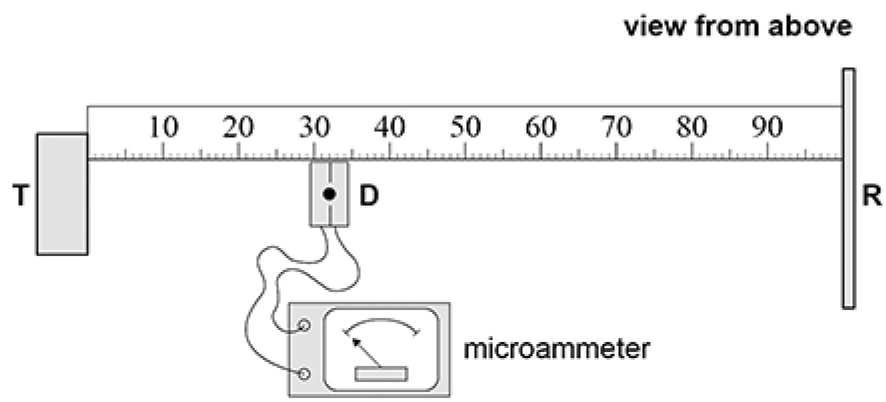
1. A student investigates stationary waves using microwaves.

Figure 1 shows a metre ruler fixed to a bench. The student places a microwave transmitter **T** at one end of the ruler and a vertical metal reflector **R** at the other end. **R** is at a right angle to the ruler.

Figure 1



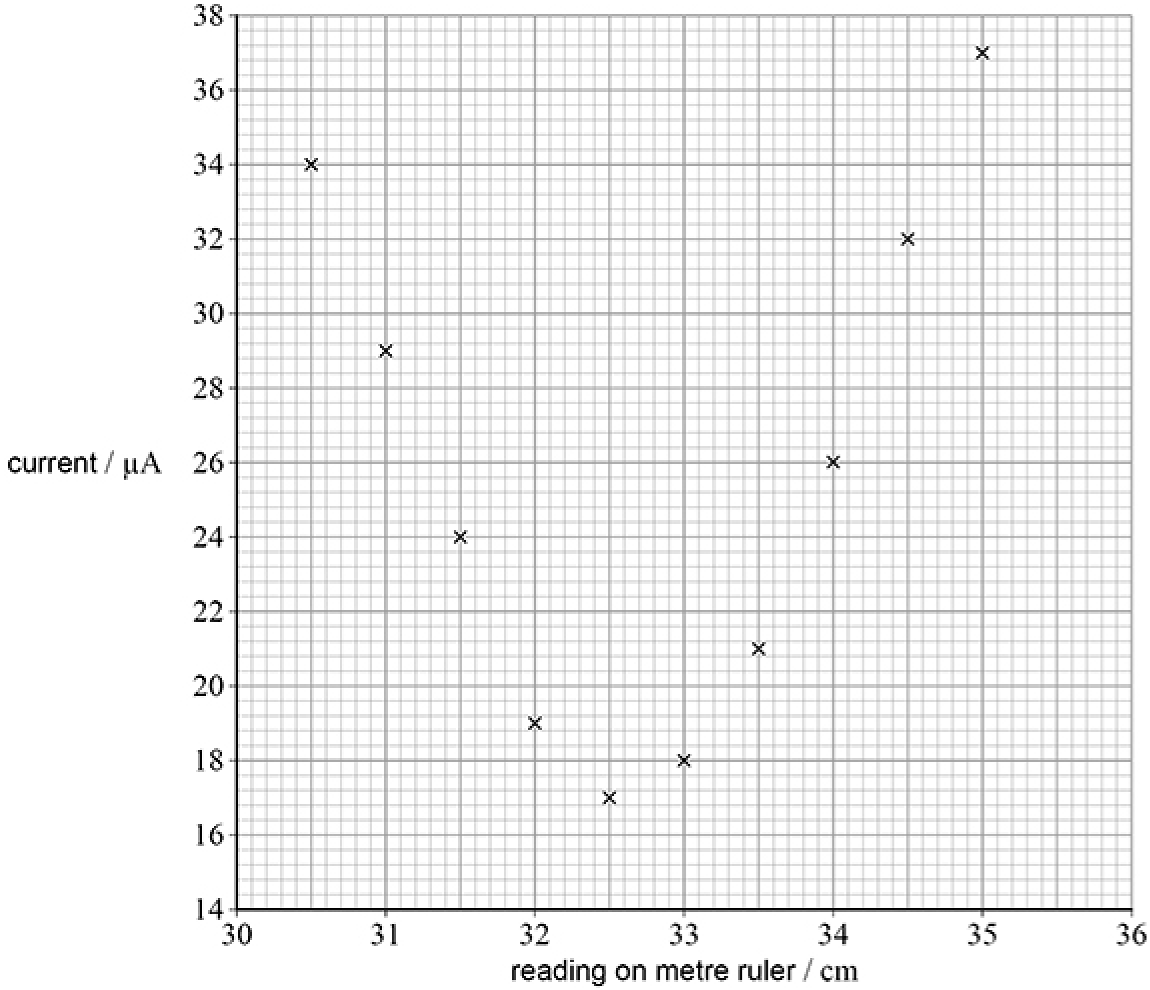
The student places a microwave detector **D** approximately one-third of the distance from **T** to **R**. When **T** is switched off, the microammeter connected to **D** reads zero.

When **T** is switched on, stationary waves are produced between **T** and **R**, and the microammeter registers a current. When the student moves **D** along the ruler, the size of the current changes between maximum and minimum values.

The student measures the current at different positions of **D** along the ruler to identify a position **P** of the minimum current.

Figure 2 is a plot of the measurements taken near **P**.

Figure 2



(a) Draw a line of best fit for these data.

(2)

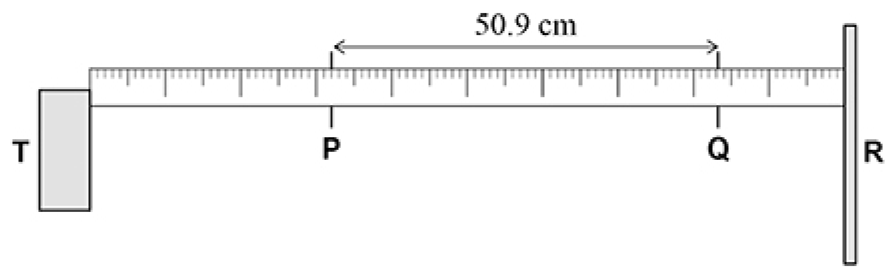
(b) State a value for the position of **P**.

position of **P** = ______________ cm

(1)

The student moves **D** along the metre ruler towards **R** and observes a series of maximum and minimum readings on the microammeter. He identifies **Q** as the position of the **8th minimum** current from **P**. He measures the distance **PQ** to be 50.9 cm, as shown in **Figure 3**.

Figure 3



(c) The absolute uncertainty in identifying any minimum current is ± 0.2 cm.

Determine the percentage uncertainty in the distance **PQ**.

percentage uncertainty in **PQ** = ______________ %

(2)

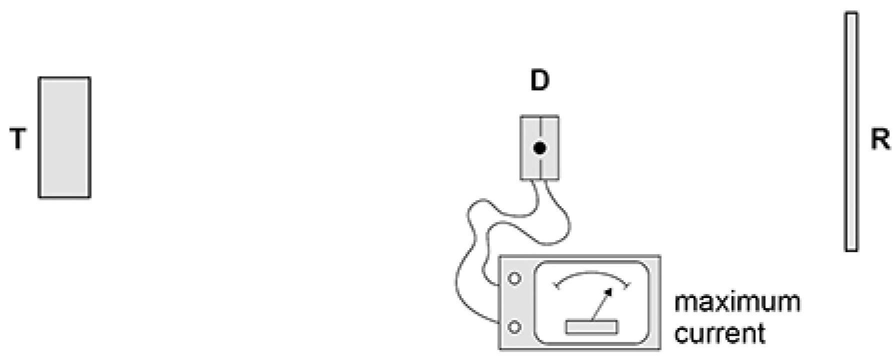
(d) Deduce the frequency of the microwaves produced by **T**.

frequency = _______________ Hz

(3)

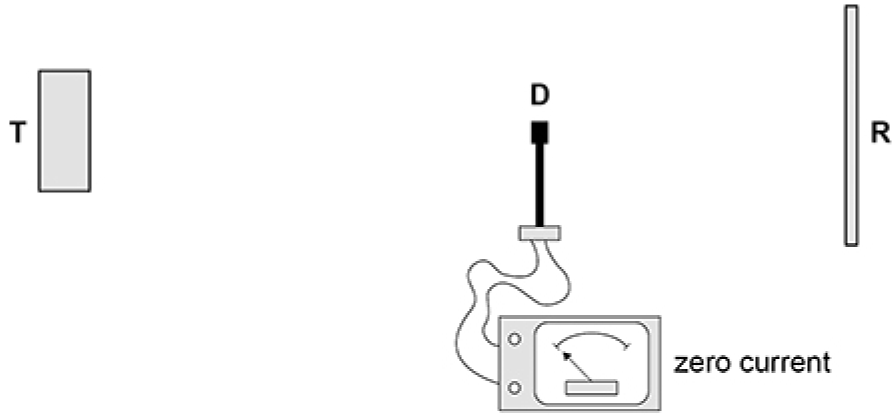
(e) **Figure 4** shows **D** placed at a position where the current is a maximum.

Figure 4



The student rotates **D** by 90°, without changing its distance from **T**, to the position shown in **Figure 5**. The current is now zero.

Figure 5



State the property of microwaves that is shown by this change in current.

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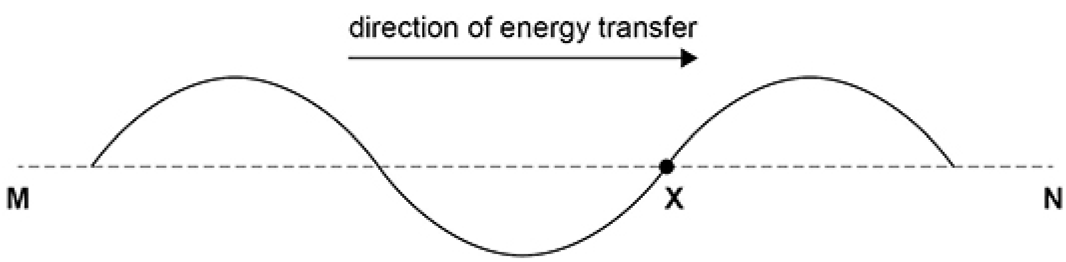
(1)

(Total 9 marks)

2. A progressive wave travels along a rope in the direction **M** to **N**.

X marks a point on the rope.



The wave has a frequency of 5.0 Hz, a wavelength of 1.0 m and an amplitude of 0.20 m.

Where will **X** be after 0.15 s?

A below **MN** by 0.20 m ○

B above **MN** by 0.20 m ○

C nearer **N** by 0.15 m ○

D nearer **N** by 0.75 m ○

(Total 1 mark)

3. The diagram shows a string stretched between two fixed points **O** and **R** which are 120 cm apart.

P and **Q** are points on the string.

OP = 30 cm
OQ = 90 cm

At a certain frequency the string vibrates at its first harmonic.

P and **Q** oscillate in phase.

The frequency is gradually increased.

What is the next harmonic at which **P** and **Q** will oscillate in phase?

A second ⬭

B third ⬭

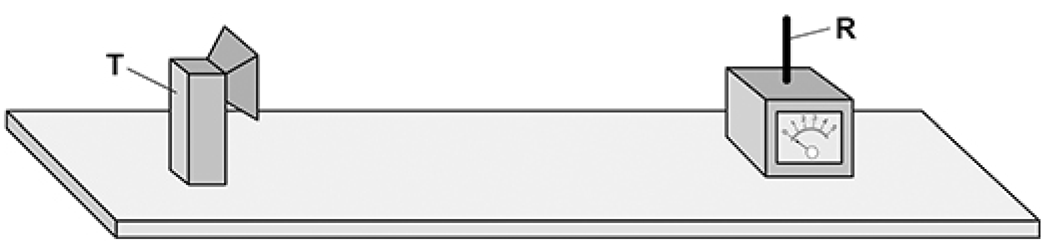
C fourth ⬭

D fifth ⬭

(Total 1 mark)

4. **Figure 1** shows apparatus used to investigate the properties of microwaves.
The microwaves from the transmitter **T** are vertically polarised and have a wavelength of about 3 cm.
The microwaves are detected at the receiver by a vertical metal rod **R**.

Figure 1



(a) Explain how the apparatus can be used to demonstrate that the waves from **T** are vertically polarised.

(3)

Figures 2a and **2b** show **T** and **R** and two different positions of a metal plate **M** that reflects microwaves. **M** is vertical and parallel to the direct transmission from **T** to **R**.

Figure 2a

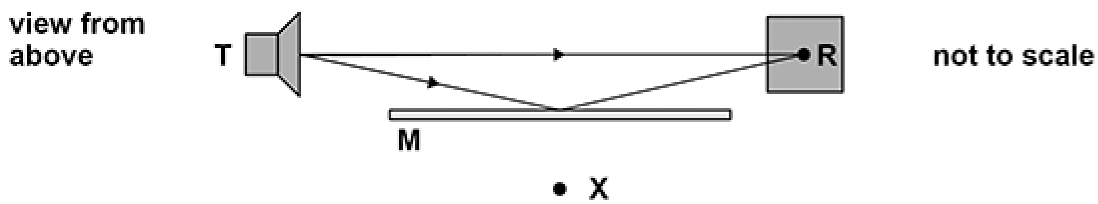
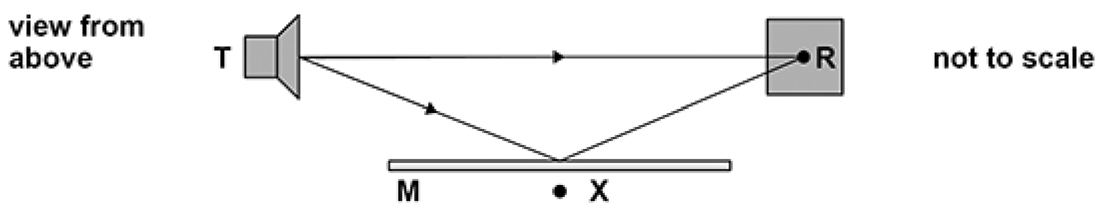


Figure 2b



In an experiment, **T** and **R** are about two metres apart. **M** is moved slowly towards **X**.
Figure 2a shows the initial position of **M**.
Figure 2b shows **M** when it has been moved a few centimetres.

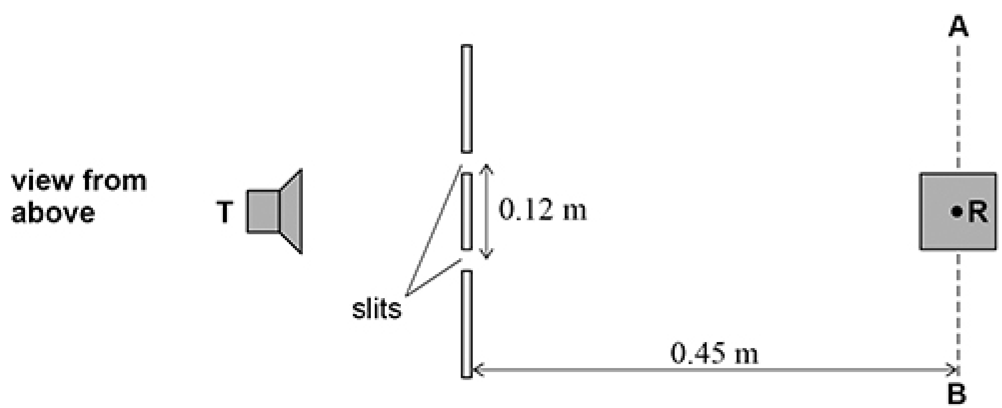
The arrowed lines show the path of waves that reach **R** directly and the path of waves that reach **R** by reflection from **M**.

(b) Explain what happens to the signal detected by **R** as **M** is moved slowly towards **X**.

(4)

Figure 3 shows an arrangement used in a different experiment to try to determine the wavelength of the microwaves.

Figure 3



A double-slit arrangement is placed between **T** and **R**.

The initial position of **R** is the same distance from each slit and is 0.45 m from the midpoint of the two slits.
AB is a line perpendicular to the line between **T** and the initial position of **R**.
R can be moved 0.25 m towards **A** and 0.25 m towards **B** along **AB**.

The two slits act as two coherent sources with a separation of 0.12 m.

(c) Suggest why Young's double-slit equation should **not** be used to determine the wavelength.

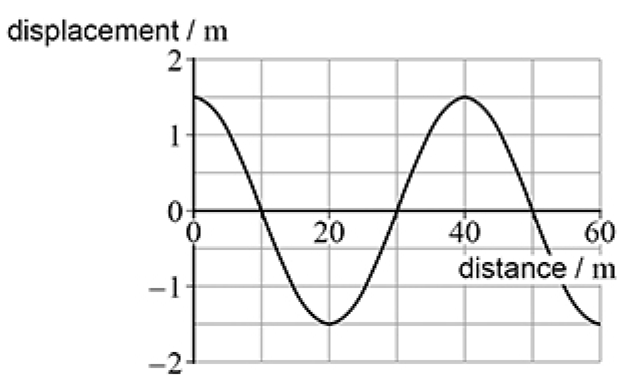
(1)

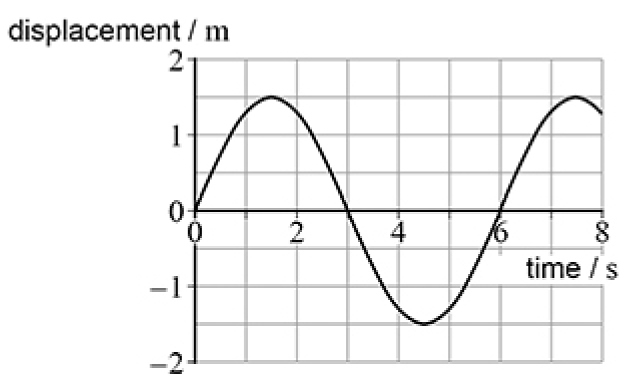
(d) The wavelength is known to be about 3 cm.

Deduce whether this practical arrangement is suitable for a determination of a value for the wavelength.

(3)
(Total 11 marks)

5. The diagrams show the displacement–distance graph for a wave and the displacement–time graph for a point in the wave.





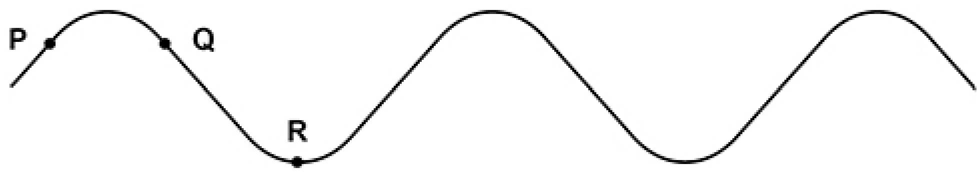
Which is correct for this wave?

A	The amplitude is 3.0 m.	⬭
B	The wavelength is 6 m.	⬭
C	The speed is 8.3 m s^{-1}.	⬭
D	The frequency is 0.17 Hz.	⬭

(Total 1 mark)

6. The diagram shows a stationary wave on a string at one instant in time.

P, **Q** and **R** are three points on the string.



Which row is correct?

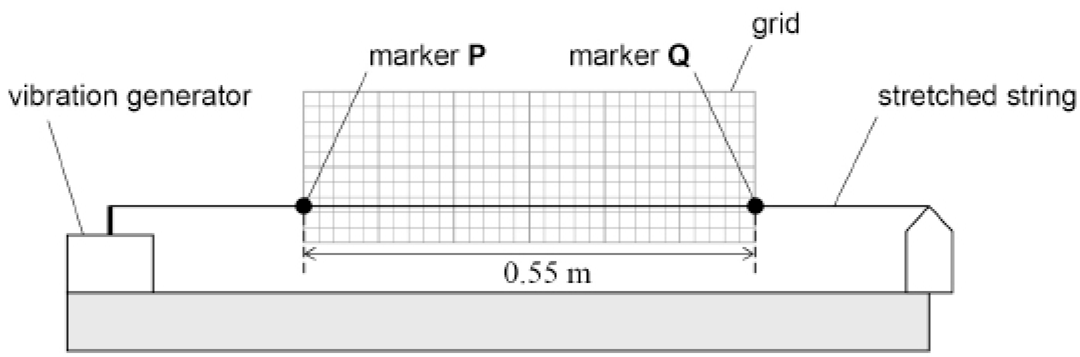
A	**P** is in antiphase with **R**	**P** has the same amplitude as **Q**	⬭
B	**P** is out of phase with **R**	**P** has the same amplitude as **R**	⬭
C	**P** is in phase with **Q**	**P** has the same amplitude as **R**	⬭
D	**P** is out of phase with **Q**	**P** has a smaller amplitude than **R**	⬭

(Total 1 mark)

7. **Figure 1** shows the apparatus a student uses to investigate stationary waves in a stretched string.

Two small pieces of adhesive tape are fixed to the string as markers **P** and **Q**. Markers **P** and **Q** are 0.55 m apart and an equal distance from the ends of the string. A graph paper grid is placed behind the string between **P** and **Q**.

Figure 1



not to scale

(a) The string is made to vibrate at the second harmonic.

Compare the motion of **P** with that of **Q**.

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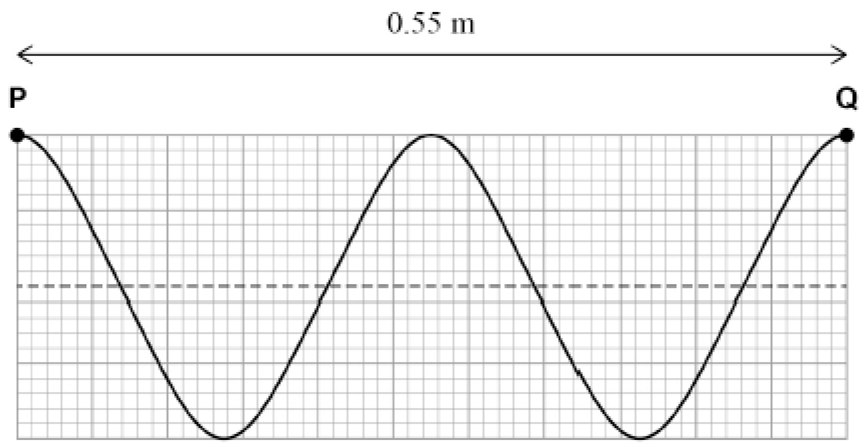
(2)

(b) The frequency of the vibration generator is increased, and a higher harmonic of the stationary wave is formed.

Figure 2 shows the string between **P** and **Q** at an instant in time. The dashed horizontal line indicates the position of the string at rest when the vibration generator is switched off.

Figure 2



The frequency of the vibration generator is 250 Hz.

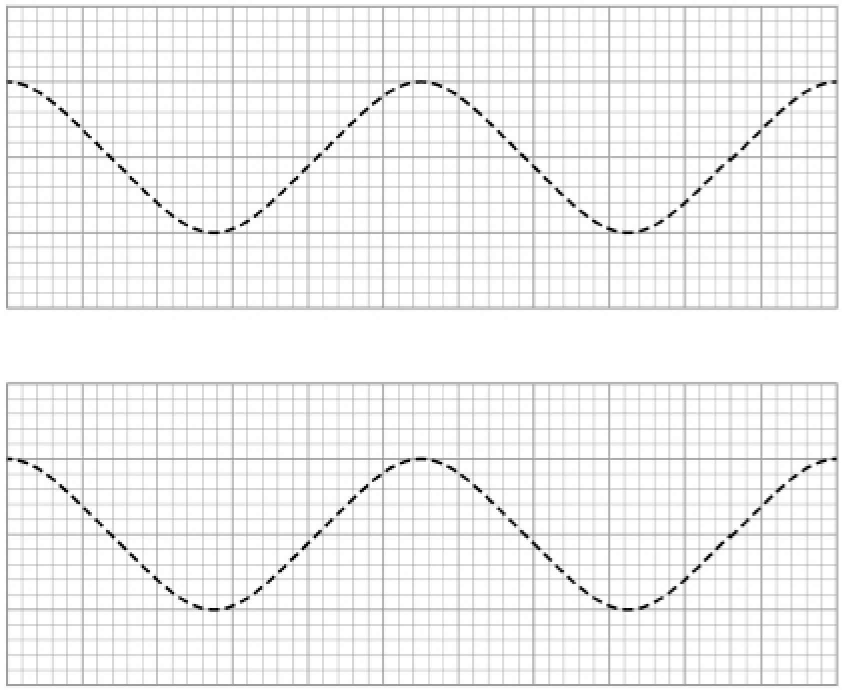
Calculate the wave speed.

wave speed = _______________ m s^{-1}

(2)

(c) The instantaneous position of the string in **Figure 2** can be explained by the superposition of two waves. The instantaneous positions of these waves between **P** and **Q** are shown in **Figure 3**.

Figure 3



Describe the properties that the waves must have to form the shape shown in **Figure 2**.

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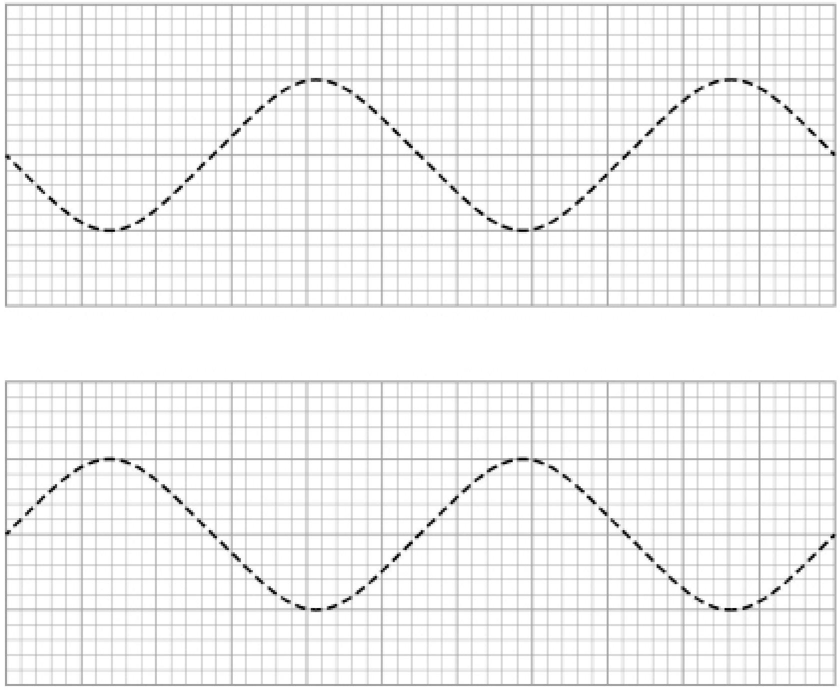
(3)

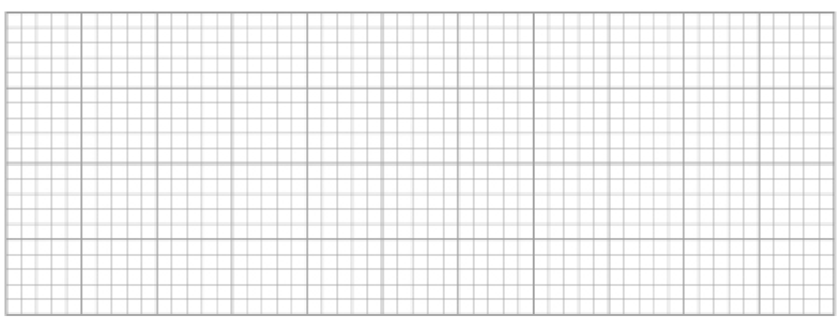
(d) **Figure 4** shows the positions of the two waves between **P** and **Q** a short time later.

Figure 4



Draw, on **Figure 5**, the appearance of the string between **P** and **Q** at this instant.

Figure 5



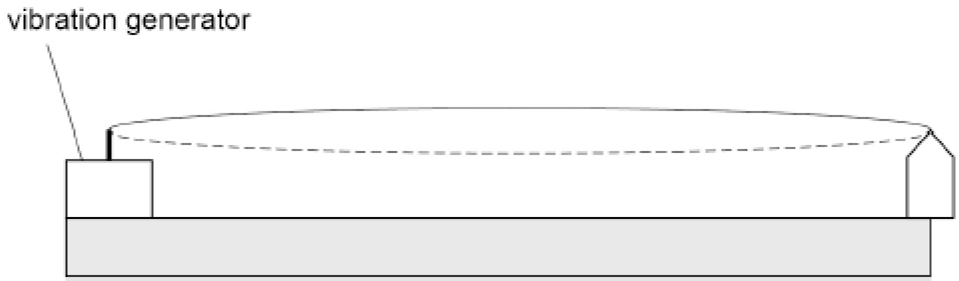
(1)

(e) Annotate (with an **A**) the positions of any antinodes on your drawing in **Figure 5**.

(2)

(f) The frequency of the vibration generator is reduced until the first harmonic is observed in the string, as shown in **Figure 6**.

Figure 6



The string in **Figure 6** is replaced with one that has 9 times the mass per unit length of the original string. All other conditions are kept constant, including the frequency of the vibration generator and the tension in the string.

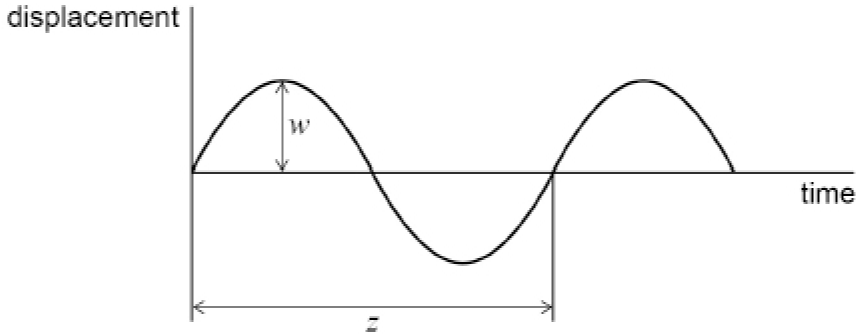
Deduce the harmonic observed.

(3)

(Total 13 marks)

8. A wave travels along a water surface.

The variation with time of the displacement of a water particle at the surface is shown.



What properties of the wave are represented by w and z?

	w	z	
A	phase	frequency	⬭
B	amplitude	wavelength	⬭
C	wavelength	phase	⬭
D	amplitude	period	⬭

(Total 1 mark)

9. Two points on a progressive wave are out of phase by 0.41 rad.

What is this phase difference?

A 23° ⬭

B 47° ⬭

C 74° ⬭

D 148° ⬭

(Total 1 mark)

10. (a) Distinguish between longitudinal and transverse waves.

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(2)

(b) A piano repairer replaces the wire that produces the highest note on a piano. The wire has a vibrating length of 0.050 m. He uses a wire with the following properties:

diameter = 3.5×10^{-4} m
density = 7.8×10^{3} kg m^{-3}
breaking stress = 3.0×10^{9} N m^{-2}

Calculate the tension required for the vibrating wire to produce its correct frequency of 4.1 kHz.

tension = ____________________ N

(2)

(c) Evaluate, using the data provided in part **(b)**, whether it is safe to use this wire.

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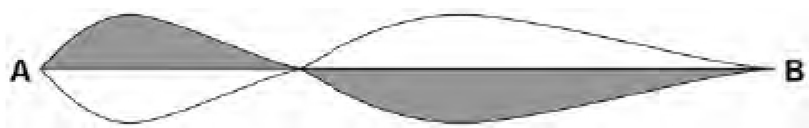
(2)

(d) The repairer uses faulty wire so that the diameter of the wire increases linearly with distance along its length. The profile of the vibration produced when the wire sounds its second harmonic is shown in the diagram below.



The speed c of a transverse progressive wave travelling along a string of mass per unit length μ and under tension T is given by

$$c = \sqrt{\frac{T}{\mu}}$$

Explain which end of the wire, **A** or **B**, has the greater diameter and why the profile of the stationary wave has the shape shown in the diagram above.

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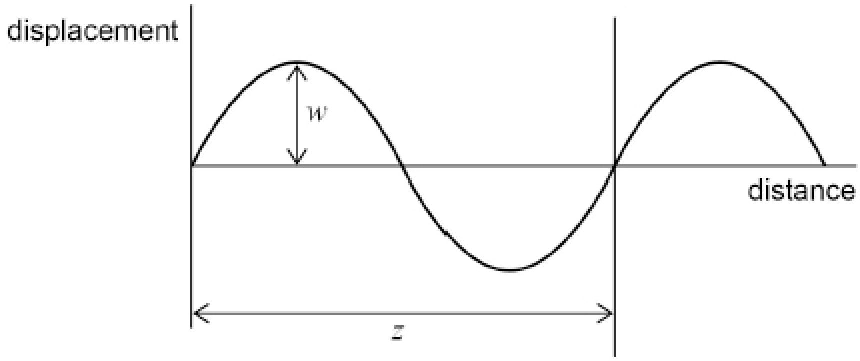
(4)

(Total 10 marks)

11. A wave travels across the surface of water.
The diagram shows how the displacement of water particles at the surface varies with distance.

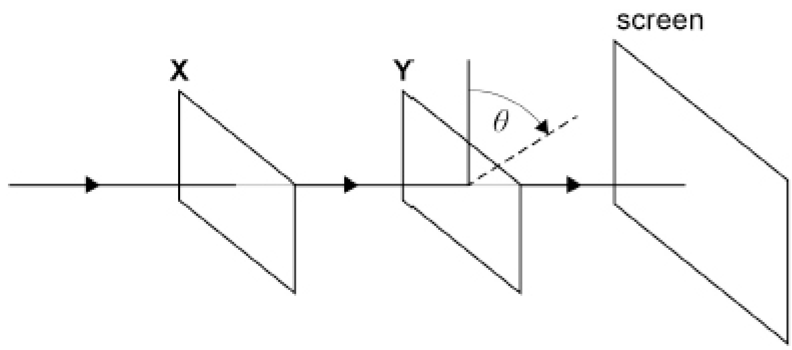


Which row correctly describes both w and z?

	w	z	
A	amplitude	wavelength	⬭
B	half-amplitude	period	⬭
C	half-amplitude	wavelength	⬭
D	amplitude	period	⬭

(Total 1 mark)

12. Unpolarised light travels through two polarising filters **X** and **Y** and is then incident on a screen. When **X** and **Y** are arranged as shown, there is a maximum intensity on the screen.
X is held stationary but **Y** is rotated in a plane at right angles to the beam so that θ increases.



What are the next three values of θ, in rad, for which the beam hits the screen with maximum intensity?

A $\frac{\pi}{2}, \frac{2\pi}{2}, \frac{3\pi}{2}$ ⬭

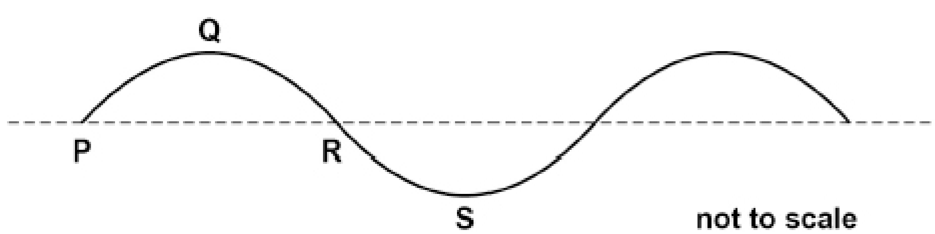
B $\frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}$ ⬭

C $\pi, 2\pi, 3\pi$ ⬭

D $2\pi, 4\pi, 6\pi$ ⬭

(Total 1 mark)

13. The diagram shows the cross-section of a progressive transverse wave travelling at 24 cm s^{-1} on water. The amplitude of the wave is 2.0 cm and the frequency is 4.0 Hz.



Which statement is correct?

A The phase difference between particles at **P** and **S** is $\frac{\pi}{2}$rad. ⬭

B The distance between **P** and **R** is 6.0 cm. ⬭

C The particle velocity at **Q** is a maximum. ⬭

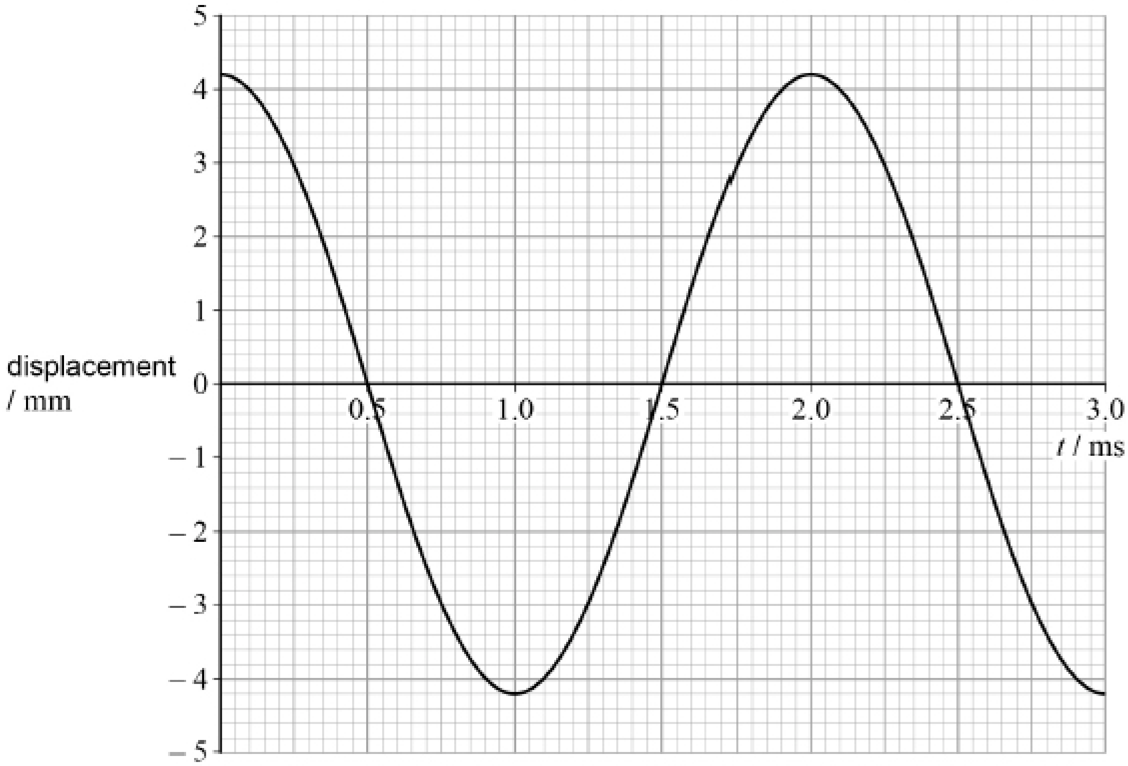
D Particles at **P** and **R** are in phase. ⬭

(Total

14. A loudspeaker cone is driven by a signal generator (oscillator).

The graph shows the variation of displacement with time *t* for a point **P** at the centre of the cone.

P is oscillating with simple harmonic motion.



(a) State the time, in milliseconds, when **P** is moving at its maximum positive velocity.

time = ____________________ ms

(1)

(b) Calculate the maximum acceleration of **P**.

acceleration = ____________________ m s^{-2}

(3)

(c) The loudspeaker creates variations in pressure and produces a sound wave in the air around it.

State the type of wave produced and describe the motion of the particles in this type of wave.

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(1)

(Total 5 marks)

15. Stationary waves are set up on a rope of length 1.0 m fixed at both ends.

Which statement is **not** correct?

A The first harmonic has a wavelength of 2.0 m. ⬭

B The midpoint of the rope is always stationary for even-numbered harmonics. ⬭

C A harmonic of wavelength 0.4 m can be set up on the rope. ⬭

D There are five nodes on the rope for the fifth harmonic. ⬭

(Total 1 mark)

16. A sonar transmitter on a ship produces pulses of sound waves.
Each pulse of sound waves contains 12 complete oscillations.
The frequency of these waves is 8.0 kHz and the speed of sound in seawater is 1.5×10^3 m s^{-1}.

What is the length of one pulse in seawater?

A 0.188 m ⬭

B 2.25 m ⬭

C 2.25×10^3 m ⬭

D 1.44×10^5 m ⬭

(Total 1 mark)

17. The frequency of the first harmonic of a wire fixed at both ends is 300 Hz.
The tension in the wire is now doubled.

What is the frequency of the first harmonic after this change?

A 150 Hz ☐

B 210 Hz ☐

C 420 Hz ☐

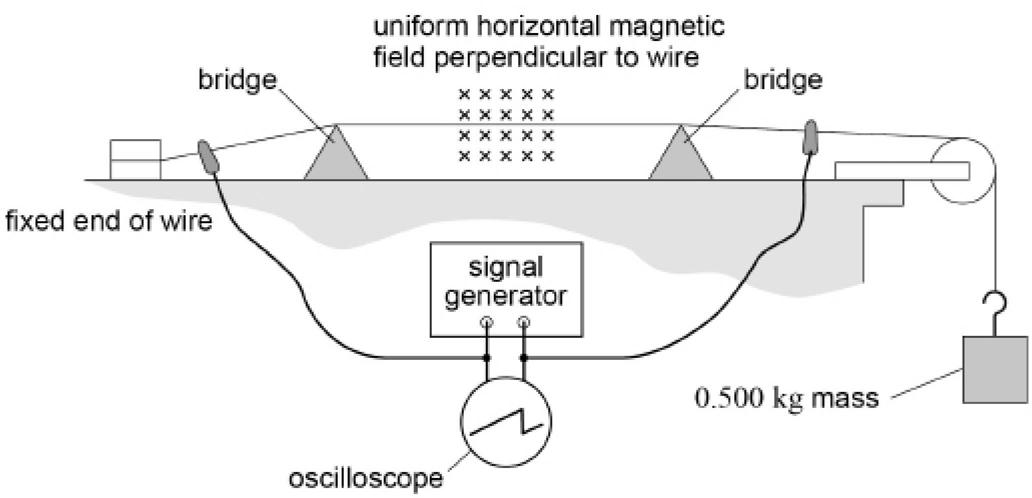
D 600 Hz ☐

(Total 1 mark)

18. A stationary wave is formed on a stretched wire.

Figure 1 shows the wire, fixed at one end, supported by two bridges and passing over a pulley.

Figure 1

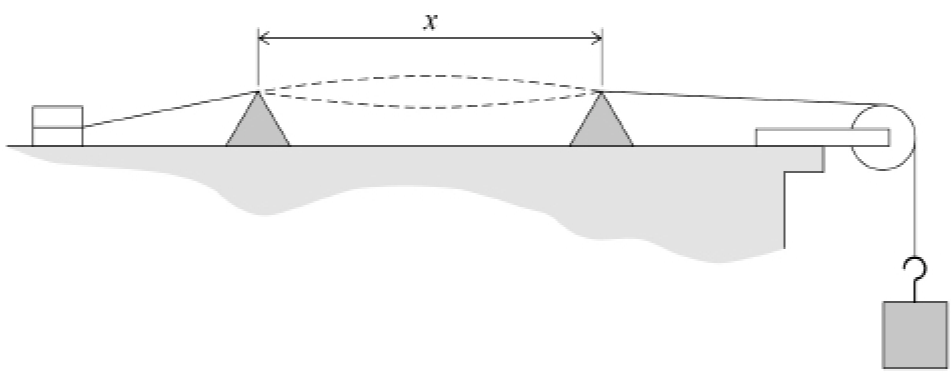


A 0.500 kg mass is attached to the free end of the wire.
A uniform horizontal magnetic field is applied perpendicular to the wire between the bridges.
A signal generator is connected to each end of the wire.

The oscilloscope shown is used to determine the frequency of the output of the signal generator.
The wire oscillates because the alternating current in the wire interacts with the magnetic field.

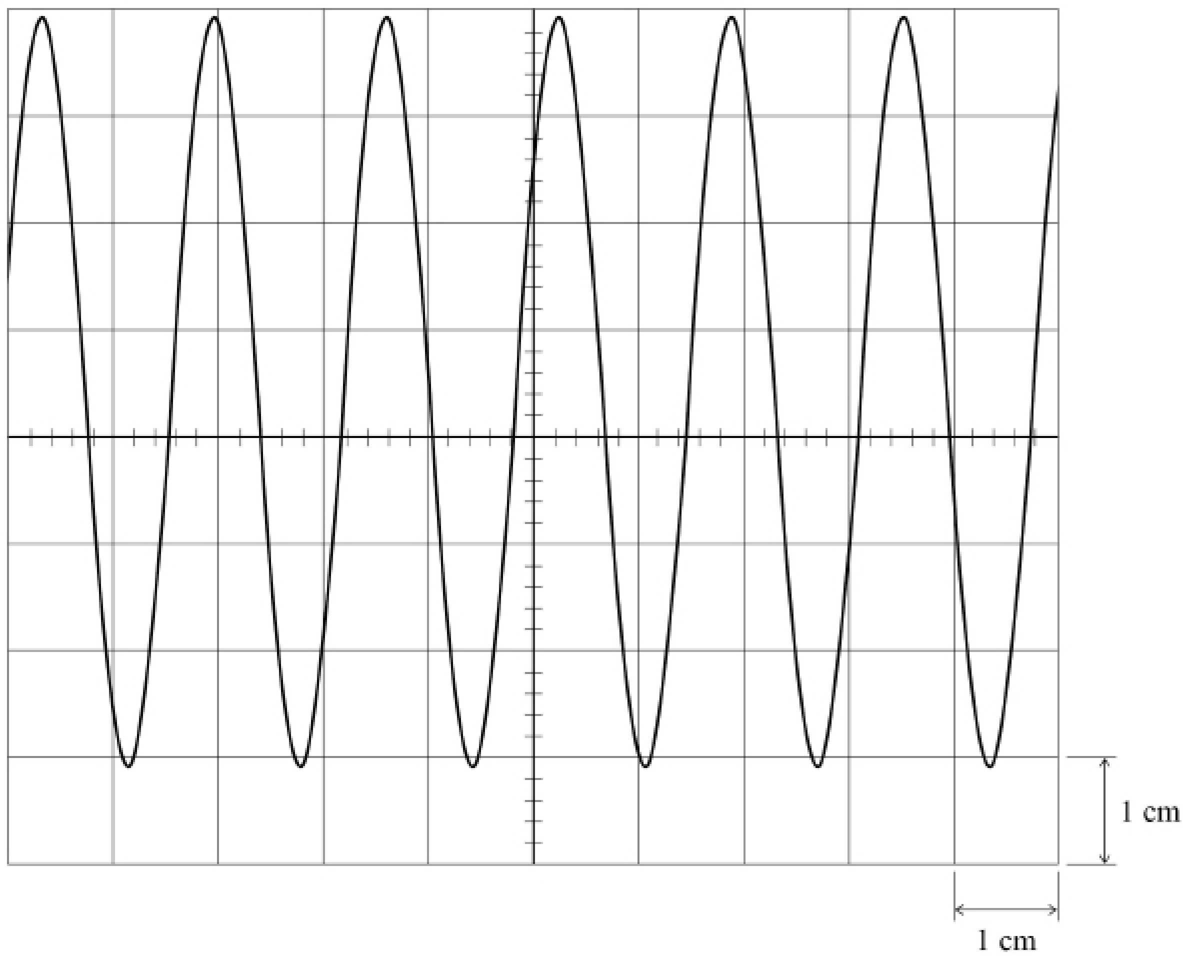
Figure 2 shows the first harmonic stationary wave produced when the distance *x* between the bridges is adjusted.

Figure 2



(a) The output potential difference (pd) of the signal generator is displayed on the oscilloscope, as shown in **Figure 3**.

Figure 3



The time-base setting of the oscilloscope is 10 ms cm^{-1}.

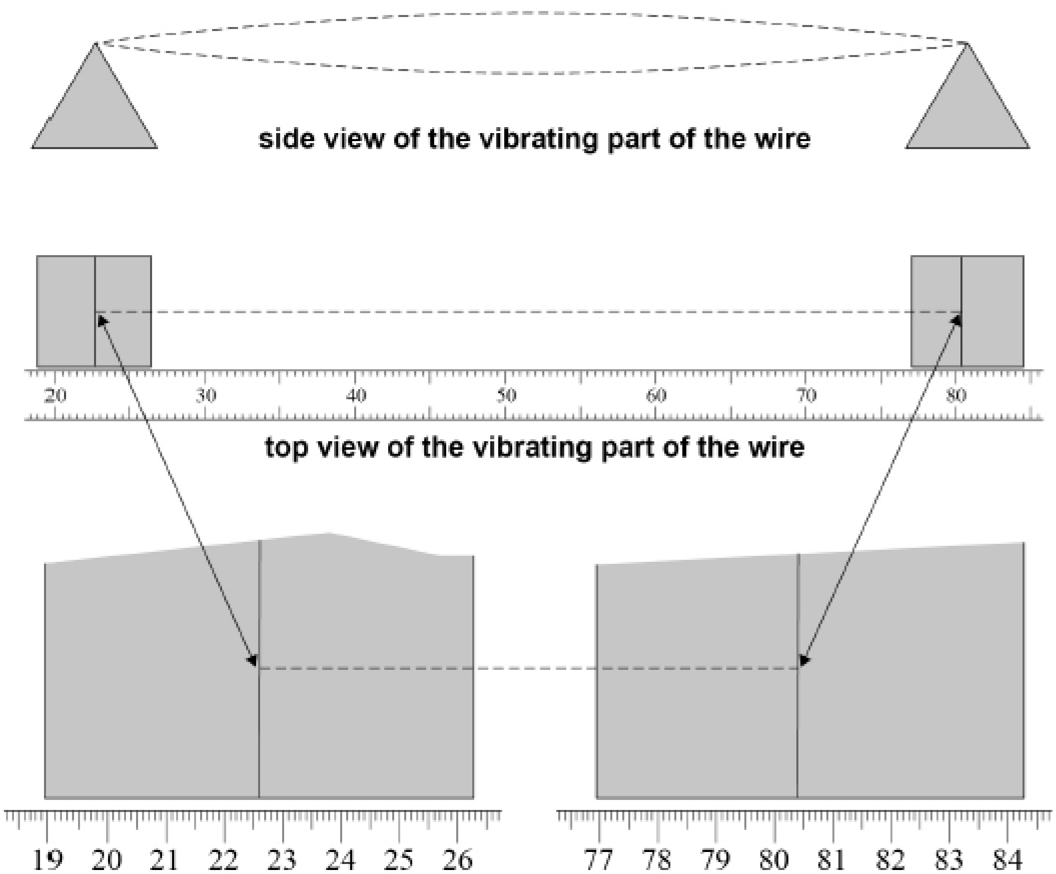
Determine f, the frequency of the alternating pd.

f = ____________________ Hz

(2)

(b) A metre ruler is placed next to the bridges supporting the wire, as shown in **Figure 4**.

Figure 4



Determine the wavelength of the stationary wave shown in **Figure 4**.

λ = ____________________ m

(2)

(c) The stationary wave is formed by two waves of frequency f and wavelength travelling λ with speed c in opposite directions.

Determine c.

c = ____________________ m s^{-1}

(1)

(d) Determine, in kg m^{-1}, the mass per unit length of the wire.

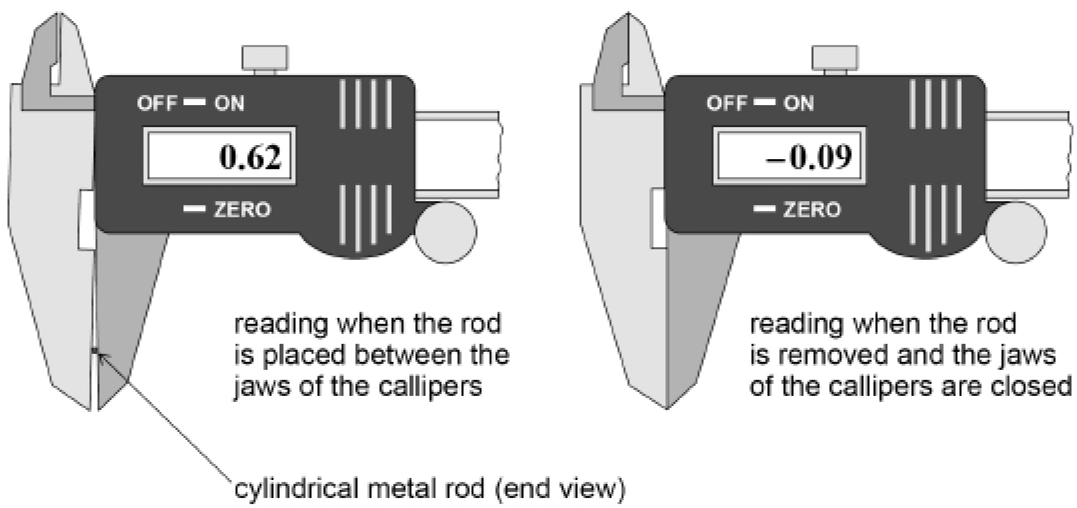
mass per unit length = ____________________ kg m^{-1}

(2)

(e) A student uses digital vernier callipers to measure the diameter of a cylindrical metal rod. The student places the rod between the jaws of the callipers and records the reading indicated. Without pressing the zero button, the student removes the rod and closes the jaws.

Figure 5 shows the calliper readings in millimetres, before and after the jaws are closed.

Figure 5



Calculate the diameter d of the rod.

d = ____________________ mm

(1)

(f) Describe relevant procedures to limit the effect of random error in the result for d.

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(2)

(g) Determine the density of the rod.

The mass per unit length of the rod is 3.54×10^{-3} kg m^{-1}.

density = ____________________ kg m^{-3}

(3)

(Total 13 marks)

19. The fundamental frequency f is the lowest frequency heard when a stretched string is vibrating.

The string is now lightly touched one third of the way along its length.

What is the lowest frequency heard?

A $\frac{f}{3}$ ⬭

B $\frac{2f}{3}$ ⬭

C f ⬭

D $3f$ ⬭

(Total 1 mark)

20. Two points on a progressive wave have a phase difference of $\frac{\pi}{6}$ rad

The speed of the wave is 340 m s^{-1}

What is the frequency of the wave when the minimum distance between the two points is 0.12 m?

A 240 Hz ⬭

B 470 Hz ⬭

C 1400 Hz ⬭

D 2800 Hz ⬭

(Total 1 mark)

21. **Figure 1** shows the structure of a violin and **Figure 2** shows a close-up image of the tuning pegs.

Figure 1

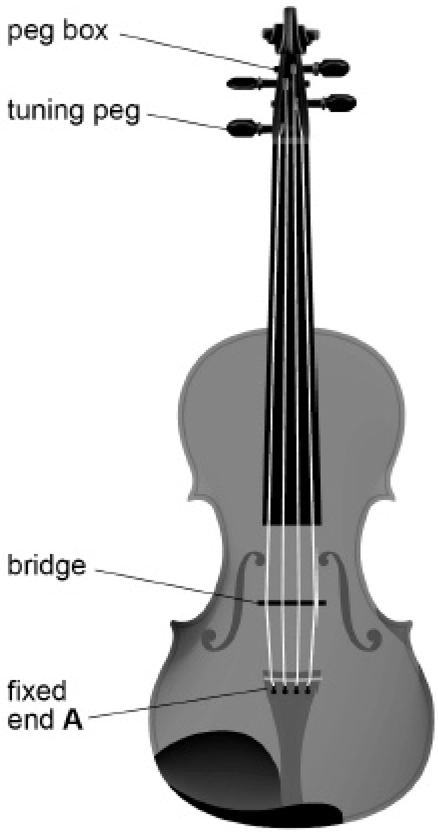
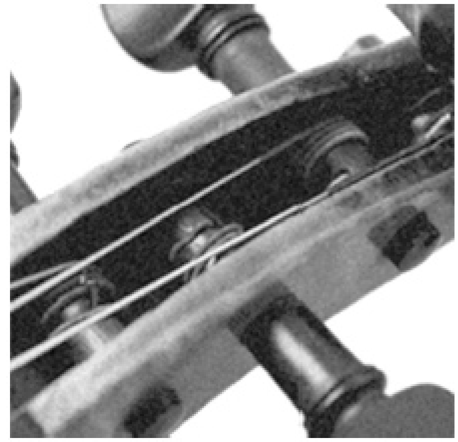


Figure 2



The strings are fixed at end **A**. The strings pass over a bridge and the other ends of the strings are wound around tuning pegs that have a circular cross-section. The tension in the strings can be increased or decreased by rotating the tuning pegs.

(a) Explain how a stationary wave is produced when a stretched string is plucked.

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(3)

(b) The vibrating length of one of the strings of a violin is 0.33 m
When the tension in the string is 25 N, the string vibrates with a first-harmonic frequency of 370 Hz

Show that the mass of a 1.0 m length of the string is about 4×10^{-4} kg

(2)

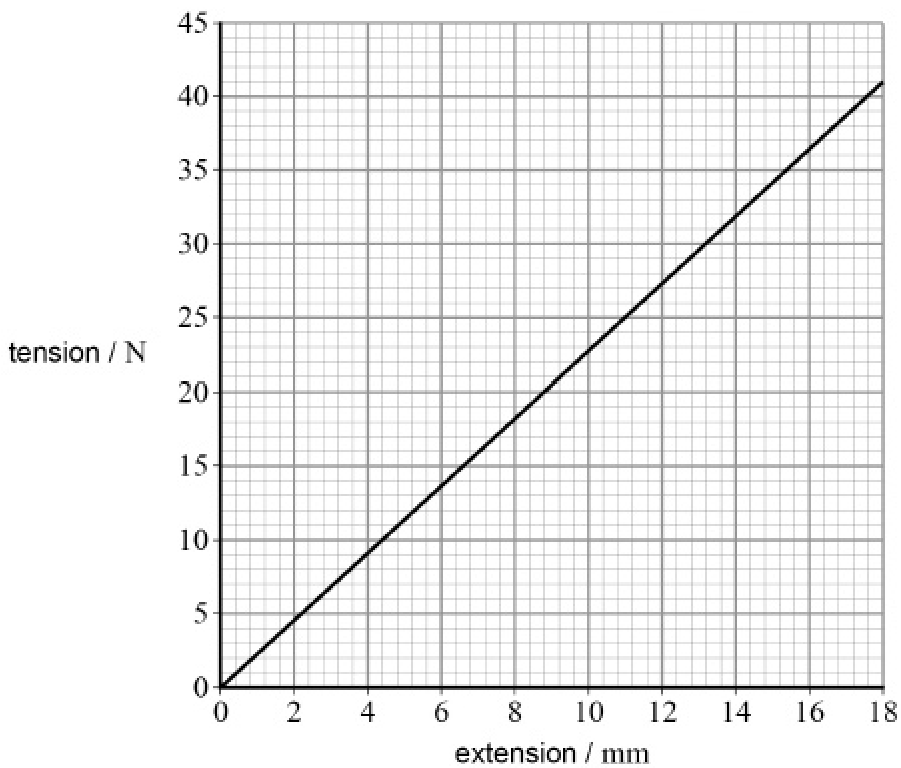
(c) Determine the speed at which waves travel along the string in question **(b)** when it vibrates with a first-harmonic frequency of 370 Hz

speed of waves = ____________________ m s^{-1}

(1)

(d) **Figure 3** shows how the tension in the string in question **(b)** varies with the extension of the string.

Figure 3



The string with its initial tension of 25 N is vibrating at a frequency of 370 Hz
The diameter of the circular peg is 7.02 mm

Determine the higher frequency that is produced when the string is stretched by rotating the tuning peg through an angle of 75°

Assume that there is no change in the diameter of the string.

frequency = ____________________ Hz

(4)

(Total 10 marks)

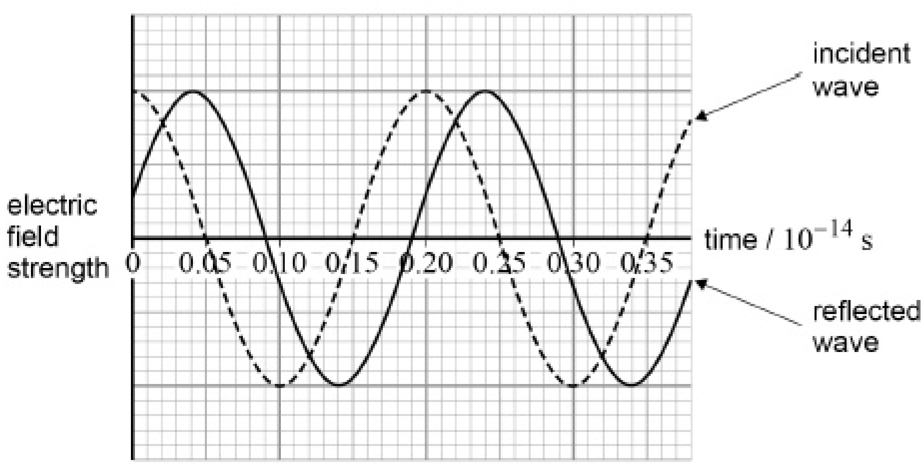
22. A gravimeter is an instrument used to measure the acceleration due to gravity. The gravimeter measures the distance fallen by a free-falling mirror in a known time.

To do this, monochromatic light is reflected normally off the mirror, creating interference between the incident and reflected waves. The mirror is released from rest and falls, causing a change in the phase difference between the incident and reflected waves at a detector.

At the point of release of the mirror, the waves are in phase, resulting in a maximum intensity at the detector. The next maximum is produced at the detector when the mirror has fallen through a distance equal to half a wavelength of the light. The gravimeter records the number of maxima detected in a known time as the mirror falls. These data are used by the gravimeter to compute the acceleration of the free-falling mirror.

Figure 1 illustrates the phase relationship between the incident and reflected waves at the detector for one position of the mirror.

Figure 1



(a) Show that the wavelength of the light is 600 nm.

(3)

(b) Determine the phase difference, in rad, between the incident and reflected waves shown in **Figure 1**.

phase difference = ____________________________ rad

(2)

(c) A maximum is detected each time the mirror travels a distance equal to half a wavelength of the light.

In one measurement 2.37×10^5 maxima are recorded as the mirror is released from rest and falls for 0.120 s.

Using an appropriate equation of motion, calculate the acceleration due to gravity that the gravimeter computes from these data.

State your answer to 3 significant figures.

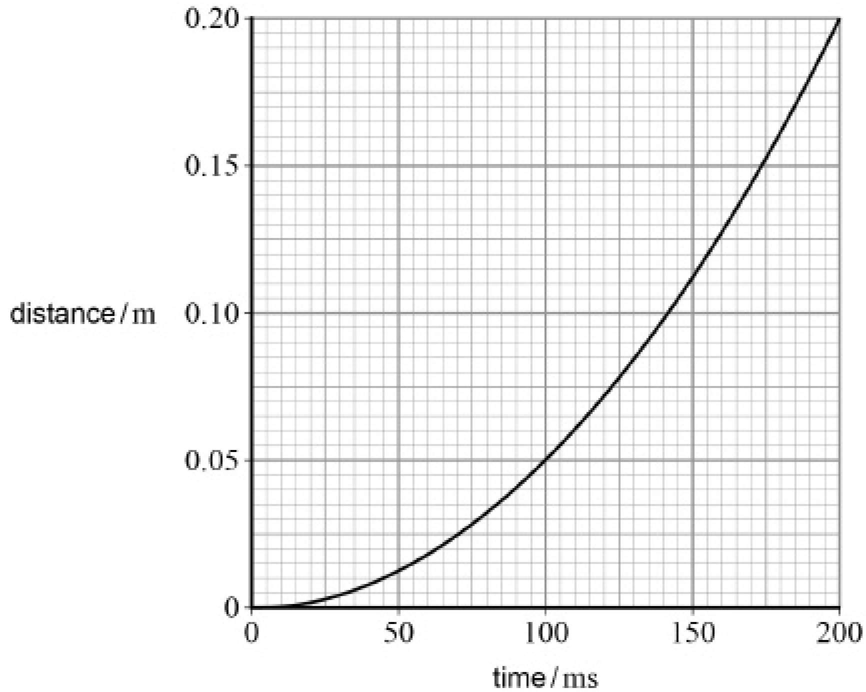
wavelength of the light = 600 nm

acceleration due to gravity = ____________________________ $m\ s^{-2}$

(3)

(d) **Figure 2** is a graph that the gravimeter could produce to show how the distance travelled by the mirror varies with time as it falls.

Figure 2



Determine the gradient of the line when the time is 0.12 s.

gradient = ______________________________

(2)

(e) State what this gradient represents.

____

(1)

(Total 11 marks)

23. Which statement is correct about the properties of an unpolarised electromagnetic wave as it passes through a polariser?

A The wave remains unchanged.

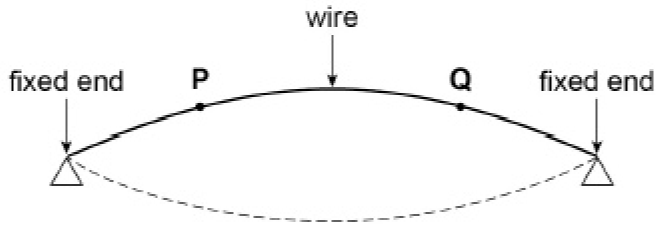
B The wave does not pass through the polariser.

C The wave's electric field oscillates along the direction of travel.

D The intensity of the wave is reduced.

(Total 1 mark)

24. A uniform wire, fixed at both ends, is plucked in the middle so that it vibrates at the first harmonic as shown.



What is the phase difference between the oscillations of the particles at **P** and **Q**?

A zero

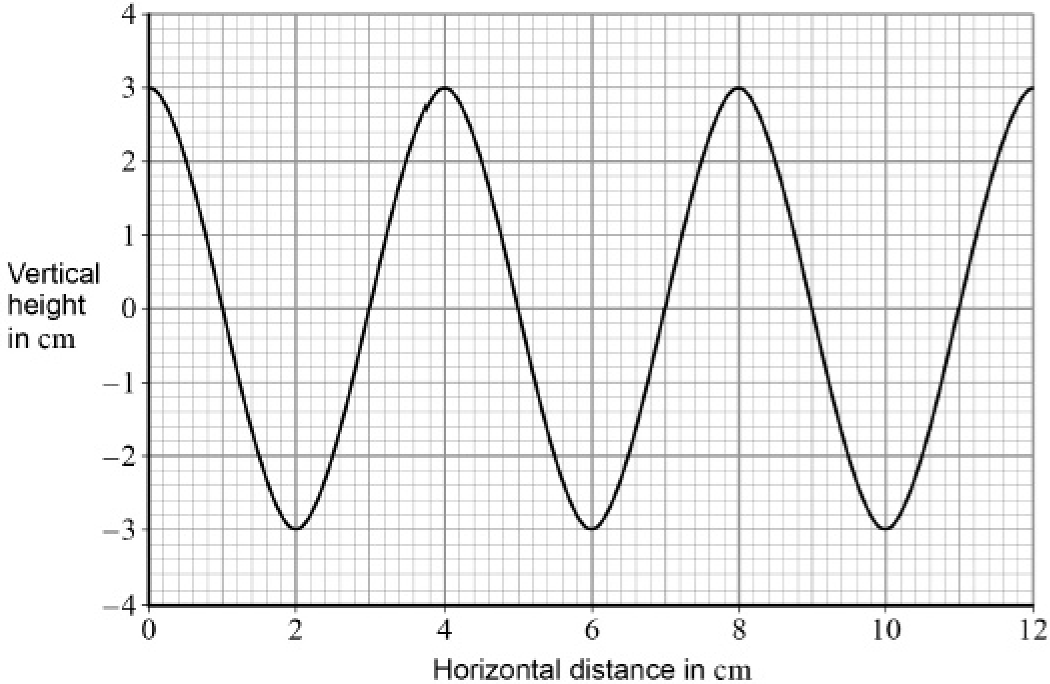
B $\frac{\pi}{4}$ rad

C $\frac{\pi}{2}$ rad

D $\frac{3\pi}{4}$ rad

(Total 1 mark)

25. The graph shows how the vertical height of a travelling wave varies with distance along the path of the wave.



The speed of the wave is 20 cm s^{-1}.

What is the period of the wave?

A 0.1 s

B 0.2 s

C 5.0 s

D 10.0 s

(Total 1 mark)

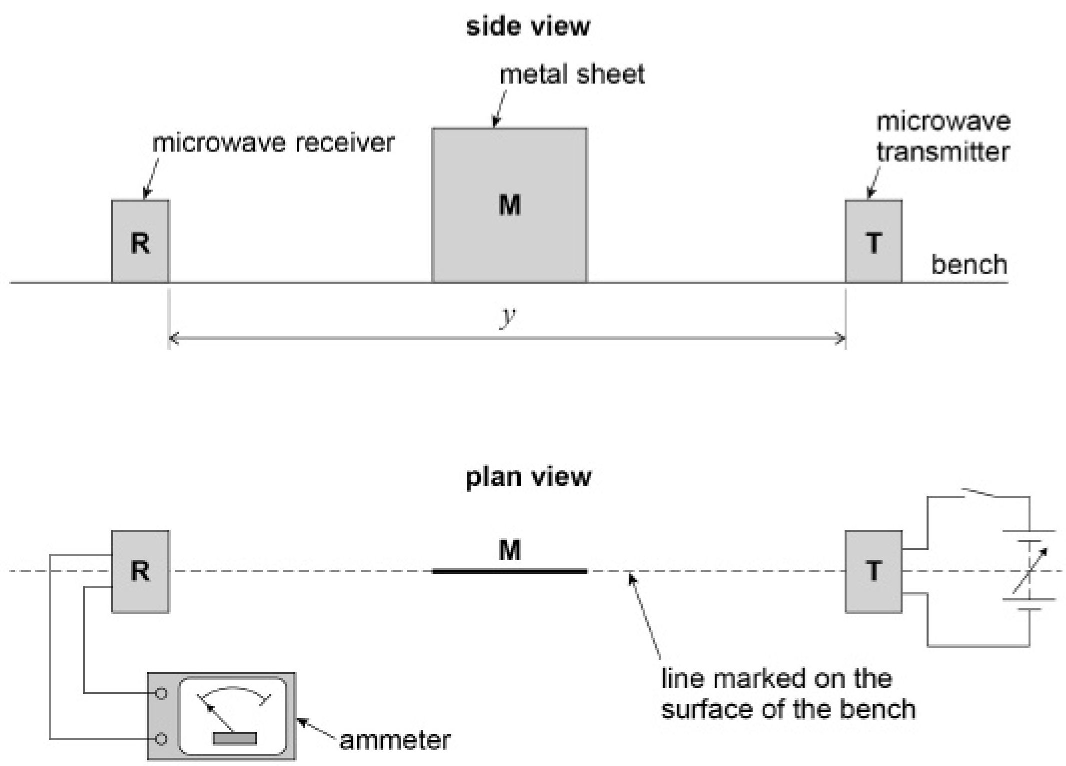
26. This question is about an experiment to measure the wavelength of microwaves.

A microwave transmitter **T** and a receiver **R** are arranged on a line marked on the bench.

A metal sheet **M** is placed on the marked line perpendicular to the bench surface.

Figure 1 shows side and plan views of the arrangement.
The circuit connected to **T** and the ammeter connected to **R** are only shown in the plan view.

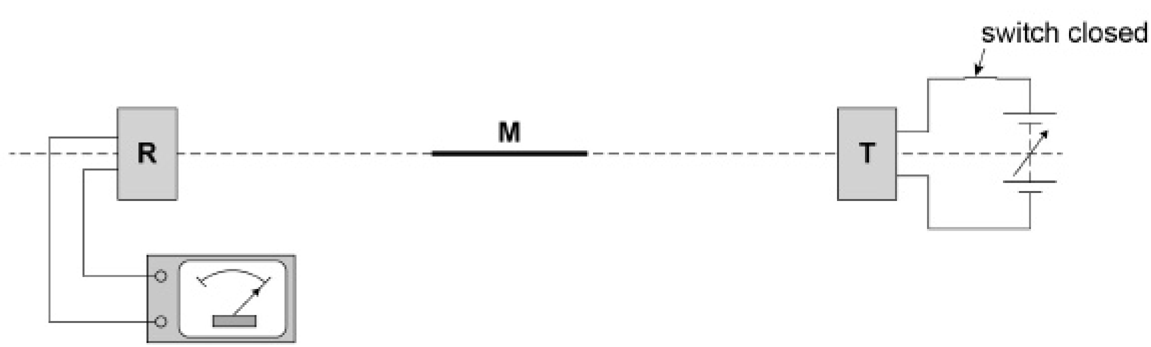
Figure 1



The distance y between **T** and **R** is recorded.

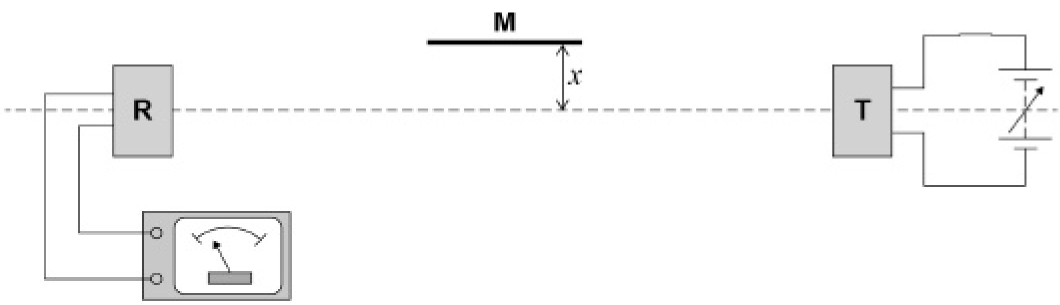
T is switched on and the output from **T** is adjusted so a reading is produced on the ammeter as shown in **Figure 2**.

Figure 2



M is kept parallel to the marked line and moved slowly away as shown in **Figure 3**.

Figure 3



The reading decreases to a minimum reading **which is not zero**.

The perpendicular distance *x* between the marked line and **M** is recorded.

(a) The ammeter reading depends on the superposition of waves travelling directly to **R** and other waves that reach **R** after reflection from **M**.

State the phase difference between the sets of waves superposing at **R** when the ammeter reading is a **minimum**.
Give a suitable unit with your answer.

____

(1)

(b) Explain why the minimum reading is **not** zero when the distance x is measured.

____

____

____

(1)

(c) When **M** is moved further away the reading increases to a maximum then decreases to a minimum.

At the first minimum position, a student labels the minimum n = 1 and records the value of x.
The next minimum position is labelled n = 2 and the new value of x is recorded.
Several positions of maxima and minima are produced.

Describe a procedure that the student could use to make sure that **M** is parallel to the marked line before measuring each value of x.
You may wish to include a sketch with your answer.

(2)

(d) It can be shown that

$$n\lambda = \sqrt{4x^2 + y^2} - y$$

where λ is the wavelength of the microwaves and y is the distance defined in **Figure 1**.

The student plots the graph shown in **Figure 4**.

The student estimates the uncertainty in each value of $\sqrt{4x^2 + y^2}$ to be 0.025 m and adds error bars to the graph.

Determine

- the maximum gradient G_{max} of a line that passes through all the error bars
- the minimum gradient G_{min} of a line that passes through all the error bars.

G_{max} = ____________________

G_{min} = ____________________

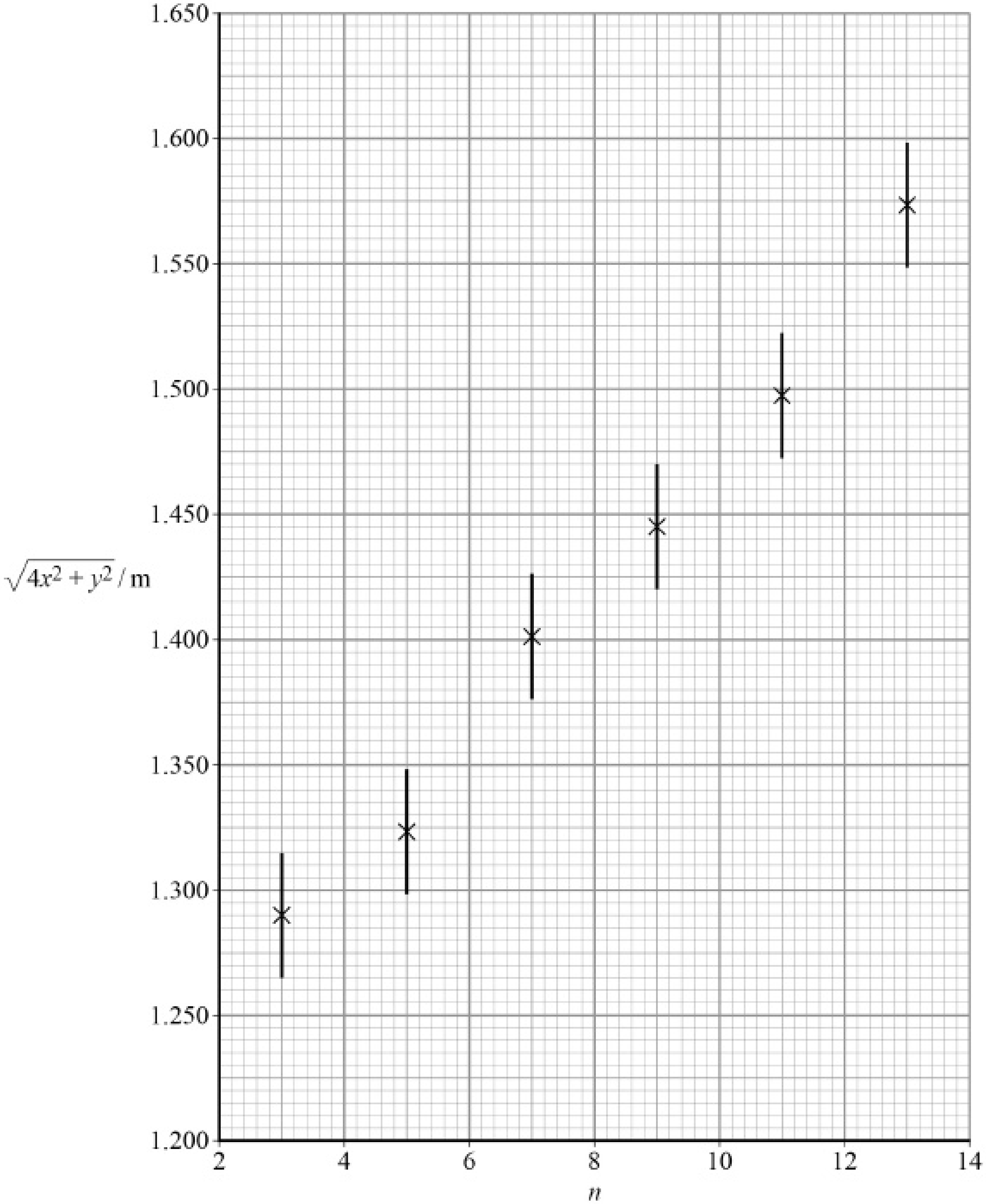
(3)

(e) Determine λ using your results for G_{max} and G_{min}.

λ = ____________________ m

(2)

Figure 4



(f) Determine the percentage uncertainty in your result for λ.

percentage uncertainty in λ = ____________________ %

(3)

(g) Explain how the graph in **Figure 4** can be used to obtain the value of y.
You are **not** required to determine y.

(2)

(h) Suppose that the data for n = 13 had not been plotted on **Figure 4**.

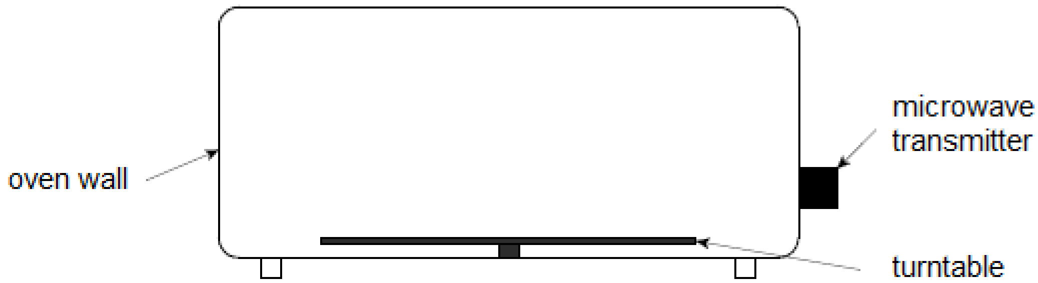
Add a tick (✓) in each row of the table to identify the effect, if any, on the results you would obtain for G_{max}, G_{min}, λ and y.

Result	**Reduced**	**Not affected**	**increased**
G_{max}			
G_{min}			
λ			
y			

(4)
(Total 18 marks)

27. **Figure 1** is a diagram of a microwave oven.

Figure 1



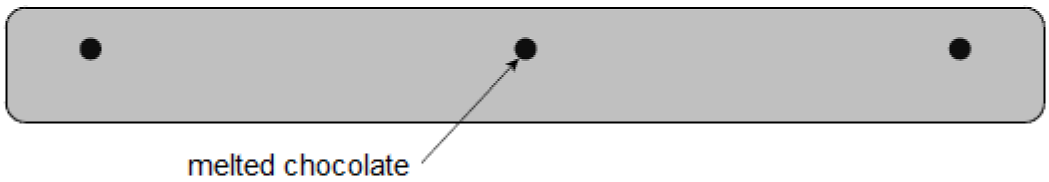
A student wants to use the stationary waves formed in the microwave oven to measure the frequency of the microwaves emitted by the transmitter.

(a) Suggest how stationary waves are formed in the microwave oven.

(2)

(b) The student removes the turntable and places a bar of chocolate on the floor of the oven. He then switches the oven on for about one minute. When the chocolate is removed the student observes that there are three small patches of melted chocolate with unmelted chocolate between them. **Figure 2** is a full-sized diagram of the chocolate bar.

Figure 2



Suggest why the chocolate only melts in the positions shown.

____

____

____

____

(2)

(c) Calculate, by making suitable measurements on **Figure 2**, the frequency of the microwaves used by the oven.

frequency = ______________________ Hz

(5)

(d) Explain why most microwave ovens contain a rotating turntable on which the food is placed during cooking.

____

____

____

(1)

(Total 10 marks)

28. What is the phase difference between two points 0.16 m apart on a progressive sound wave of frequency 256 Hz?

speed of sound = 330 m s^{-1}

A $\frac{\pi}{8}$ ☐

B $\frac{\pi}{6}$ ☐

C $\frac{\pi}{4}$ ☐

D $\frac{\pi}{3}$ ☐

(Total 1 mark)

29. The frequency of the first harmonic of a standing wave on a wire is f. The length of the wire and tension in the wire are both doubled.

What is the frequency of the first harmonic as a result?

A $\frac{f}{\sqrt{2}}$ ☐

B f ☐

C $\sqrt{2}f$ ☐

D $2f$ ☐

(Total 1 mark)

30. (a) Explain what is meant by a progressive wave.

____

____

____

(2)

(b) **Figure 1** shows the variation with time of the displacement of one point in a progressive wave.

Figure 1

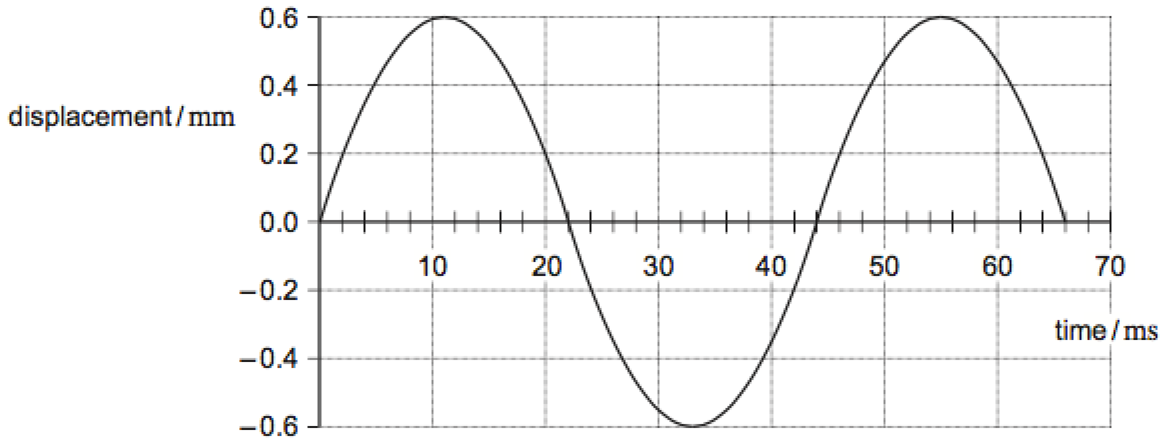
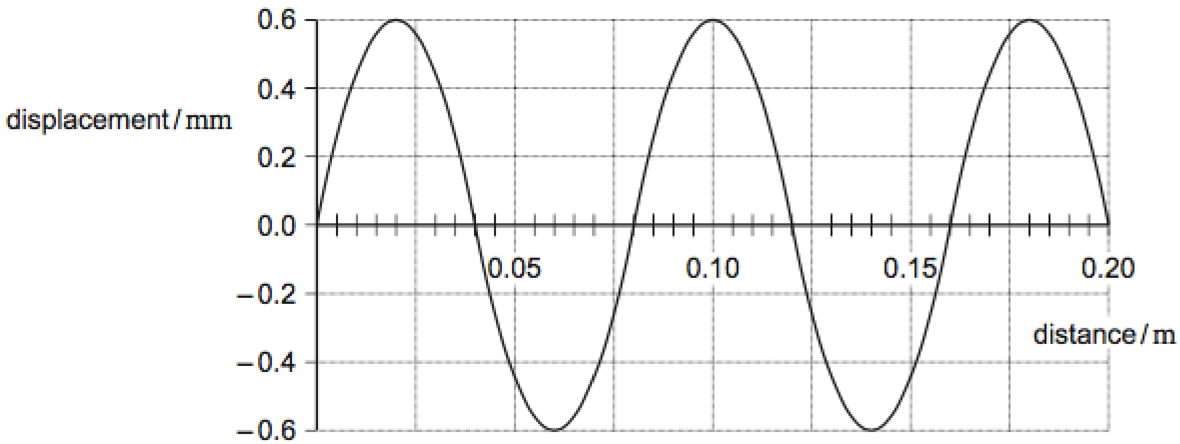


Figure 2 shows the variation of displacement of the same wave with distance.

Figure 2



Use **Figures 1 and 2** to determine

(i) the amplitude of the wave

amplitude = ____________________ mm

(1)

(ii) the wavelength of the wave

wavelength = ____________________ m

(1)

(iii) the frequency of the wave

frequency = ____________________ Hz

(1)

(iv) the speed of the wave

speed = ____________________ m s^{-1}

(1)

(c) Which of the following statements apply?
Place a tick (✓) in the right-hand column for each correct statement.

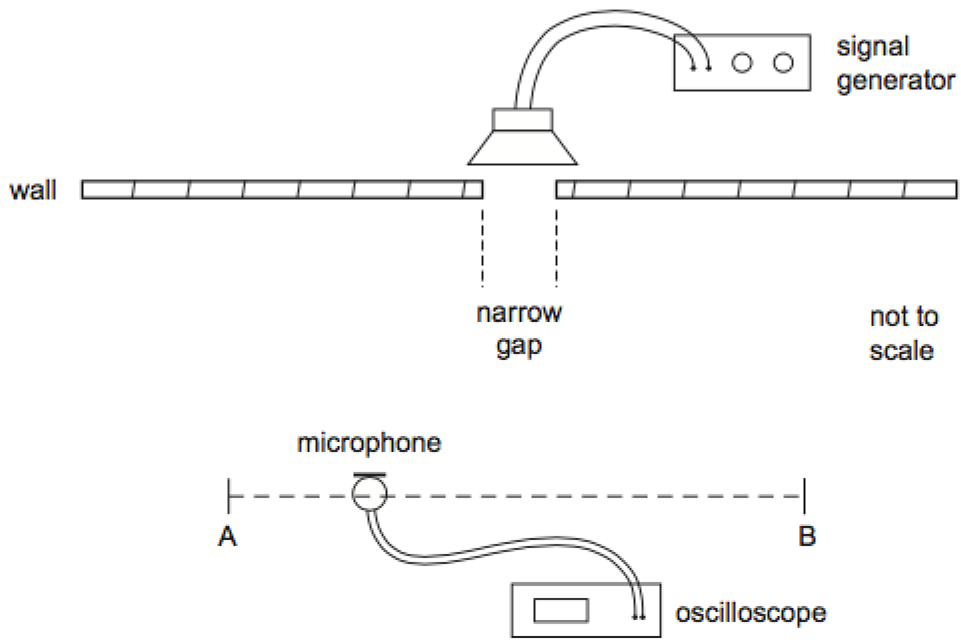
	✓ if correct
sound waves are transverse	
sound waves are longitudinal	
sound waves can interfere	
sound waves can be polarised	

(1)

(d) In an investigation, a single loudspeaker is positioned behind a wall with a narrow gap as shown in **Figure 3**.

A microphone attached to an oscilloscope enables changes in the amplitude of the sound to be determined for different positions of the microphone.

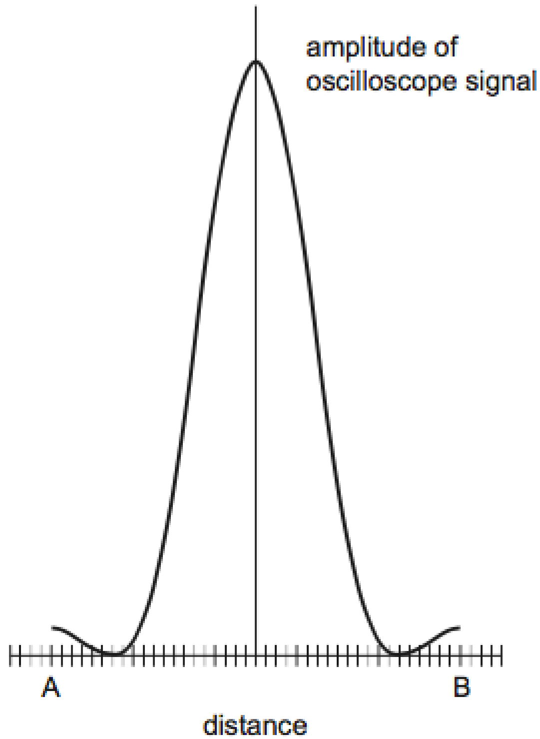
Figure 3



The amplitude of sound is recorded as the microphone position is moved along the line AB a large distance from the gap.

The result of the measurements is shown in **Figure 4**.

Figure 4



The signal generator is adjusted so that sound waves of the same amplitude but of a higher frequency are emitted by the loudspeaker. The investigation using the apparatus shown in **Figure 3** is then repeated.
Explain the effect this has on **Figure 4**.

(3)
(Total 10 marks)