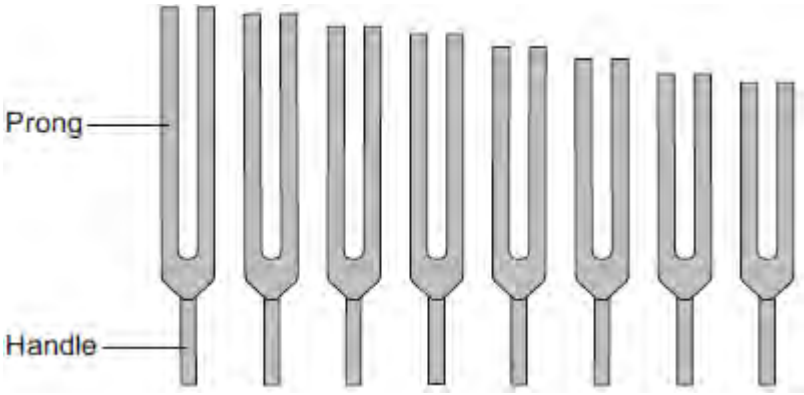
.....

Speed = .....

**(3)**
**(Total 6 marks)**

**Q8.Figure 1** shows a set of tuning forks.

**Figure 1**




A tuning fork has a handle and two prongs. It is made from metal.

When the prongs are struck on a hard object, the tuning fork makes a sound wave with a single frequency. The frequency depends on the length of the prongs.

(a) Use the correct answer from the box to complete each sentence.

| direction | loudness | pitch | speed |
|---|---|---|---|

The frequency of a sound wave determines its ..... .

The amplitude of a sound wave determines its ..... .

**(2)**

(b) Each tuning fork has its frequency engraved on it. A student measured the length of the prongs for each tuning fork.

Some of her data is shown in the table.

| Frequency in hertz | Length of prongs in cm |
|---|---|
| 320 | 9.5 |
| 384 | 8.7 |
| 480 | 7.8 |
| 512 | 7.5 |

(i) Describe the pattern shown in the table.

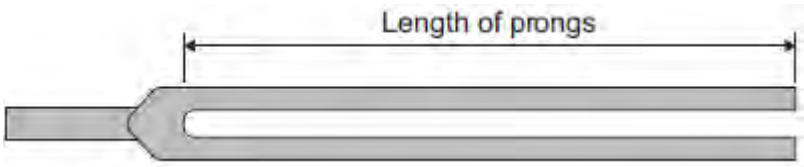
.....

.....

**(1)**

(ii) **Figure 2** shows a full-size drawing of a tuning fork.

**Figure 2**




Measure and record the length of the prongs.

Length of prongs = ..... cm

**(1)**

Use the data in the table above to estimate the frequency of the tuning fork in **Figure 2**.

Explain your answer.

.....

.....

.....

.....

.....

Estimated frequency = ..... Hz

**(3)**

(c) Ultrasound waves are used in hospitals.

(i) Use the correct answer from the box to complete the sentence.

| **electronic** | **hydraulic** | **radioactive** |
|---|---|---|

Ultrasound waves can be produced by ..... systems.

**(1)**

(ii) The frequency of an ultrasound wave used in a hospital is $2 \times 10^6$ Hz.

It is **not** possible to produce ultrasound waves of this frequency using a tuning fork.

Explain why.

.....

.....

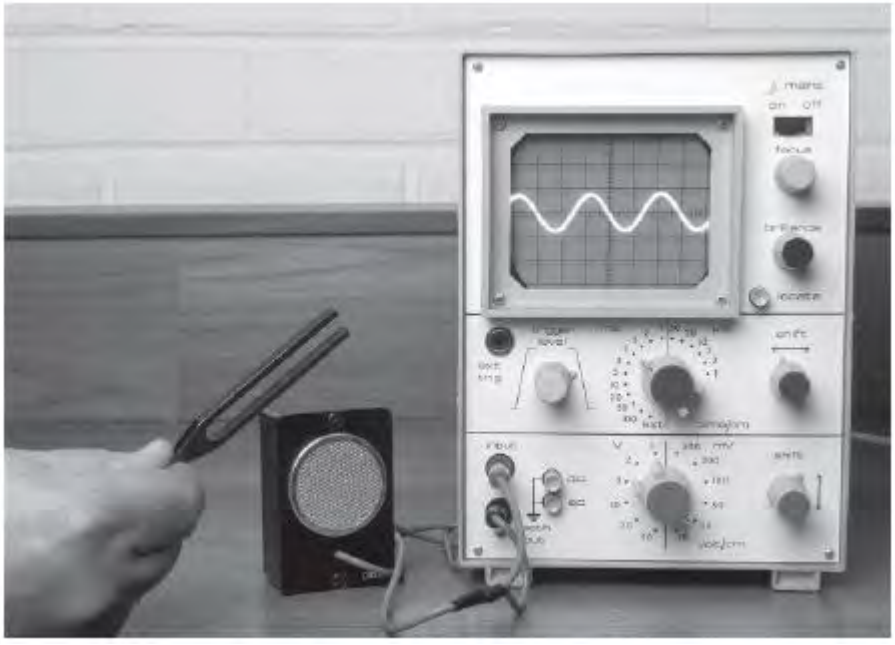
.....

.....

**(2)**

(d) **Figure 3** shows a tuning fork and a microphone. The microphone is connected to an oscilloscope.

**Figure 3**

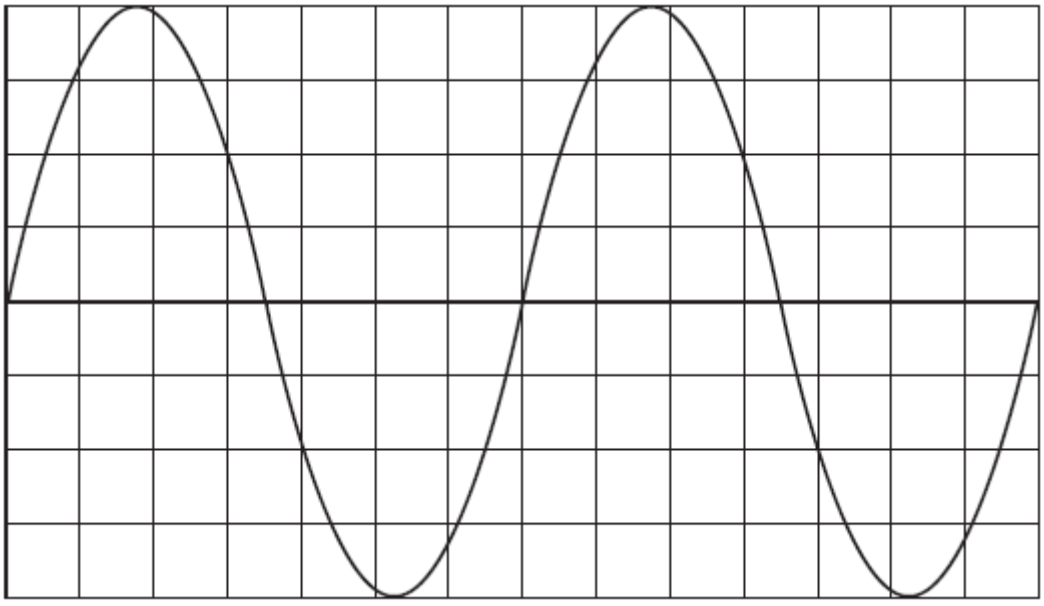




When the tuning fork is struck and then placed in front of the microphone, a trace appears on the oscilloscope screen.

**Figure 4** shows part of the trace on the screen.

**Figure 4**



Each horizontal division in **Figure 4** represents a time of 0.0005 s.

What is the frequency of the tuning fork?

.....

.....

.....

Frequency = ..... Hz

**(3)**

**(Total 13 marks)**