PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

PHYSICS



EXAM QUESTION PACK

TOPIC 4: WAVES (PAPER 1)

SCORE	PERCENTAGE
/109	%

STEMUP

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Q1.

The photograph shows a pulse oximeter. This is used to show the heart rate and the amount of oxygen in the blood.



(i) Where is the oximeter usually placed to take measurements?

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

(1)

☒ **A** on the finger

☒ **B** over the heart

☒ **C** on the neck

☒ **D** on the wrist

(ii) There are two LEDs used in an oximeter.
One emits visible light.
State what type of radiation the other LED emits.

(1)

.....

.....

(iii) The oximeter shows a heart rate of 89 beats per minute.
Calculate the frequency in beats per second.

(2)

frequency =.....beats/second

(iv) Calculate the time between each heartbeat.

Use the equation

$$\text{time between heartbeats} = \frac{1}{\text{frequency}}$$

(2)

time between heartbeats =..... .s

(**Q26 1SC0/1PF, June 2013**)

Q2.

Four students and their teacher do an experiment to measure the speed of sound in air.

The teacher stands at a distance and fires a starting pistol into the air.
The students see the flash when the pistol is fired.
They measure the time from when they see the flash to when they hear the bang.

A student drew a diagram of the arrangement as shown in Figure 5.

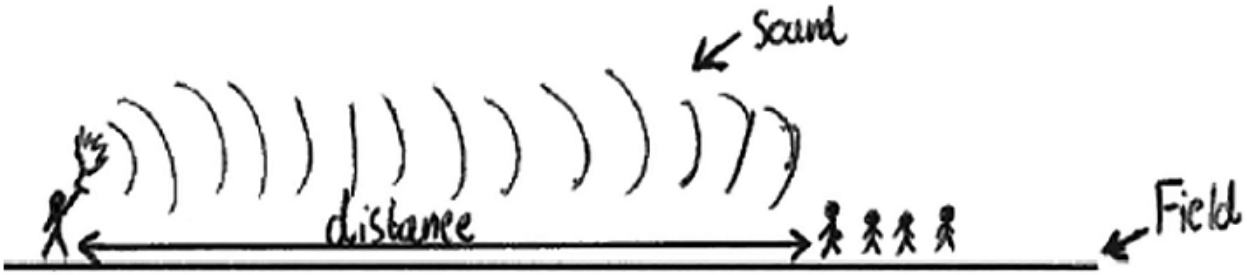


Figure 5

The students obtained a value of 240 m/s for the speed of sound.

The accepted value, in a science data book, is 343 m/s.

(i) Calculate the difference between the students' value and the accepted value as a percentage of the accepted value.

(2)

percentage difference = ... %

(ii) When the distance was 100 m, the students measured the following times:

0.43 s 0.35 s 0.50 s 0.38 s

Explain why their times vary so much.

(2)

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(iii) Explain **one** way the students might improve this experiment.

(2)

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(Total for question = 6 marks)

(**Q04a 1SC0/1PH, Nov 2020**)

Q3.

When an earthquake happens, waves are transmitted through the Earth.
Figure 13 is a diagram of a part of the Earth's crust.

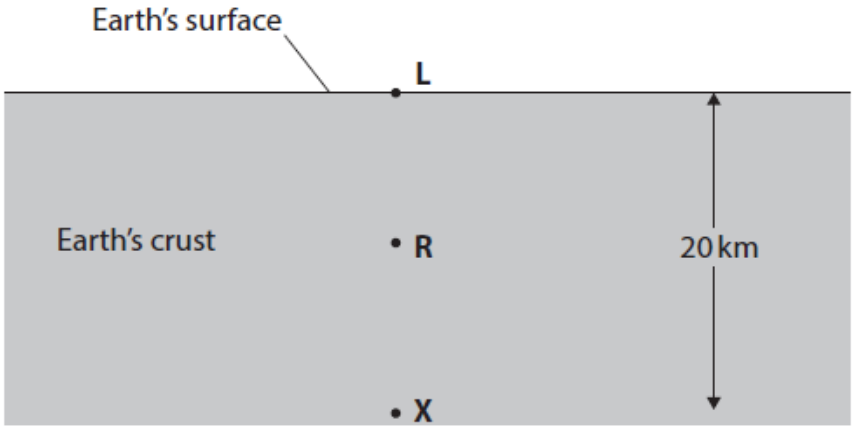


Figure 13

An earthquake happens at point **X**, 20 km below the Earth's surface.

An earthquake wave from **X** is detected at point **L**.

This earthquake wave is a transverse wave.

(i) State **one** other example of a transverse wave.

(1)

.....

(ii) A point in the crust is labelled **R** in Figure 13.

There is a rock at point **R**.

Describe the effect that this earthquake wave has on the rock at **R** as the wave passes through the rock.

You may add to Figure 13 to help your answer.

(2)

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(Total for question = 3 marks)

(QU06b 1SC0/1PF, June 2025)

Q4.

When an earthquake happens, waves are transmitted through the Earth.
Figure 5 is a diagram of a part of the Earth's crust.

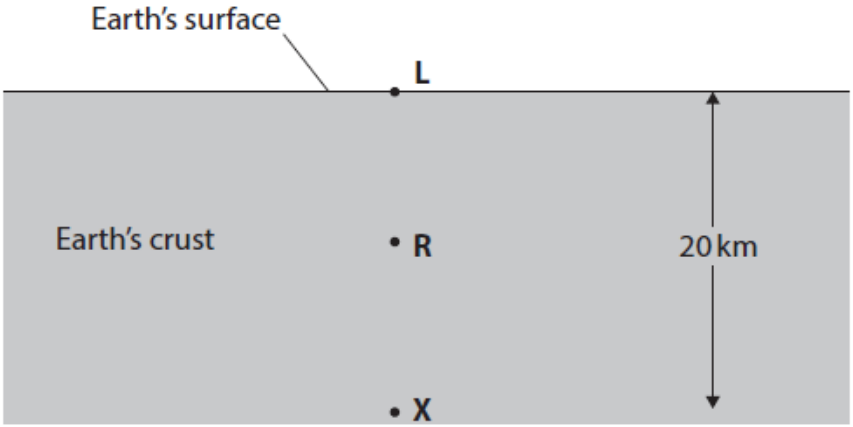


Figure 5

An earthquake happens at point **X**, 20 km below the Earth's surface.

An earthquake wave from **X** is detected at point **L**.

This earthquake wave is a transverse wave.

(i) State **one** other example of a transverse wave.

(1)

.....

(ii) A point in the crust is labelled **R** in Figure 5.

There is a rock at point **R**.

Describe the effect that this earthquake wave has on the rock at **R** as the wave passes through the rock.

You may add to Figure 5 to help your answer.

(2)

.....

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.....

.....

(iii) The wave from **X** reaches **L** 3.8 seconds after it passes through **R**.

The speed of the wave is 4500 m/s.

Calculate the distance between **X** and **R**.

(2)

distance = ... m

(Total for question = 5 marks)

(**QU02b 1SC0/1PH, June 2025**)

Q5.

Figure 12 is a diagram of part of a water wave.

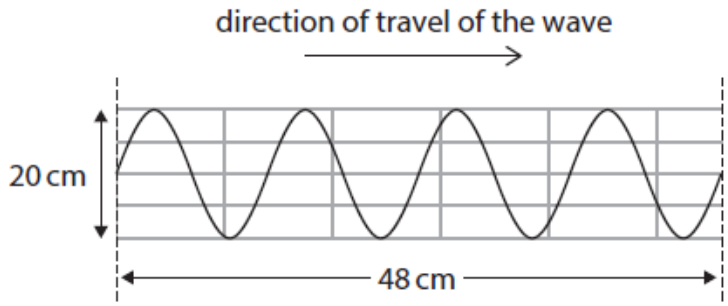


Figure 12

(i) Use data from Figure 12 to determine the amplitude of the wave.

(1)

amplitude = ... cm

(ii) Use data from Figure 12 to determine the wavelength of the wave.

(1)

wavelength = ... cm

(iii) The water wave shown in Figure 12 is generated in a large tank.

A student observes the wave.

Describe how the student could determine the wave speed of the wave.

(2)

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(Total for question = 4 marks)

(**QU06a 1SC0/1PF, June 2025**)

Q6.

Figure 4 is a diagram of part of a water wave.

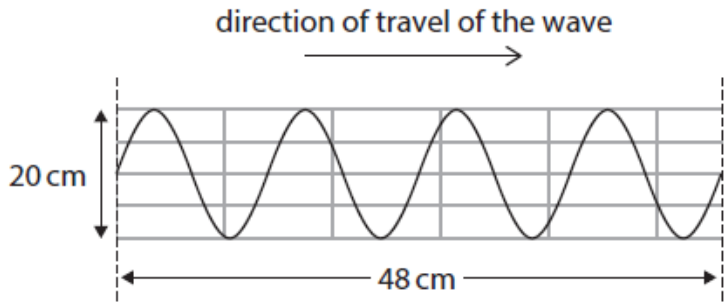


Figure 4

(i) Use data from Figure 4 to determine the amplitude of the wave.

(1)

amplitude = ... cm

(ii) Use data from Figure 4 to determine the wavelength of the wave.

(1)

wavelength = ... cm

(iii) The water wave shown in Figure 4 is generated in a large tank.

A student observes the wave.

Describe how the student could determine the wave speed of the wave.

(2)

.....

.....

.....

.....

(Total for question = 4 marks)

(**QU02a 1SC0/1PH, June 2025**)

Q7.

There is a piece of music called "The Flight of the Bumble Bee."
This takes 4 minutes to play.
During this time, a bee flies 1608 m.

Calculate the average speed of the bee.

(3)

speed ..... m/s

(**Q05 1SC0/1PF, June 2015**)

Q8.

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 = 4 marks)

(**Q06c 1SC0/1PH, SAM 2016**)

Q9.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 6 shows two technicians, L and M, measuring the speed of sound in air.

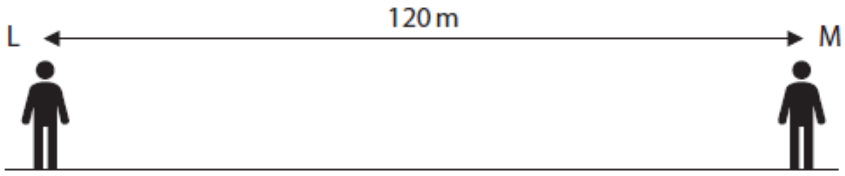


Figure 6

L fires a starting pistol.

M starts a stopwatch when first seeing the smoke from the starting pistol.

M stops the stopwatch when hearing the bang made by the starting pistol.

The distance between L and M is 120 m.

M's reaction time is 0.23 s.

The speed of sound in air is 330 m / s.

(i) Calculate M's reaction time as a percentage of the time sound takes to travel from L to M.

(3)

..... %

(ii) Which of these would improve the technicians' measurement of the speed of sound?

(1)

☒ **A** Use a firework 'banger' instead of the starting pistol.

☒ **B** Use a stop clock that measures time in minutes.

☒ **C** Increase the distance between **L** and **M**.

☒ **D** Decrease the distance between **L** and **M**.

(Total for question = 4 marks)

(**QU04a 1SC0/1PH, June 2023**)

Q10.

An earthquake causes a sea wave.

This sea wave travels 26 400 m in two minutes.

Calculate the speed of the wave.

Use the equation

$$\text{wave speed} = \frac{\text{distance}}{\text{time}}$$

(3)

speed = ... m/s

(Total for question = 3 marks)

(**Q02d 1SC0/1PF, SAM 2016**)

Q11.

Sound waves travel at 330 m/s in air.

A student sees a flash of lightning.

The student hears the sound of thunder 4.0 s later.

Calculate the distance from the student to the flash of lightning.

Use the equation

$$x = v \times t$$

(2)

distance ..... m

(Total for question = 2 marks)

(**Q05c 1SC0/1PF, Nov 2021**)

Q12.

In a swimming pool, a wave is produced with a wavelength of 4.0 m and a velocity of 0.8 m / s.

Calculate the frequency of the wave.

State the unit of frequency.

(3)

Use the equation

$$v = f \times \lambda$$

frequency of wave .....
unit.....

(Total for question = 3 marks)

(**QU04c 1SC0/1PF, June 2023**)

Q13.

The speed of a sound wave in air is 330 m/s.

The wavelength of this wave is 0.75 m.

Calculate the frequency of this wave.

Use the equation

$v = f \times \lambda$

(3)

frequency = ... Hz

(Total for question = 3 marks)

(**QU03c 1SC0/1PF, June 2024**)

Q14.

A radio station transmits on 97.4 MHz.

To receive the waves an aerial needs a length equal to half the wavelength of the radio waves being transmitted.

Calculate the length of the aerial needed.

The speed of the radio waves is 3.00×10^8 m / s.

(3)

length of aerial = ... m

(Total for question = 3 marks)

(**Q03a 1SC0/1PH, Nov 2020**)

Q15.

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 = ...

(**Q07 1SC0/1PF, Mar 2013**)

Q16.

A different water wave has a wavelength of 0.25 m and a frequency of 1.5 Hz.

Calculate the wave speed.

(2)

wave speed = ... m/s

(Total for question = 2 marks)

(**Q05d 1SC0/1PF, June 2019**)

Q17.

A different water wave has a wavelength of 0.25 m and a frequency of 1.5 Hz.

Calculate the wave speed.

(2)

wave speed = ... m/s

(Total for question = 2 marks)

(**Q01d 1SC0/1PH, June 2019**)

Q18.

Figure 8 shows part of a wave.

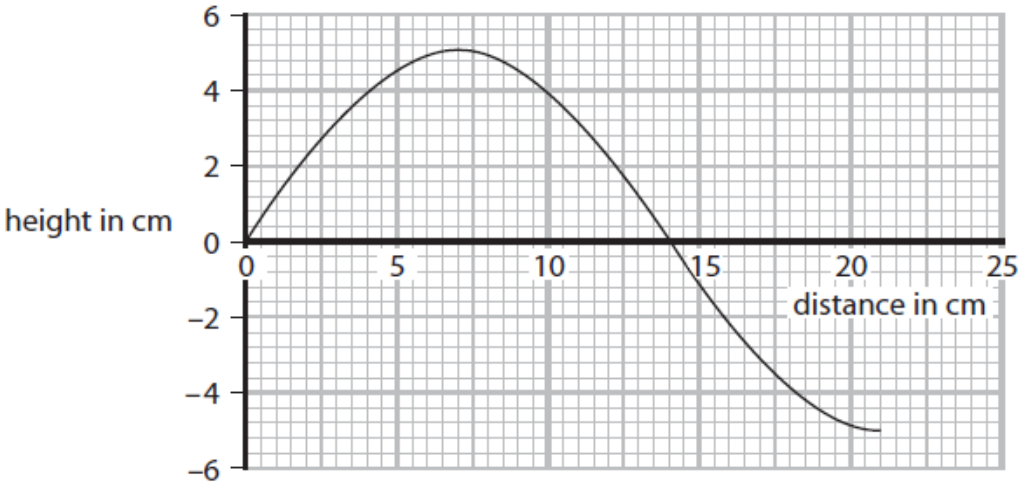


Figure 8

Use data from Figure 8 to calculate the wavelength of the wave.

(2)

wavelength = ... cm

(Total for question = 2 marks)

(**Q05a 1SC0/1PF, Nov 2021**)

Q19.

Figure 1 shows part of a wave.

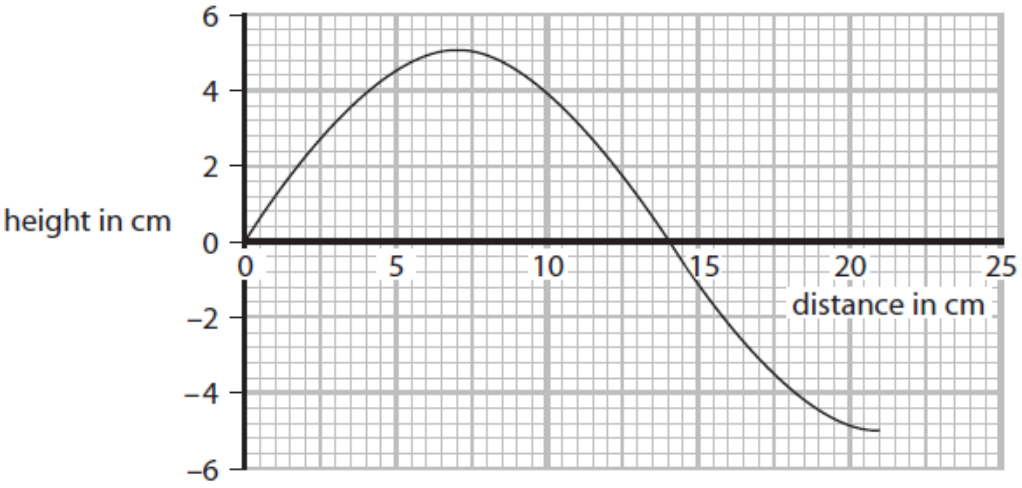


Figure 1

Use data from Figure 1 to calculate the wavelength of the wave.

(2)

wavelength = ... cm

(Total for question = 2 marks)

(**Q01a 1SC0/1PH, Nov 2021**)

Q20.

(i) A microwave oven uses waves of frequency 2.45 GHz.

Calculate the wavelength of the microwaves.

The velocity of light is 3.00×10^8 m/s.

(3)

wavelength = ... m

(ii) The microwave oven is 55% efficient and transfers 42 000 J of energy to some food when it is heated.

Calculate the total amount of energy that must be supplied to the oven.

(3)

energy supplied to oven = ... J

(Total for question = 6 marks)

(**QU06b 1SC0/1PH, June 2022**)

Q21.

The electromagnetic spectrum is continuous.
Different regions of the spectrum have different properties.

An electromagnetic wave has a frequency of 7×10^9 Hz.
The speed of the wave is 3×10^8 m/s.
Calculate the wavelength of the wave.

(3)

wavelength = ...m

(**Q34 1SC0/1PH, June 2013**)

Q22.

Figure 1 shows a ripple tank.

This is used to study the behaviour of water waves.

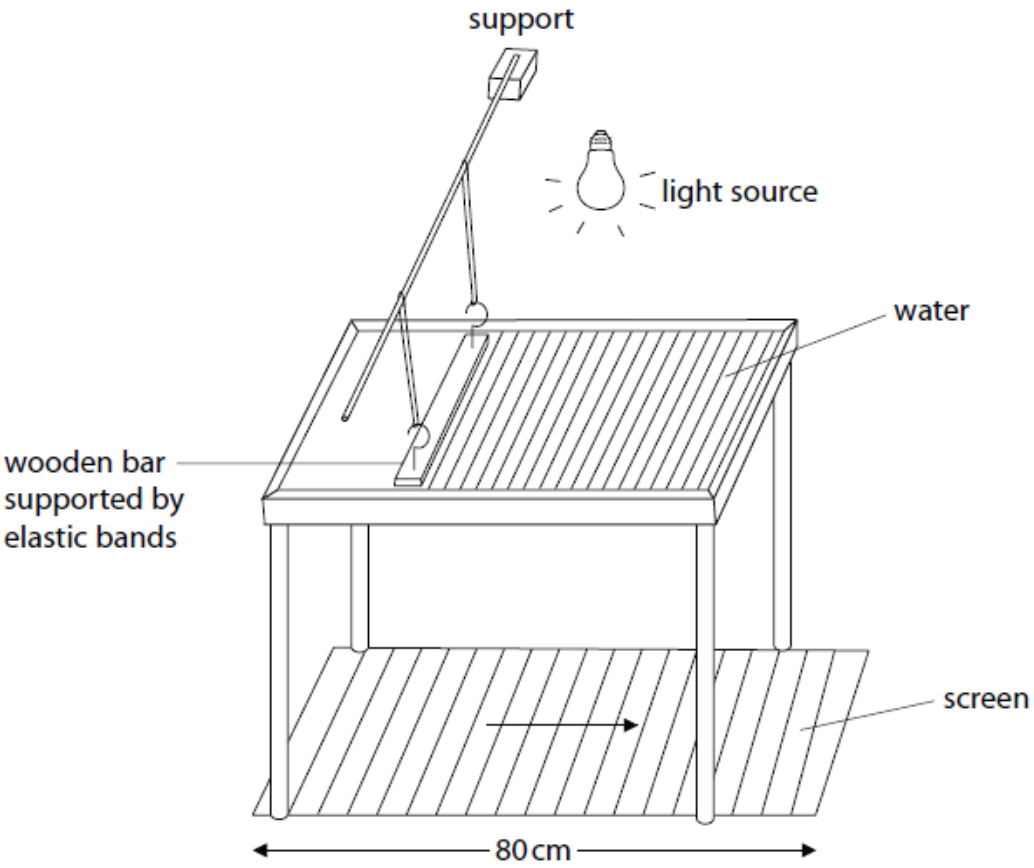


Figure 1

Water waves are produced in the tank.

The shadow of the waves is projected onto the screen below the tank.

The waves appear to move in the direction of the arrow.

(i) Describe how to determine the frequency of the waves.

(2)

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.....

(ii) The screen is 80 cm long.

What is the approximate wavelength of the waves as seen on the screen?

(1)

☒ **A** 4 cm

☒ **B** 8 cm

☒ **C** 40 cm

☒ **D** 80 cm

(iii) A student uses the image to estimate the speed of the water wave as 75 cm/s.

Which of these is a reason why the estimate is not correct?

(1)

☒ **A** the student used a ruler without mm markings

☒ **B** the light was not bright enough

☒ **C** the student's measurement was inaccurate

☒ **D** the wave seen on the screen is magnified

(Total for question = 4 marks)

(**Q01b 1SC0/1PH, SAM 2016**)

Q23.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

(i) Which row of the table is correct for sound waves?

(1)

		sound waves are	can sound waves transfer energy?
☒	**A**	longitudinal	yes
☒	**B**	longitudinal	no
☒	**C**	transverse	yes
☒	**D**	transverse	no

(ii) A sound wave has a frequency of 440 Hz and a wavelength of 0.75 m.

Calculate the wave speed of the sound wave.

(2)

wave speed = ... m/s

(Total for question = 3 marks)

(**QU02b 1SC0/1PF, June 2022**)

Q24.

Light and sound waves are produced at the same time by an explosion on Earth.

(i) The sound of the explosion is heard 1920 metres away 6.0 seconds after the explosion has happened.

Calculate the speed of sound in air.

(2)

speed of sound in air = ...m/s

(ii) A scientist is standing a long way from the explosion.

Explain why he hears the explosion a few seconds after he sees it.

(2)

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(**Q09 1SC0/1PF, June 2013**)

Q25.

A class is learning about refraction of waves.
The teacher shows them a demonstration using a battery-powered toy car travelling across a smooth road and onto some sand.
The car slows down as it enters the sand.

Figure 4 shows the car just before it meets the sand.

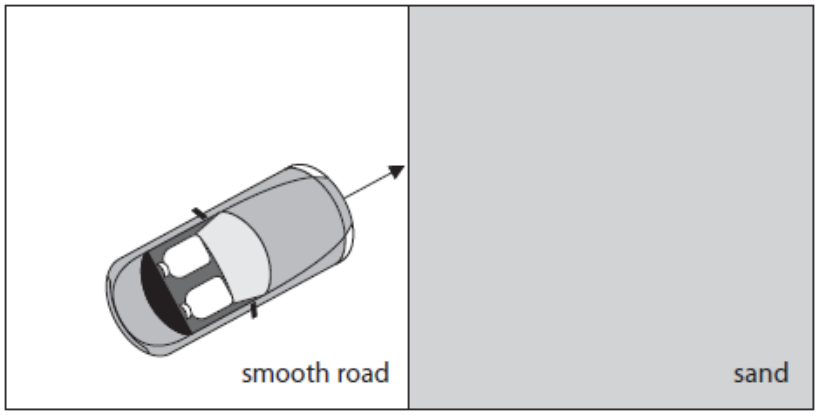


Figure 4

(i) Draw an arrow on the diagram to show the direction of the car as it travels across the sand.

(1)

(ii) Explain why this is a useful model for refraction of light.

(2)

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(Total for question = 3 marks)

(**Q04a 1SC0/1PH, SAM**)

Q26.

Sound travels slower in air than it does in water.

Figure 6 shows the direction of travel of a sound wave approaching a boundary between air and water.

The sound wave refracts at the boundary between air and water.

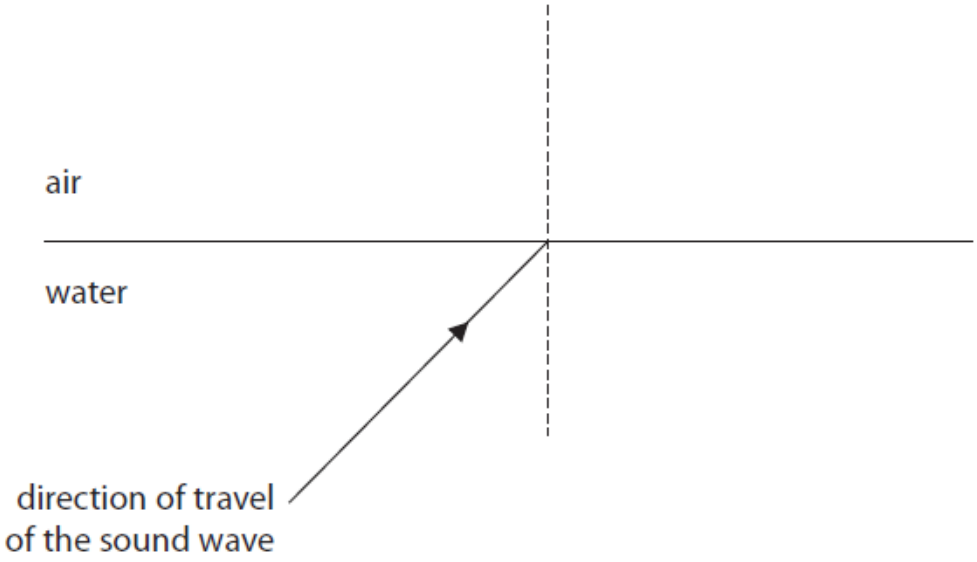


Figure 6

Complete the diagram in Figure 6 to show the direction the sound wave travels in the air.

(Total for question = 2 marks)

(**Q04c 1SC0/1PH, June 2019**)

Q27.

A student is standing 600 m from a firework display.

A firework explodes with a loud bang, and a flash of light is seen.

Describe how a student can measure the time it takes for the sound wave from the loud bang to travel 600 m.

(2)

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(Total for question = 2 marks)

(**Q02a 1SC0/1PF, SAM 2016**)

Q28.

There are many different types of waves.

Waves on the surface of water are transverse waves.

Sound waves are longitudinal waves.

Describe the difference between transverse waves and longitudinal waves.

(2)

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(Total for question = 2 marks)

(**Q01a 1SC0/1PH, SAM 2016**)

Q29.

Ripples travel out from the centre of a small circular pond to its edge.

(i) Describe how a student could determine the wave speed of the ripples.

(3)

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(ii) Figure 5 shows a duck floating on the pond.

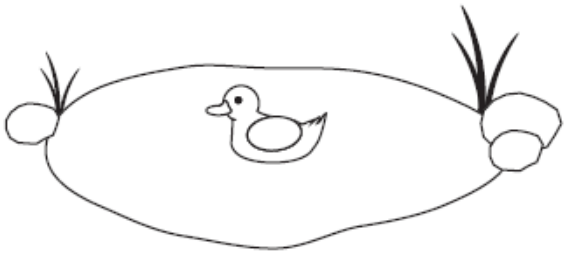


Figure 5

The ripples cause the duck to move.

Draw arrows on Figure 5 to show how the duck moves due to the ripples.

(1)

(Total for question = 4 marks)

(**QU03e 1SC0/1PF, June 2024**)

Q30.

Figure 5 shows a long metal rod and a hammer.
The rod is hit at one end by the hammer.
This causes a sound wave to travel along the inside of the metal rod.

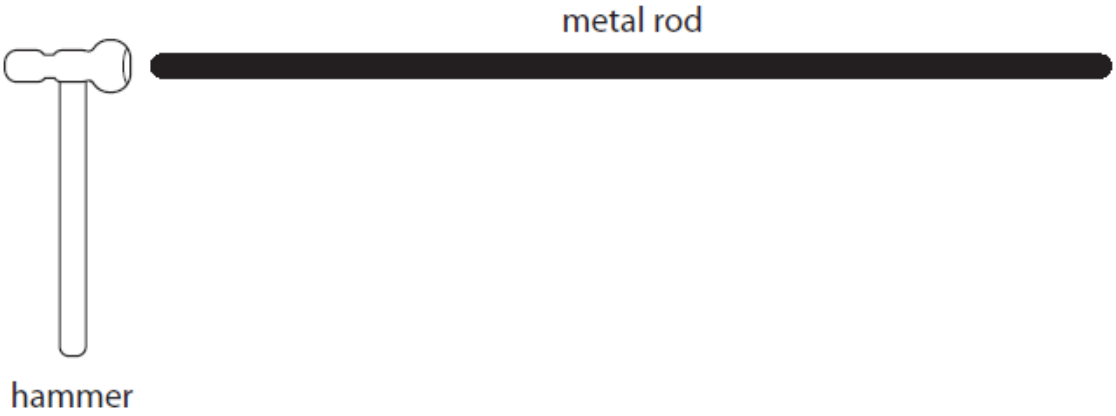


Figure 5

Describe how hitting the rod causes a sound wave to travel along the inside of the rod.

(2)

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(Total for question = 2 marks)

(**Q04b 1SC0/1PH, June 2019**)

Q31.

Figure 6 shows a ripple tank.

A screen is placed below the ripple tank.

The wave pattern produced by the ripples can be seen on the screen.

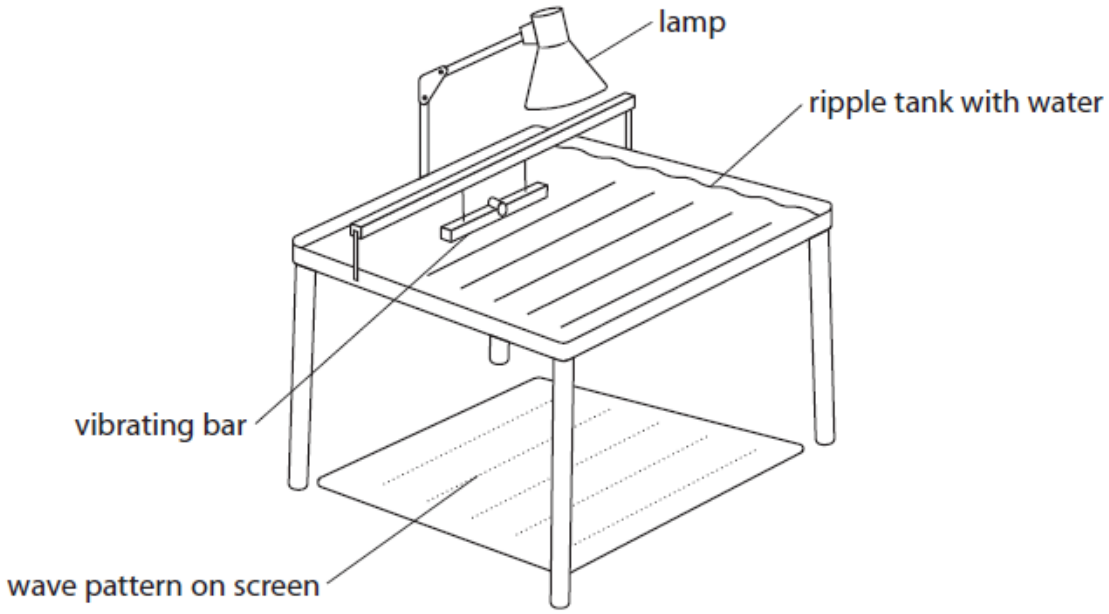


Figure 6

A student has a stop clock and a ruler.

(i) Describe how the student could measure the frequency of the ripples.

(2)

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(ii) Describe how the student could measure the wavelength of the ripples.

(2)

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(Total for question = 4 marks)

(**QU04b 1SC0/1PF, June 2023**)

Q32.

A man throws a stone into a pond.

Devise a method of measuring the frequency of the waves.

(2)

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(Total for question = 2 marks)

(**Q03c 1SC0/1PF, SAM**)

Q33.

Sound waves are longitudinal waves.

Water waves are transverse waves.

Describe the difference between longitudinal waves and transverse waves.

(3)

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(Total for question = 3 marks)

(**Q07 1SC0/1PF, June 2018**)

Q34.

* 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.

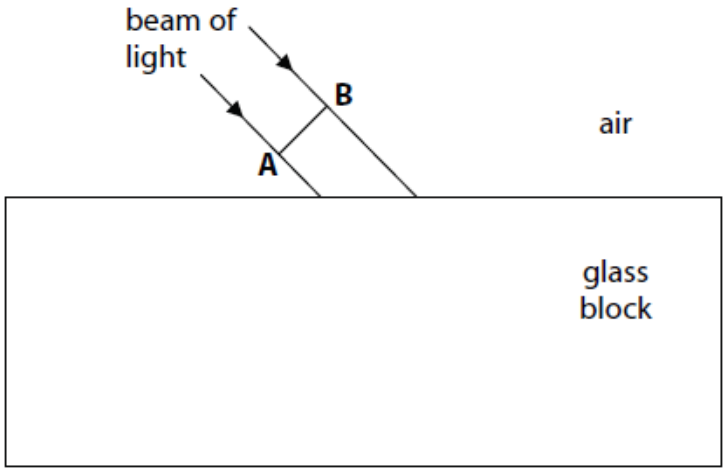


Figure 13

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

(6)

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(Total for question = 6 marks)

(Q06b 1SC0/1PH, SAM 2016)

Q35.

Figure 6 represents a sound wave coming from a loudspeaker and shows the effects on particles of the air at one instant in time.

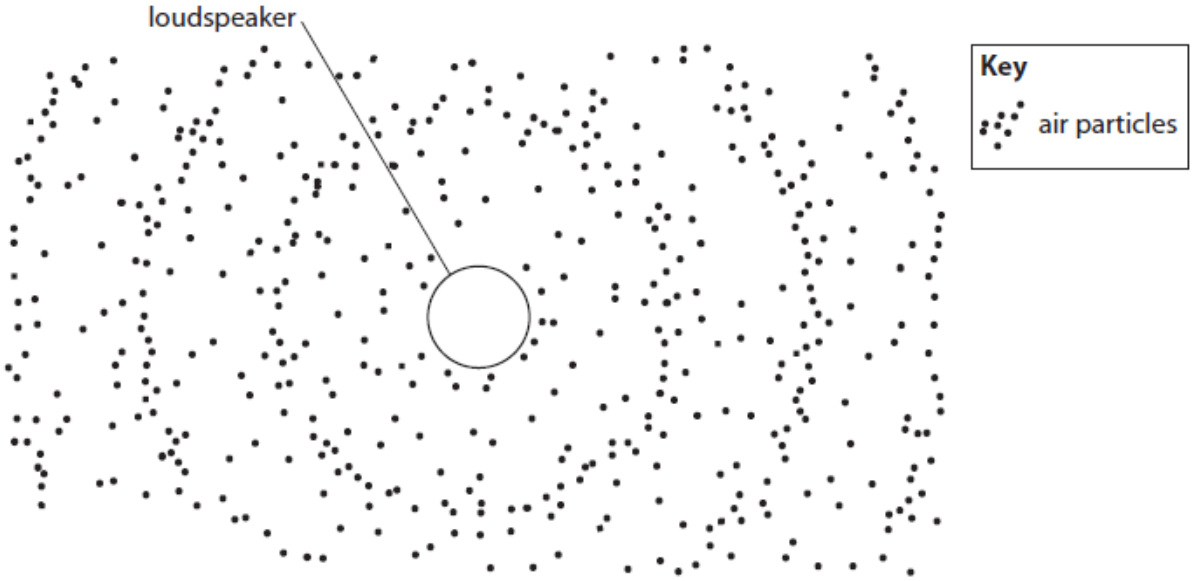


Figure 6

(i) Draw and label a distance of one wavelength in Figure 6.

(1)

(ii) Describe the motion of the particles as the wave travels through the air.

(2)

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(Total for question = 3 marks)

(**Q04b 1SC0/1PH, Nov 2020**)

Q36.

(a) Seismic (earthquake) waves can be either P-waves or S-waves.

Which row of the table is correct for P-waves?

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

(1)

	type of wave	can they be refracted?
☒ **A**	longitudinal	yes
☒ **B**	transverse	no
☒ **C**	longitudinal	no
☒ **D**	transverse	yes

(b) Explain why it is difficult to predict when an earthquake will happen.

(2)

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(**Q07 1SC0/1PF, June 2015**)

Q37.

The electromagnetic spectrum is continuous.
Different regions of the spectrum have different properties.

(a) (i) Name an electromagnetic wave that is also an ionising radiation.

(1)

.....

(ii) Genuine banknotes contain a special ink.
This ink is invisible under normal light.

Suggest why the ink glows when ultraviolet radiation is shone on it.

(2)

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(b) An electromagnetic wave has a frequency of 7×10^9 Hz.
The speed of the wave is 3×10^8 m/s.
Calculate the wavelength of the wave.

(3)

wavelength = ...m

*(c) Radiation from different regions of the electromagnetic spectrum can affect the human body in many ways.

Discuss the different ways in which excessive exposure to electromagnetic radiations of various frequencies may cause damage to the human body.

(6)

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(Total for Question = 12 marks)

(**Q28 1SC0/1PH, June 2013**)

Q38.

Ultraviolet (UV) waves from the Sun travel towards the Earth.

Ultraviolet waves can be grouped by wavelength.

The three groups of wavelengths are UVA, UVB and UVC.

Figure 4 shows, for each group,

- the wavelength range
- the effect of the Earth's atmosphere on each type of UV wave.

	UVA	UVB	UVC
wavelength range	400 nm to 315 nm	314 nm to 280 nm	279 nm to 100 nm
% energy absorbed by the Earth's atmosphere	5%	95%	100%

Figure 4

(i) Explain why UVC is potentially the most dangerous ultraviolet radiation but does not cause harm to people.

(2)

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(ii) The speed of electromagnetic radiation is 3.00×10^8 m/s.

Calculate the frequency of the shortest wavelength of UVB radiation.

(3)

frequency = ... Hz

(Total for question = 5 marks)

(**QU03a 1SC0/1PH, June 2024**)

Q39.

The diagram in Figure 4 shows two students, P and Q, trying to measure the speed of sound in air.

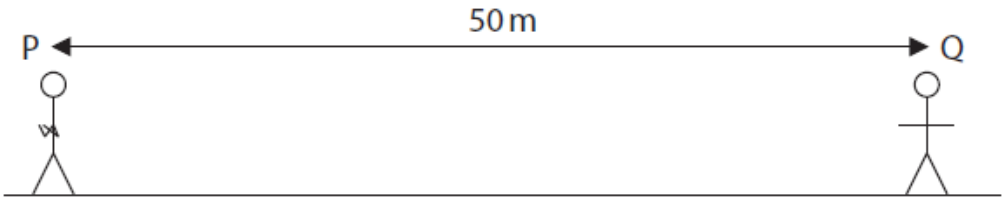


Figure 4

P will clap his hands together.

When Q sees P clap his hands, she will start a timer.

When Q hears the clap, she will stop the timer.

Explain **one** way the students could improve their method.

(2)

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(Total for question = 2 marks)

Q40.

Figure 4 is a simplified diagram to show radio waves from a transmitter moving upwards, then meeting a boundary between lower and upper layers of the atmosphere.

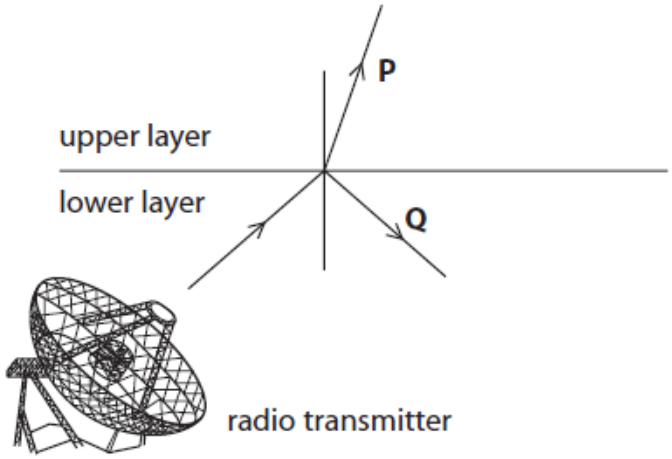


Figure 4

Explain what happens to the radio waves after they meet the boundary between the lower and upper layers as shown in Figure 4.

Your explanation should refer to changes in direction and speed of the waves.

(4)

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(Total for question = 4 marks)