NAME: ________________________________ (   )   CLASS: 3E_____

HOUGANG SECONDARY SCHOOL

SEMESTRAL ASSESSMENT 2 / 2019

SCIENCE (PHYSICS) 5076 / 02
PAPER 2

SECONDARY THREE EXPRESS

Wednesday, 9 October 2019

Total duration for Paper 1 and 2:
1 hour 45 minutes

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READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on all the work you hand in.
You may use an HB pencil for any diagrams or graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

Hand in your OTAS, Paper 1 and Paper 2 separately.

FOR EXAMINER'S USE			
PAPER 1	PAPER 2		TOTAL
	Section A	Section B	
20	45	20	85

This document consists of **15** printed pages.

[Turn over

Section A

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

1 A student clamps a metre rule to the edge of a bench, as shown in Fig. 1.1.
He attaches a mass to the end of the metre rule.

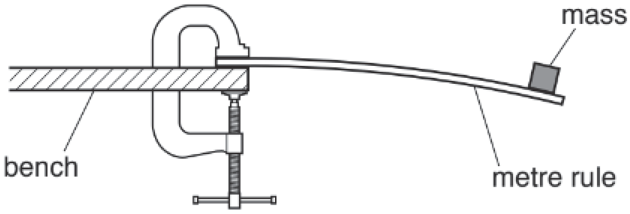


Fig. 1.1

The student displaces one end of the metre rule and it oscillates up and down at a frequency of 5.00 Hz. The student then measures the time for ten complete oscillations.

(a) Define frequency of 5.00 Hz.

…………………………………………………………………………………………………....... [1]

(b) State why does the student measure the time taken for ten oscillations instead of one oscillation.

……………………………………………………………………………………………………… [1]

(c) The student repeats the procedure and records his results in Table 1.2.

Table 1.2

results	time for ten complete oscillations / s
1st	3.93
2nd	4.07
3rd	3.55
4th	3.99

Using the results in Table 1.2, calculate the period of the oscillations.

period = …………………… s [2]

(d) The student repeats the experiment with a shorter metre rule.
State a change, if any, to the period of the oscillations compared to **(c)**.

……………………………………………………………………………………………………… [1]

2 Fig. 2.1 shows a man pushing a box of mass 7.00 kg, with a force **P** along a rough surface. The box is moving at a constant speed of 1.50 m/s.

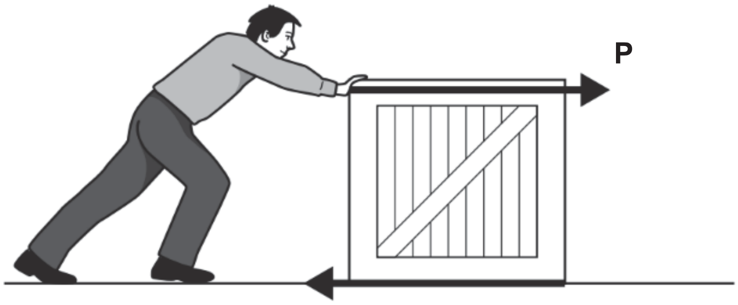


Fig. 2.1

(a) Compare the magnitude of **P** and **F**. Explain your answer.

…………………………………………………………………………………………………..

……………………………………………………………………………………………… [2]

(b) When the man stops pushing, the box continues moving. Given that the frictional force, **F**, is 90.0 N, calculate the deceleration of the box.

deceleration = …………………… m/s^2 [3]

3 Fig. 3.1 shows a bottle resting on a table.

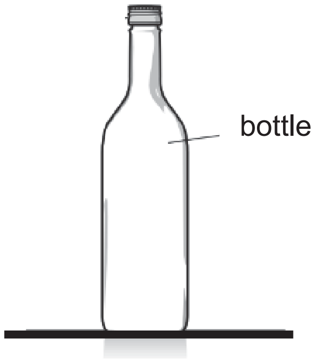


Fig. 3.1

(a) The bottle weighs 45.0 N and has a base area of 5.00 cm^2.
Calculate the pressure exerted by the bottle on the table, leaving your answer in **pascal, Pa**.

pressure = …………………… Pa [3]

(b) Fig. 3.2 shows another bottle that has the same weight as the bottle shown in Fig. 3.1.
The base of this bottle is not flat but concaves into the bottle.

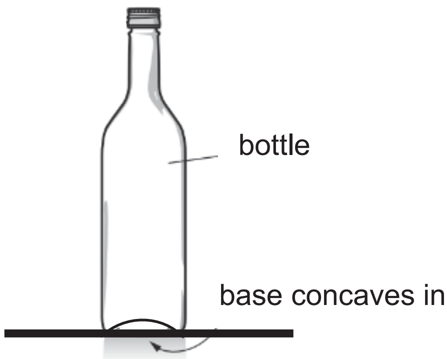


Fig. 3.2

Explain what will be the change to the pressure exerted by the bottle on the table.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

……………………………………………………………………………………………. [2]

4 Fig. 4.1 shows a raft that is made from an unknown material **X**.
The raft is made up of 8 identical poles.

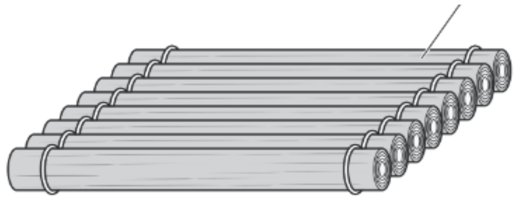


Fig. 4.1

(a) Given that each pole has a mass of 45.0 kg, calculate the total weight of the raft. The gravitational field strength is 10.0 N/kg. You may ignore the mass of the ropes used.

total weight = …………………… N [2]

(b) The volume of each pole is 0.120 m^3.

(i) Calculate the density of material **X**.

density = …………………… kg/m^3 [2]

(ii) Hence, explain whether the raft will float or sink when placed on the surface of water (density of water is 1000 kg/m^3).

……………………………………………………………………………………………

……………………………………………………………………………………………… [1]

5 Fig. 5.1 shows a lady standing in front of a plane mirror. She sees the reflection of her shoe in the mirror.

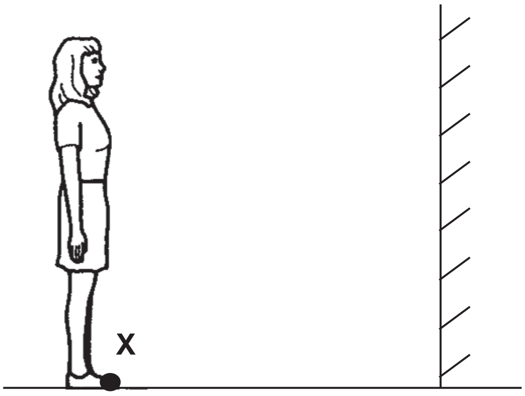


Fig. 5.1

In Fig. 5.1,

(a) Draw a ray of light from point **X**, reflected by the mirror, to the lady's eye. Mark the image of point **X**, with the letter **Y**. [3]

(b) If the lady moves 1.00 m nearer to the mirror, state the change to the distance between the lady and her image.

………………………………………………………………………………………………… [1]

6 Electromagnetic waves has many applications. Some refrigerators are installed with ultraviolet radiation lamps to reduce the growth of mould and fungus.

(a) State two properties of ultraviolet radiation that are typical of electromagnetic waves.

…………………………………………………………………………………………………

………………………………………………………………………………………………… [2]

(b) Name another electromagnetic wave that has a shorter wavelength than ultraviolet radiation and state its application.

…………………………………………………………………………………………………

………………………………………………………………………………………………… [2]

7 Fig. 7.1 (not drawn to scale) shows an object 5.00 cm high placed 2.00 cm from a converging lens and is used as a magnifying glass. The image produced is 6.00 cm from the lens and is 15.0 cm high.

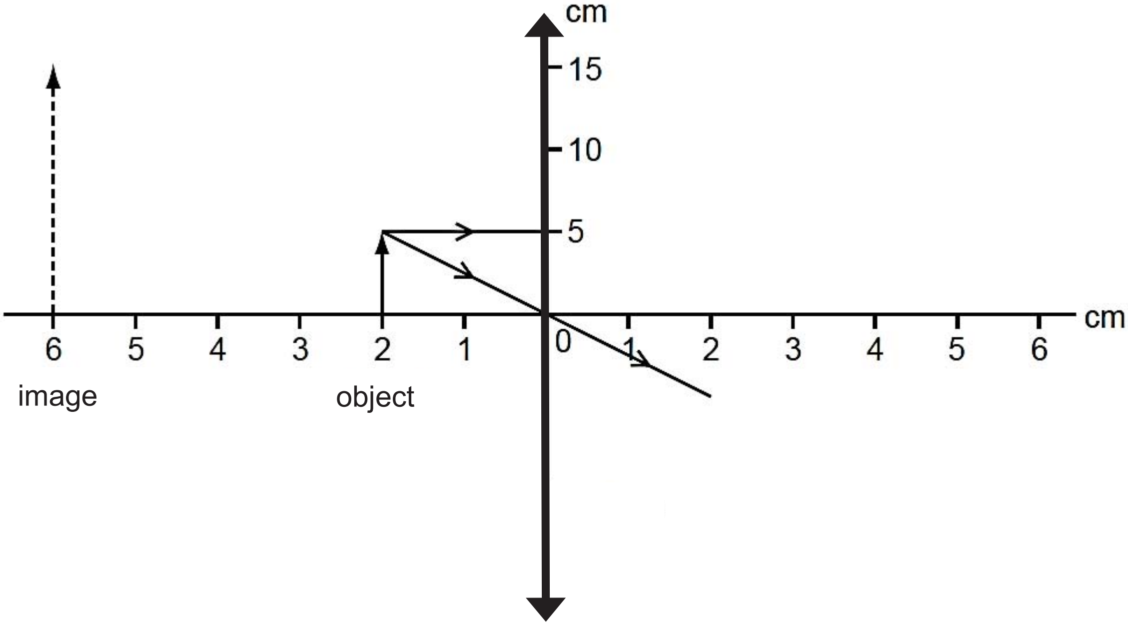


Fig. 7.1

(a) Complete the ray diagram in Fig. 7.1 and determine the focal length of the converging lens.

focal length = …………………… cm [3]

(b) For the image to be real and same size as the object, state the distance the object should be placed from the converging lens.

distance = …………………… cm [1]

(c) If the object is moved nearer to the lens, state the change to the observed image.

………………………………………………………………………………………………….. [1]

8 A wavefront is an imaginary line on a wave that joins all adjacent points that are in phase. Fig. 8.1 shows circular wavefronts that is produced at the centre of a ripple tank.

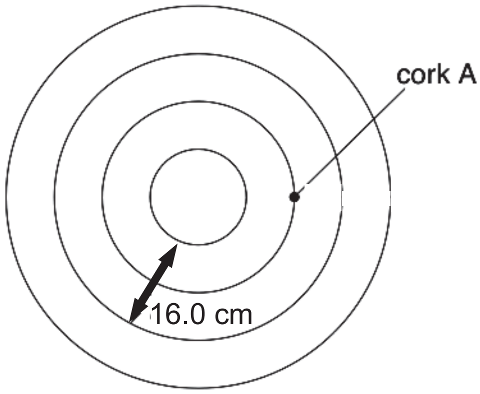


Fig. 8.1

A wooden cork **A** floats on top of the water surface, moving up and down as the wave passes.

Fig. 8.2 shows the displacement-time graph of the water wave.

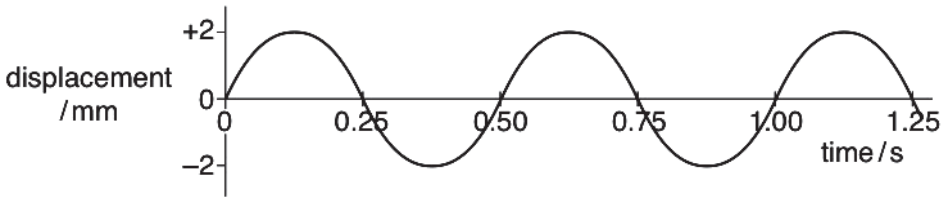


Fig. 8.2

Use the information provided to answer the following.

(a) State the wavelength and amplitude of the wave.
Include the correct units in your answers.

wavelength: .... [1]

amplitude: .... [1]

(b) Calculate the frequency of the water wave.

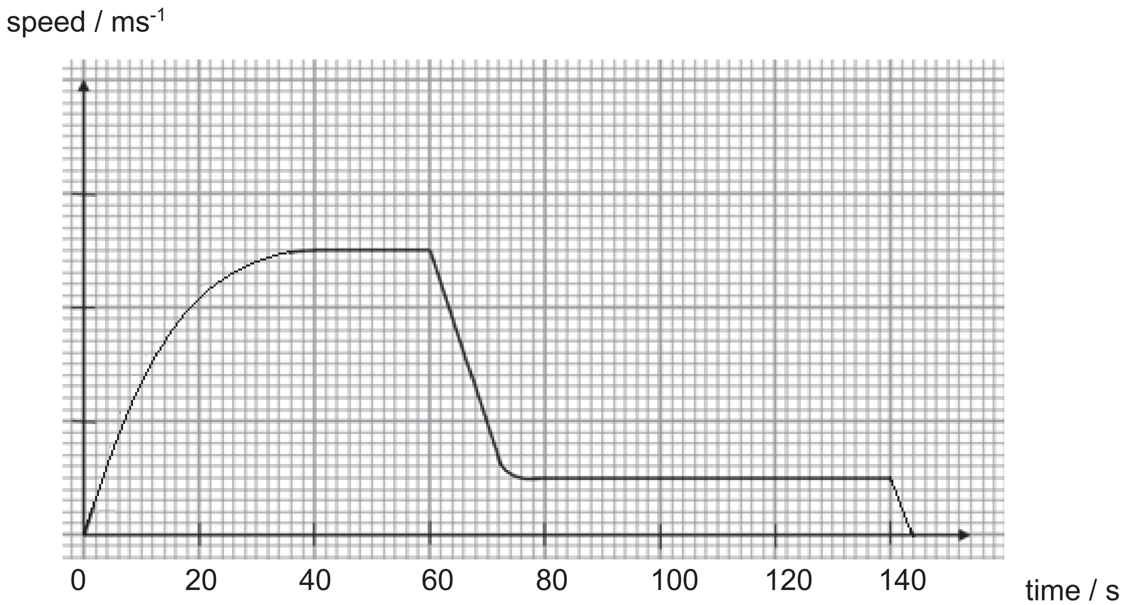
frequency = ... Hz [2]

(c) Hence, calculate the speed of the water wave.

speed = ... cm/s [2]

9 A parachutist falls from an aircraft. After some time, the parachute opens.

Fig. 9.1 shows the speed-time graph of the parachutist on his way down.



(a) Name the two forces acting on the parachutist that oppose each other as he falls.

………………………………………………………………………………………………. [2]

(b) State the initial acceleration of the parachutist. ……………………………………. m/s^2 [1]

(c) Describe the motion of the parachutist from

(i) t = 0 to t = 40.0 s,

………………………………………………………………………………………….... [1]

(ii) t = 40.0 s to t = 60.0 s.

…………………………………………………………………………………………..… [1]

(d) State the time when the parachute is first opened. …………………………………… s [1]

Section B

Answer any **two** questions from this section in the spaces provided.

10 Fig. 10.1 shows the cross-sectional view of a piece of glass of refractive index 1.60.

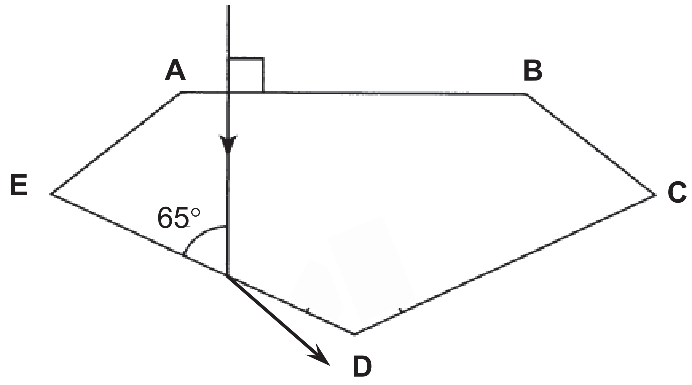


Fig. 10.1

(a) A ray of light is incident at the boundary **AB** and continues its path as shown in Fig. 10.1.

(i) Explain why the ray of light at boundary **AB** did not change its direction of path as it enters the piece of glass.

.... [1]

(ii) Determine the angle of incidence at the boundary **DE**.

angle of incidence = ... ° [1]

(iii) Hence, calculate the angle of refraction as the ray of light emerges from the glass.

angle of refraction = ... ° [2]

(b) A piece of diamond of refractive index 2.40 is cut into the same shape as the glass in **(a)**. The same ray of light is incident on boundary **AB** and its path is as shown in Fig. 10.2.

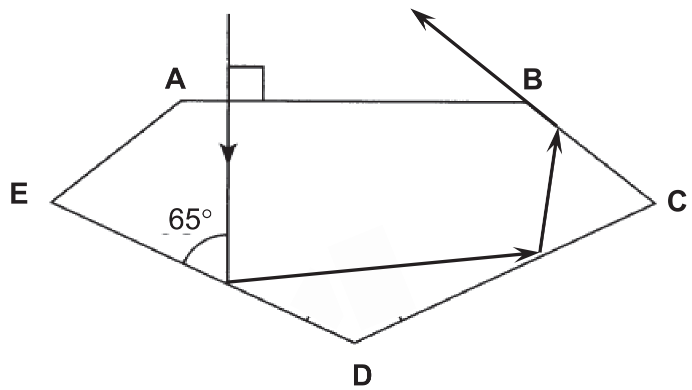


Fig. 10.2

(i) Calculate the critical angle for diamond.

critical angle = …………………… ° [2]

(ii) In Fig. 10.2, label the critical angle, θ, at boundary **BC**. [1]

(iii) Explain why the ray of light undergoes total internal reflection at the boundary **DE**.

…………………………………………………………………………………………

…………………………………………………………………………………………

………………………………………………………………………………………... [2]

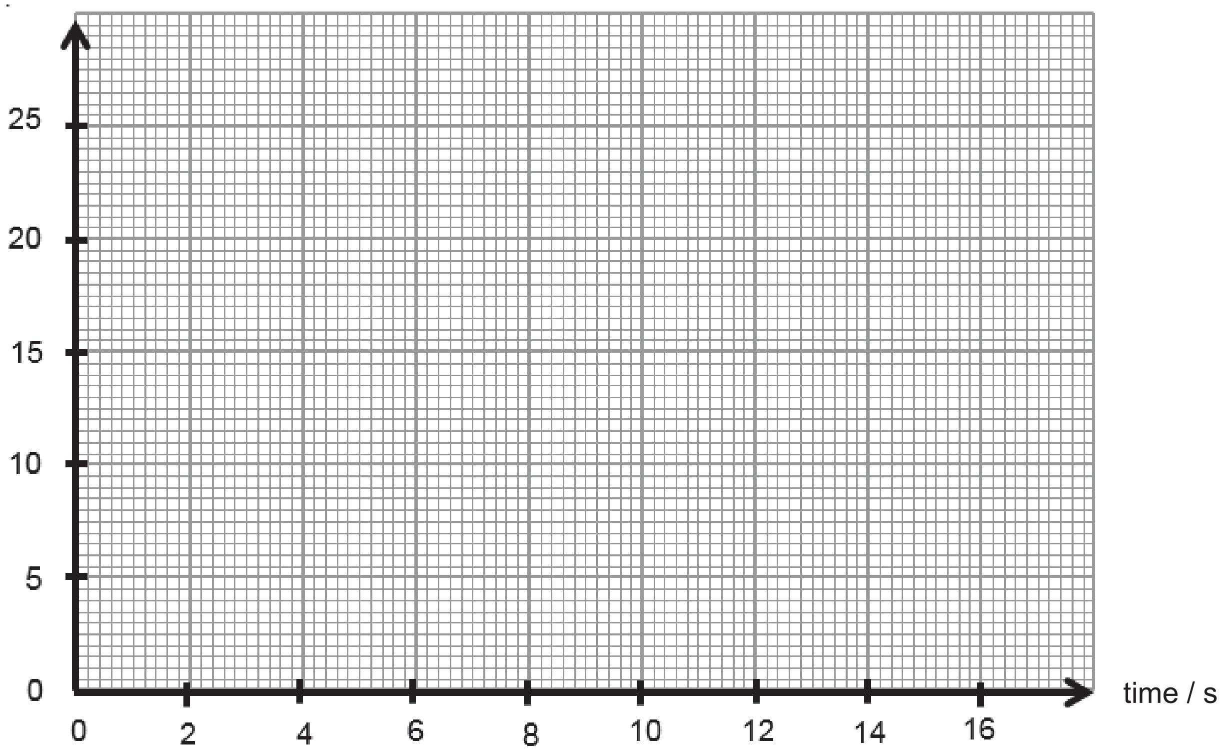
(iv) Explain why the piece of diamond appears more sparkling than the piece of glass when placed under the same light conditions.

…………………………………………………………………………………………

………………………………………………………………………………………... [1]

11 A car of mass 950 kg is initially travelling along a straight road at a constant speed of 15.0 ms^{-1} during the first 4.00 s. It then accelerates uniformly to a speed of 22.5 ms^{-1} for the next 5.00 s before decelerating uniformly to rest in the final 8.00 s.

(a) In Fig. 11.1, plot a speed-time graph of the car for the entire journey.



[3]

(b) From the graph, calculate the

(i) deceleration of the car for the last 8.00 s.

deceleration = …………………… ms^{-2} [3]

(ii) distance travelled by the car for the entire journey.

distance = …………………… m [2]

(iii) Calculate the average speed for the entire journey.

average speed = …………………… m/s [2]

12 **(a)** Fig.12.1 shows how layers of air particles are displaced when a sound wave passes through.

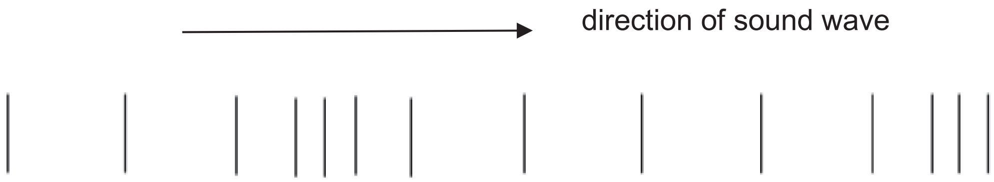


Fig. 12.1

(i) Explain how the sound wave affects the layers of air particles as it travels in Fig. 12.1.

…………………………………………………………………………………………………..

…………………………………………………………………………………………………..

…………………………………………………………………………………………………..

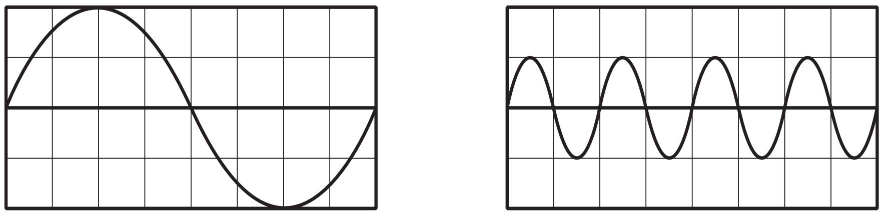
………………………………………………………………………………………………… [3]

(ii) In Fig. 12.1, mark the wavelength of the sound wave with a letter **L**. [1]

(iii) The wavelength of the sound wave is 0.0840 m. If the speed of sound in air is 330 m/s, calculate the frequency of the sound wave.

frequency = …………………… Hz [2]

(b) Fig. 12.2 shows the wave traces made by two sound waves, **X** and **Y**.



trace **X** trace **Y**

Fig. 12.2

(i) In Fig. 12.3, draw the trace of a third sound wave which has half the amplitude but with twice the frequency of trace **X**. [2]

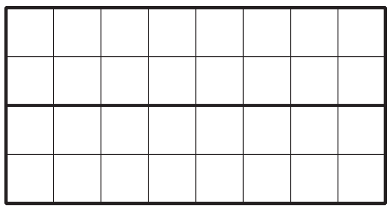


Fig. 12.3

(ii) Explain how the pitch and loudness of the sound waves in trace **X** and trace **Y** are different.

....

....

.... [2]