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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 1 Physics, 2014

90938 Demonstrate understanding of aspects of wave behaviour

2.00 pm Tuesday 25 November 2014
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of wave behaviour.	Demonstrate in-depth understanding of aspects of wave behaviour.	Demonstrate comprehensive understanding of aspects of wave behaviour.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Make sure that you have Resource Sheet L1–PHYSR.

In your answers use clear numerical working, words and / or diagrams as required.

Numerical answers should be given with an appropriate SI unit.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

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QUESTION ONE: GEOLOGICAL SURVEY

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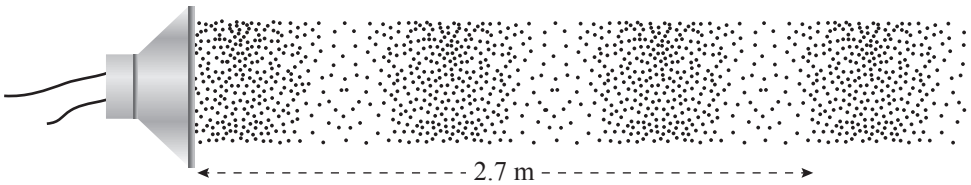
A speaker produces a sound wave.

(a) (i) Describe what a wave is.

(ii) Using a physics idea, describe the function of a wave.

(b) When a speaker produces a particular frequency of sound, the air particles in front of the speaker produce a pattern as shown in the diagram below.



(i) On the diagram above, draw arrow(s) to show the direction of movement of an air particle associated with the sound produced by the speaker.

(ii) From the information given in the diagram, calculate the wavelength of the sound wave in air produced by the speaker.

Wavelength = _____

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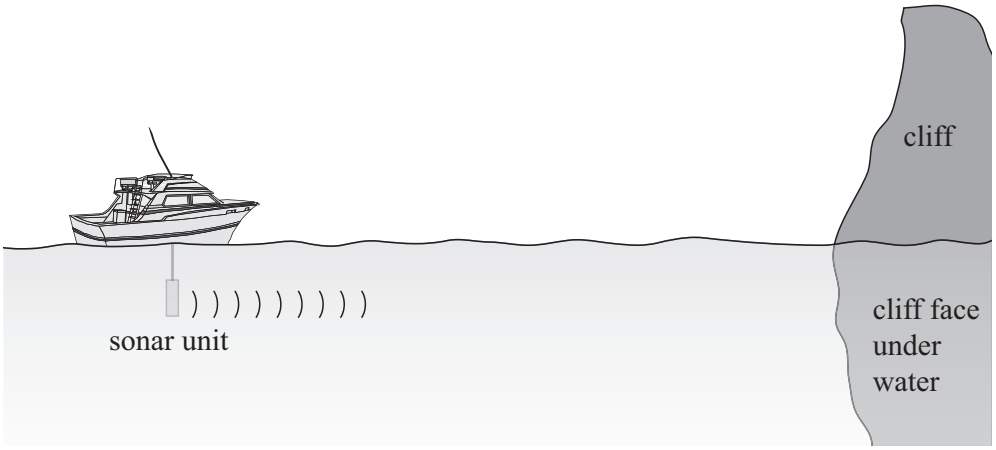
A scientist sets up a sonar unit to survey the water near a cliff. Part of the cliff face is submerged in water, as shown in the diagram. The transmitter in the sonar unit sends a pulse towards the submerged cliff face. The receiver in the sonar unit picks up the reflected pulse from the submerged cliff face 0.54 s later. The frequency of the sonar pulse is 10 kHz and its wavelength is 0.153 m.



(c) Calculate the distance between the sonar transmitter and the cliff face under water.

Distance = _____

When an object is thrown into water, it creates waves on the surface of the water. The amplitude of the waves decreases as they travel outwards. The sketch below shows the amplitude against distance for the first wave.

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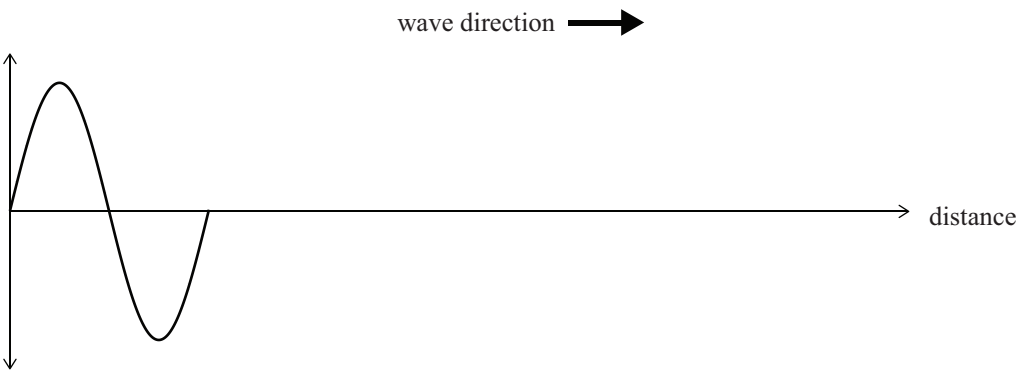
(d) (i) Complete the diagram by drawing the next two complete cycles of the wave as it travels outwards.



(ii) Using physics ideas, explain why the amplitude of the wave decreases as it travels outwards.

QUESTION TWO: BEHAVIOUR OF SOUND WAVE

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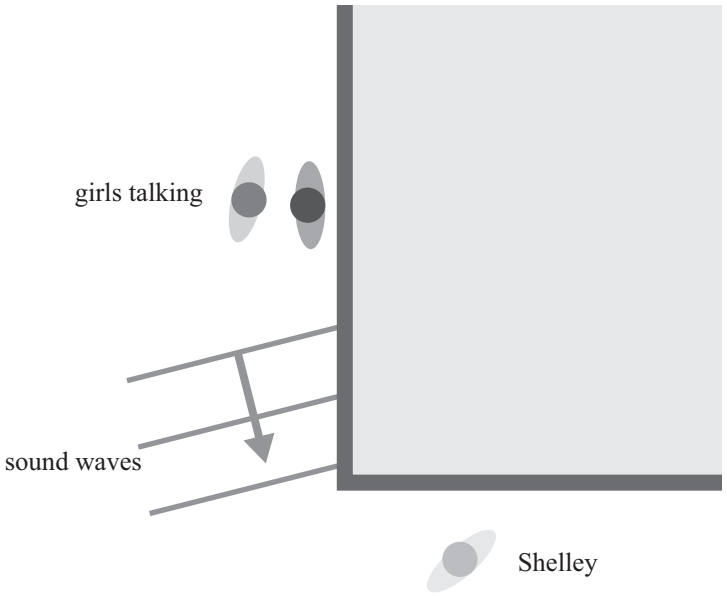
The diagram below shows two friends talking to each other next to a gymnasium wall. Shelley is standing near the corner of the gymnasium building. She can hear her friends around the corner, even though she cannot see them.



(a) Complete the diagrams to show how the sound waves diffract around the corner to reach Shelley's ear.

(b) Shelley notices that she is able to hear low frequency sounds from the girls' chat more loudly than high frequency sounds.

Explain why the low frequency sounds from the girls' chat are heard more loudly than the high frequency sounds.

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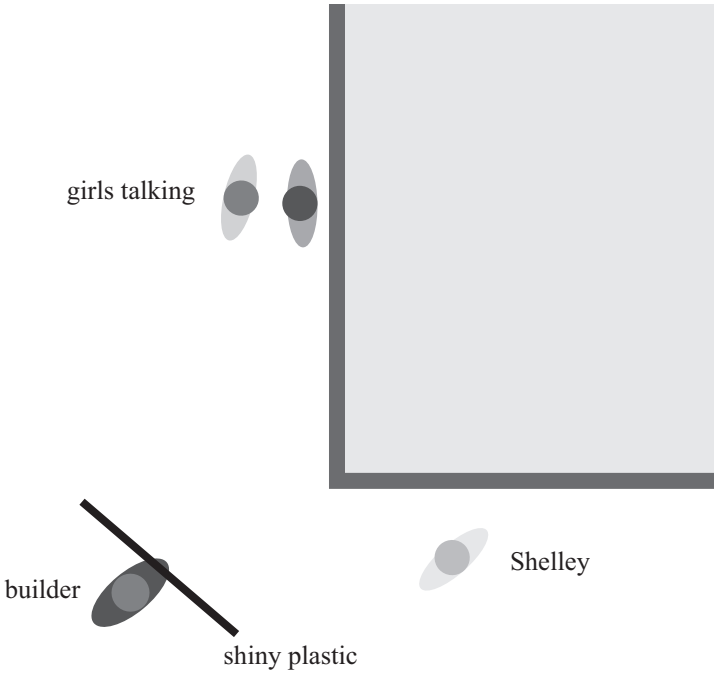
(c) When a builder carrying a large **shiny plastic board** passes by the corner of the gymnasium building, as shown in the diagram, the sound waves are reflected off the board towards Shelley.



Explain how the sound heard by Shelley in the above situation is different from the sound heard due to diffraction in the previous situation.

(d) Explain how the phenomena diffraction and reflection, affect the amplitude and direction of the sound waves.

(i) the amplitude of the waves

(ii) the direction of the waves

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QUESTION THREE: ELECTROMAGNETIC WAVES

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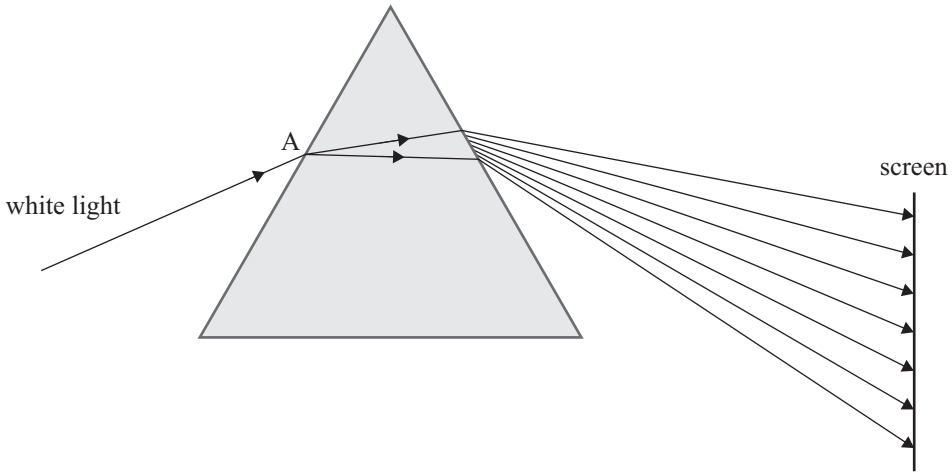
The diagram below shows a ray of white light entering a prism at point A.



(a) State the TWO phenomena that take place as the incident ray **enters** the prism at point A.

(b) (i) On the diagram above, label the position of the red and green rays on the screen.

(ii) Explain why the light splits up in this way.

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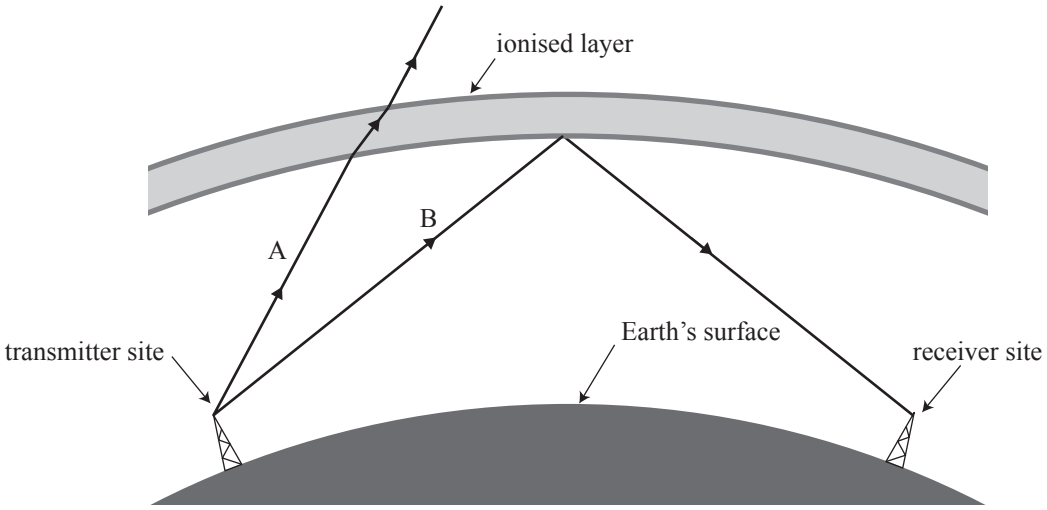
Radio waves travel in straight lines. Long-distance radio communication between distant locations on the Earth's surface is possible due to the existence of the ionised layer of the Earth's atmosphere. Two radio waves, A and B, are broadcast from the surface of the Earth. When the radio waves reach the ionised layer of the Earth's atmosphere, ray A travels into space and ray B bounces back towards the Earth's surface, as shown in the diagram.



(c) (i) Name the phenomenon that causes ray B to bounce back towards the Earth's surface.

(ii) In terms of the optical properties of the ionised layer, discuss why ray B bounces back towards the Earth's surface, while ray A is transmitted.

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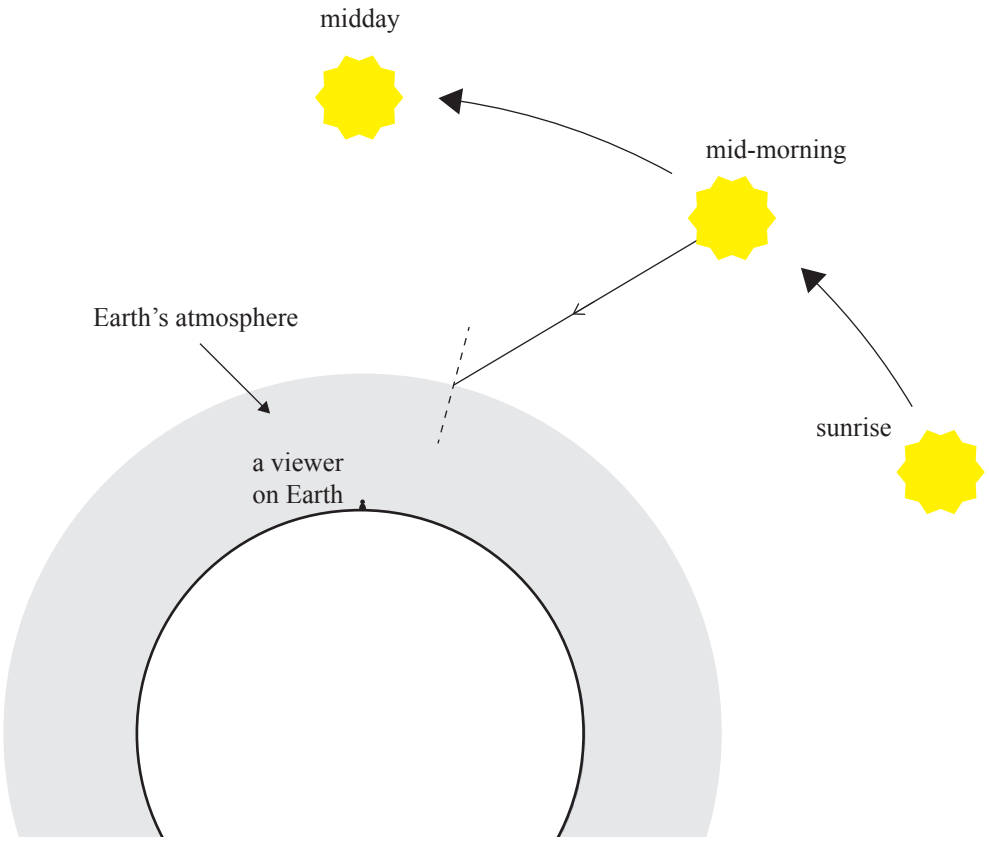
(d) The diagram below shows the true positions of the Sun from sunrise to midday. Light reaching the Earth from the Sun has to pass through the Earth's atmosphere. The atmosphere is **optically denser** than the space outside the atmosphere.



(i) Complete the diagram showing the path of the ray from the mid-morning sun after it enters the atmosphere.

(ii) On the diagram, draw the **apparent position** of the mid-morning sun, as seen by the viewer on Earth.

(iii) The angle of incidence of the light hitting the atmosphere decreases from sunrise to midday.

Explain how the **apparent position** of the Sun as seen from the Earth changes between sunrise and midday compared to its true position.

You may make sketches on the diagram to aid your answers.

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Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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