



Percentage	
Grade	

Waves

Duration: 45 min

Total Marks: 46

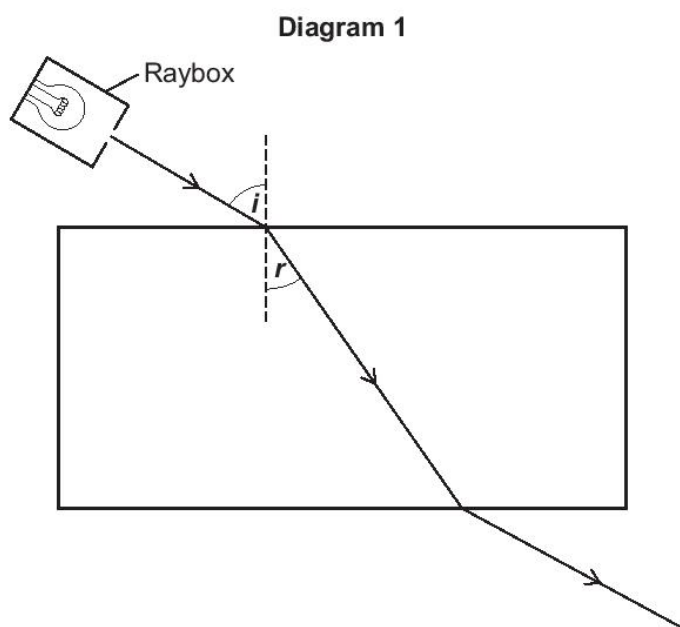
Information for Candidates:

- Use black or blue ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional paper is used, the question number(s) must be clearly shown
- The number of marks is given in brackets [] at the end of each question or part question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

[illegible]

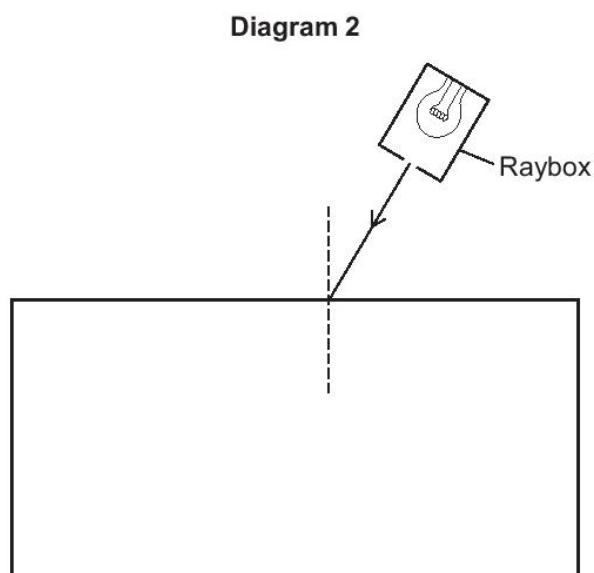
- 4 A student investigated the refraction of light as it passes into and out of a clear plastic block.

Diagram 1 shows the apparatus the student used.



- 4 (a) **Diagram 2** shows the same apparatus.

Use a ruler to draw on **Diagram 2** the path of the light ray.

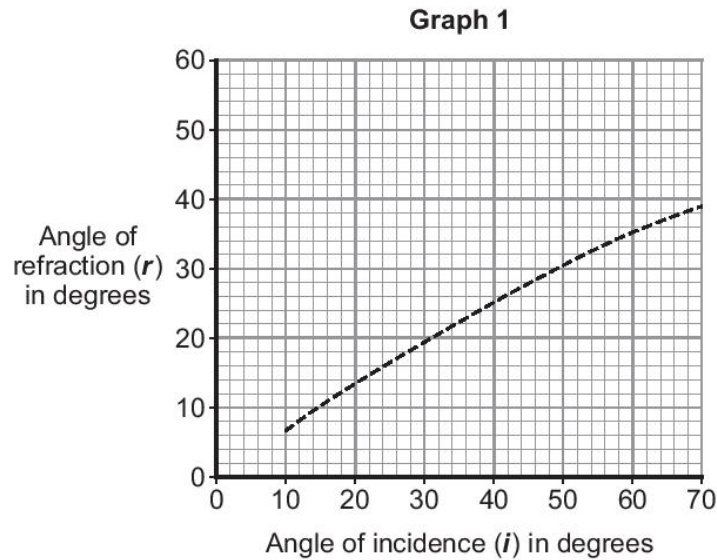


(2 marks)



- 4 (b) The student measured the angle of refraction (r) for different angles of incidence (i) for light entering the plastic block.

The results are shown in **Graph 1**.



- 4 (b) (i) What **two** conclusions can be made about the relationship between the angle of incidence and the angle of refraction from **Graph 1**?

1

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2

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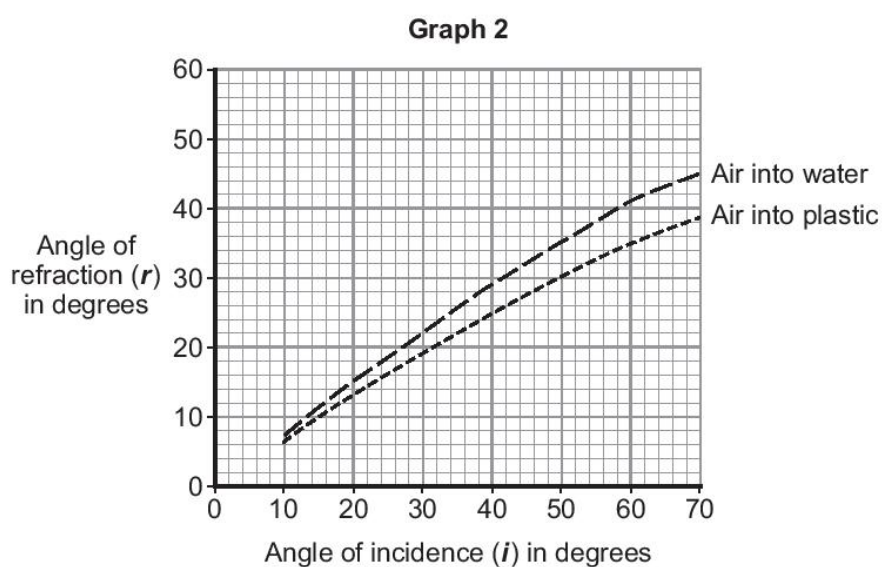
(2 marks)

Question 4 continues on the next page

Turn over ►



- 4 (b) (ii) Graph 2 shows the student's results for light passing from air into plastic. The graph also shows the results for light passing from air into water.



How does the refraction of light passing from air into water compare to the refraction of light passing from air into plastic?

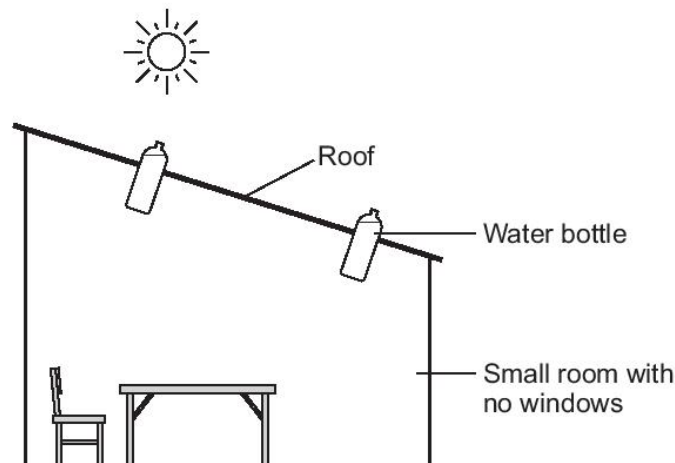
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(1 mark)



- 4 (c) In some countries people are too poor to pay for electricity. Some people living in small houses with no natural light are using bottles filled with water instead of light bulbs.

The bottles are fitted into small holes in the roof of the house. Sunlight refracts as it passes into and out of the bottle, causing light to spread into the room. This simple device gives about the same amount of light as a 50W light bulb.

Diagram 3



- 4 (c) (i) Suggest **one** way this simple device can help improve the lives of the people using it.

.....
.....
(1 mark)

- 4 (c) (ii) The increasing use of energy resources to generate electricity within developed countries has ethical implications.

Suggest **one** ethical implication.

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(1 mark)

Turn over for the next question

Turn over ►



4 A note was played on an electric keyboard.

The frequency of the note was 440 Hz.

4 (a) (i) What does a frequency of 440 Hz mean?

[1 mark]

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4 (a) (ii) The sound waves produced by the keyboard travel at a speed of 340 m/s.

Calculate the wavelength of the note.

Use the correct equation from the Physics Equations Sheet.

Give your answer to **three** significant figures.

[3 marks]

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Wavelength = metres

4 (b) **Figure 3** shows a microphone connected to a cathode ray oscilloscope (CRO) being used to detect the note produced by the keyboard.

Figure 3

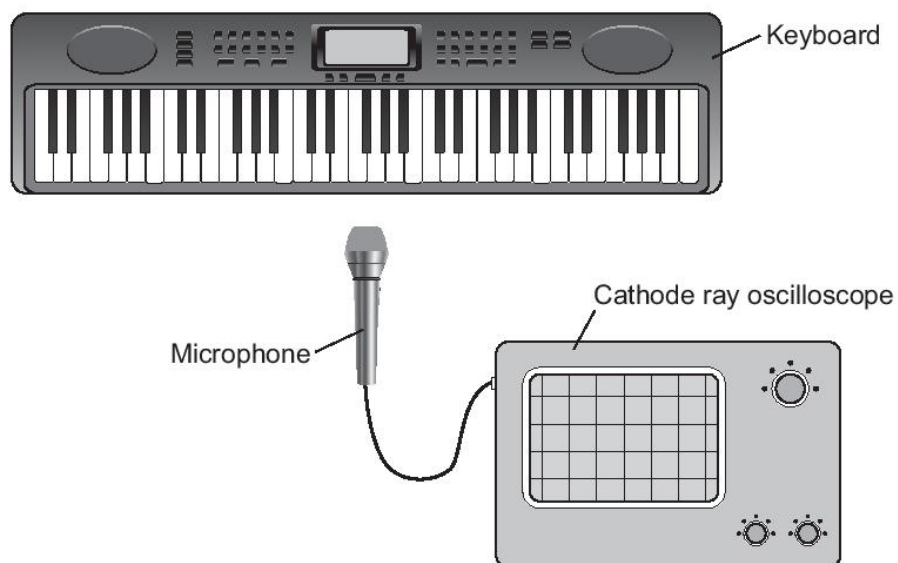
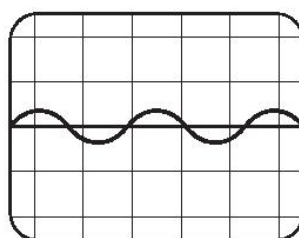


Figure 4 shows the trace produced by the sound wave on the CRO.

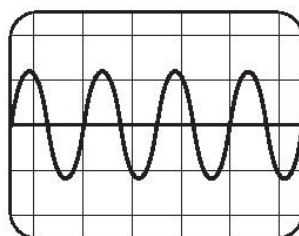
Figure 4



A second note, of different wavelength, was played on the keyboard.

Figure 5 shows the trace produced by the sound wave of the second note on the CRO.

Figure 5



The settings on the CRO were unchanged.

What **two** conclusions should be made about the **second** sound wave produced by the keyboard compared with the **first** sound wave?

Give a reason for each conclusion.

[4 marks]

Conclusion 1

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Reason

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Conclusion 2

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Reason

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Answer **all** questions in the spaces provided.

1 (a) What is ultrasound?

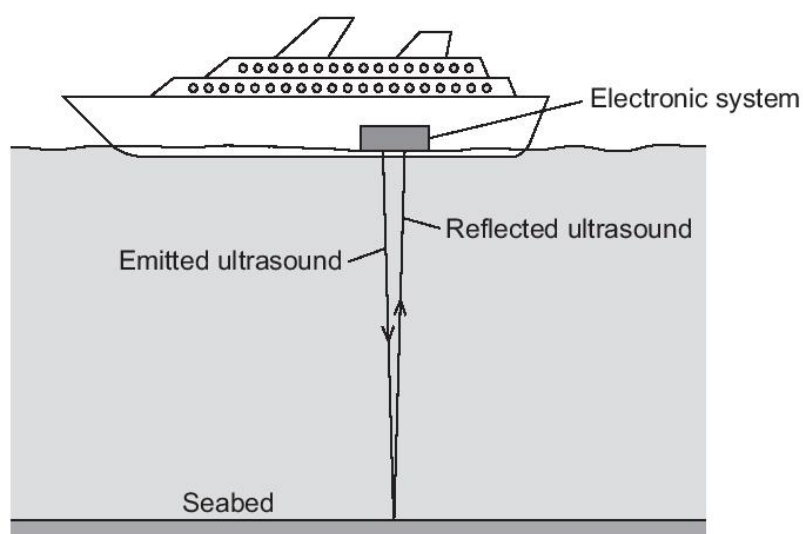
[1 mark]

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1 (b) **Figure 1** shows how ultrasound is used to measure the depth of water below a ship.

Figure 1



A pulse of ultrasound is sent out from an electronic system on-board the ship.

It takes 0.80 seconds for the emitted ultrasound to be received back at the ship.

Calculate the depth of the water.

Speed of ultrasound in water = 1600 m/s

Use the correct equation from the Physics Equations Sheet.

[3 marks]

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Depth of water = metres



- 1 (c) Ultrasound can be used in medicine for scanning.

State **one** medical use of ultrasound scanning.

[1 mark]

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- 1 (d) Images of the inside of the human body can be made using a Computerised Tomography (CT) scanner. The CT scanner in **Figure 2** uses X-rays to produce these images.

Figure 2



State **one** advantage and **one** disadvantage of using a CT scanner, compared with ultrasound scanning, for forming images of the inside of the human body.

[2 marks]

Advantage of CT scanning

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Disadvantage of CT scanning

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- 9 (a) Explain what happens to the wavelength of light when it passes from air into glass.

(2)

- *(b) Figure 13 shows a beam of red light approaching one side of a rectangular glass block.

The beam of light will pass through the block and leave through the opposite side.

AB is a wavefront.

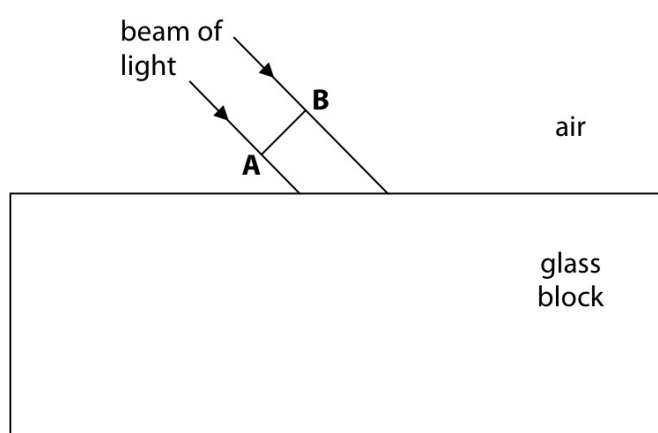


Figure 13

Discuss the path of the wavefront **AB** as it enters and leaves the glass block.

(6)

(c) The distance between the Earth and the Sun is 1.50×10^{11} m.

Light takes 500 s to travel from the Sun to the Earth.

The wavelength of red light is 670 nm.

Calculate the frequency of red light, using only the data provided.

(4)

frequency = Hz

(Total for Question 9 = 12 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Section B

Answer **all** the questions.

- 16** A crowd makes a Mexican wave.

A Mexican wave **starts** with people lifting and lowering their arms.



The Mexican wave **continues** by people, next to them, lifting and lowering their arms.

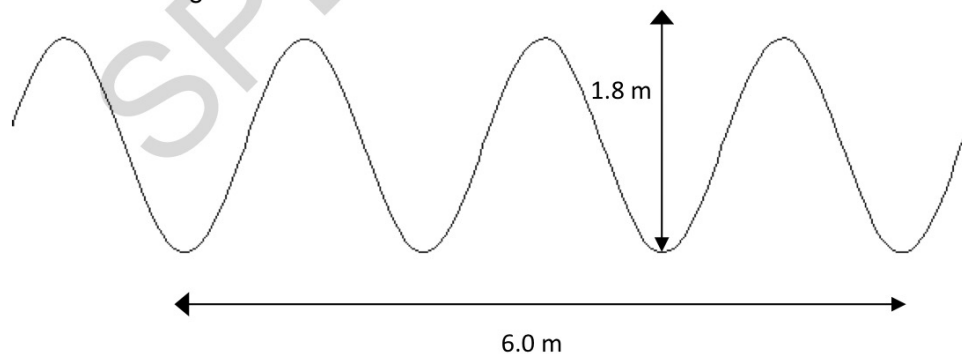
- (a)** Why is a Mexican wave an example of a transverse wave?

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[1]

- (b)** In the classroom a teacher demonstrates waves using a rope.

Look at the diagram of the wave.



- (i)** The frequency of the wave is 2 Hz.

What does this statement mean?

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[2]

- (ii) How many seconds will it take this wave to travel 12 m?

Show your working.

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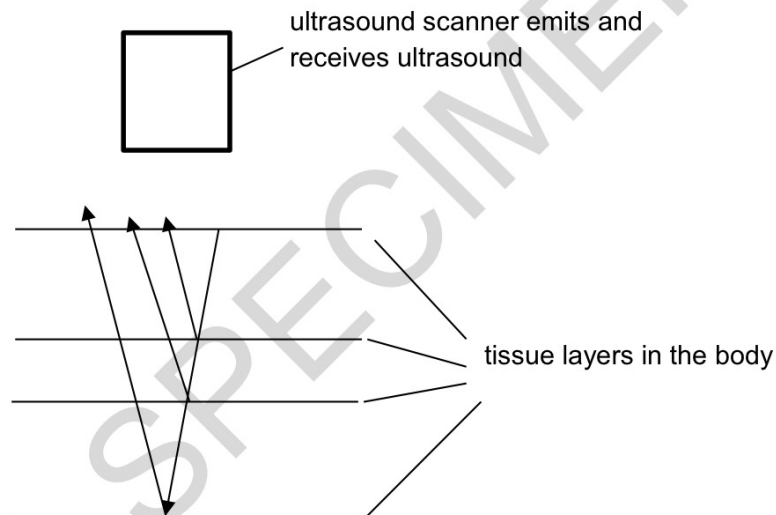
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answer: seconds

[3]

- (c) Ultrasound scans are used to produce images of tissues inside the body.



Ultrasound waves are emitted.

They reflect from layers of tissue inside the body.

Explain how the reflections are used to produce an image of the tissues.

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[3]

- (d) Ultrasound and X rays are used to scan patients in hospitals.

Complete the table to show a medical use, benefits and risk of using these waves to scan patients.

Wave	Medical use	Example of a benefit	Risk
X-rays	Shows up hard tissues inside the body.	Takes images of broken bones.	Damages living cells by causing
ultrasound	None

[3]