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90938

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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.

Not Achieved

TOTAL 02

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QUESTION ONE: GEOLOGICAL SURVEY

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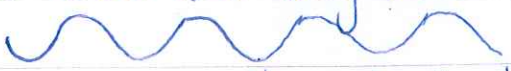
A speaker produces a sound wave.

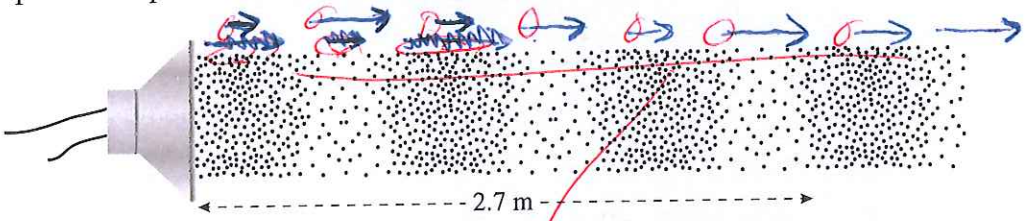
(a) (i) Describe what a wave is.

A wave is a pattern that ~~continuously~~ flows in a specific direction, a wave can carry radio signals and often looks like this:  . They are symetrical as they are a "continuous like pattern" though they are not everlasting and ~~often~~ sometimes ~~fade~~ off eventually, especially with radios.

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

Waves, especially radio waves have the function of carrying a transmition from one device too another, Speaker waves are similar, though they carry audio through into someones ear where it will be heard, most waves do not go a far distance and require huge expensive products to be able to go a far distance, like radios.

(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.

The wavelength of the sound wave in the diagram above is 2.7m

Wavelength = 2.7m

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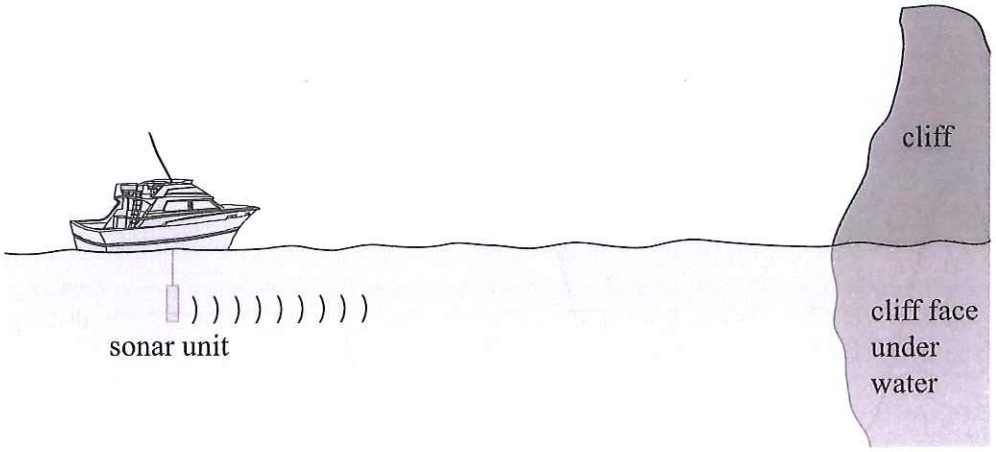
A scientist sets up a sonar unit to survey the water near a cliff. Part of the cliff face is submerged in water, as shown in the diagram. The transmitter in the sonar unit sends a pulse towards the submerged cliff face. The receiver in the sonar unit picks up the reflected pulse from the submerged cliff 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.

0.15m

0.54 seconds delay

10kHz frequency

Distance =

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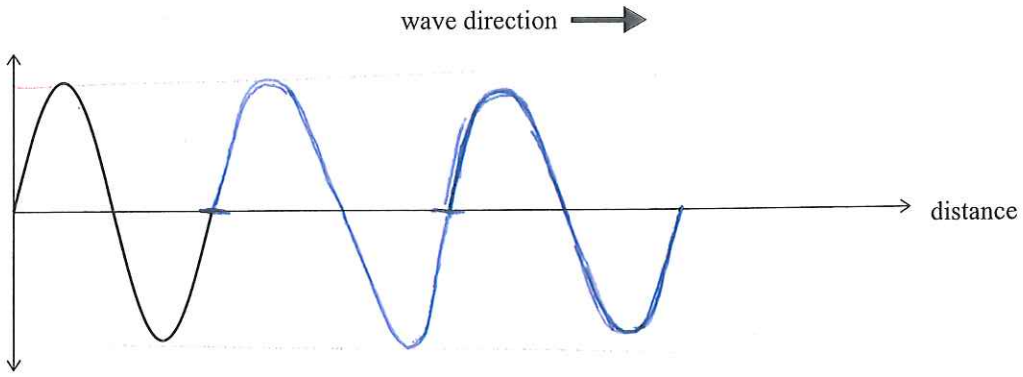
When an object is thrown into water, it creates waves on the surface of the water. The amplitude of the waves decreases as they travel outwards. The sketch below shows the amplitude against distance for the first wave.

(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.

The wave becomes weaker as it travels, it will begin to "fade away" until it eventually stops... much like the human voice, if you shout people 10m away may be able to hear you shouting, but 20m away you would not be able to be heard... The molecules in the air, like anything has resistance causing your ~~to~~ ~~slow~~ voice, for example, to eventually fade off so people cannot hear you.

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QUESTION TWO: BEHAVIOUR OF SOUND WAVE

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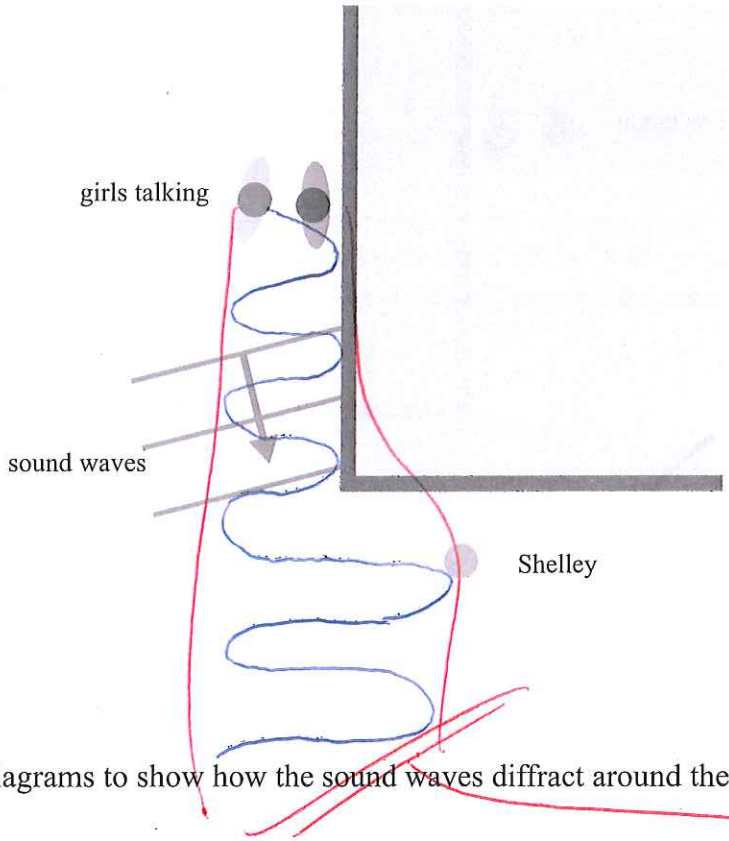
The diagram below shows two friends talking to each other next to a gymnasium wall. Shelley is standing near the corner of the gymnasium building. She can hear her friends around the corner, even though she cannot see them.



(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.

Because of their distance and the reflected sound waves, eventually as the sound wave weakens so does ~~be~~ the frequencies, higher frequencies fading away first... this is also ~~why~~ why men appear to speak louder, it is because of their lower frequency voices fading away slower than female high pitched frequency voices.

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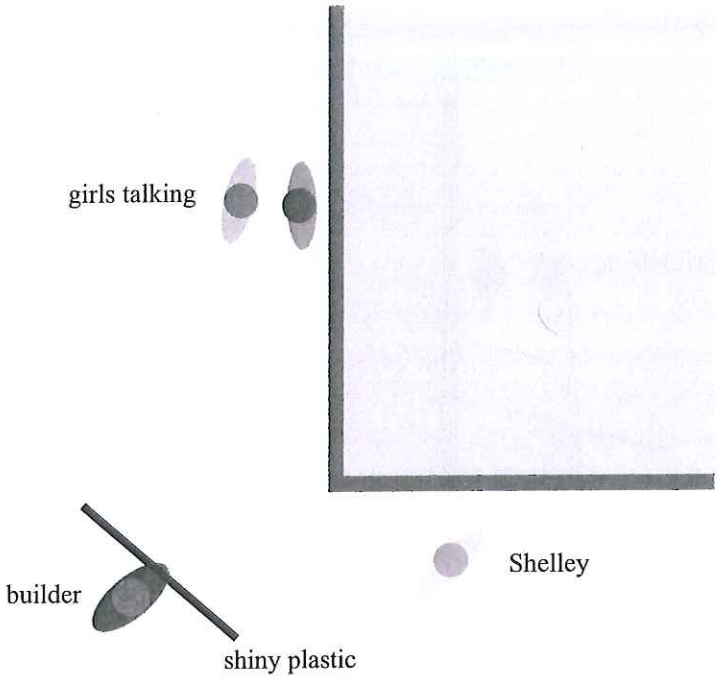
(c) When a builder carrying a large **shiny plastic board** passes by the corner of the gymnasium building, as shown in the diagram, the sound waves are reflected off the board towards Shelley.



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

In this instance, because of diffraction the sound waves would be diffracted towards Shelly as, if she was right there, making it very easy for her to hear them.

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

(i) the amplitude of the waves

Diffraction angles the waves in the way it is being diffracted as reflection refracts the waves towards a direction. reflection is like a mirror, a copy, as diffraction is the proppes thing. In terms of the amplitude, diffraction is more clearer as reflection is a distorted copyid version, for eg she will be able to hear the high and low pitches clearer with diffraction as she is hearing the full wave as when she is around the corner ~~and she is~~ if it is being reflected she is only hearing lower pitches because she isn't hearing the full ~~do~~ Sound as my diagram earlier ~~represents~~ displays.

(ii) the direction of the waves

The direction of the waves when refracted ~~only~~ only refracts part of the wave, when it is being diffracted by the builder the object is bending it towards her, meaning she is in the direction of the wave as before she was in the direction of the refraction of the wave.

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QUESTION THREE: ELECTROMAGNETIC WAVES

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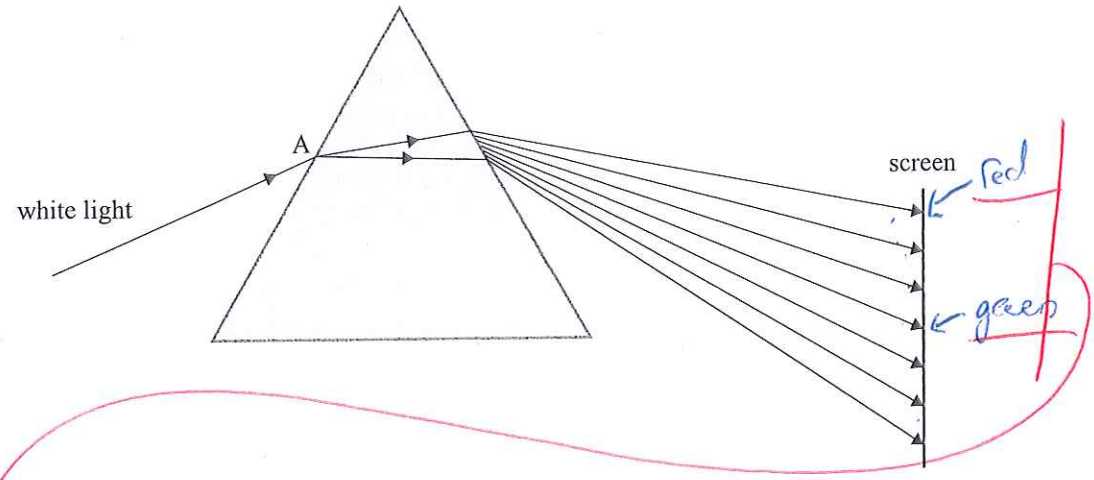
The diagram below shows a ray of white light entering a prism at point A.



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

refraction and reflection

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.

The light hitting the prism on the entry angle causes it to refract and reflect inside the prism onto the other side where it defracts again when leaving the prism and is displayed in multiple different lights because of its reflection and refraction.

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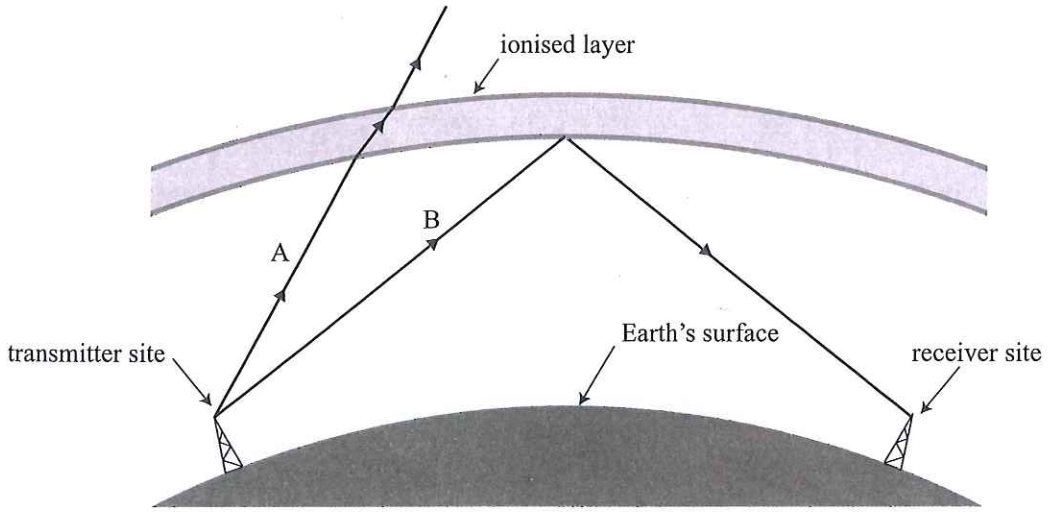
Radio waves travel in straight lines. Long-distance radio communication between distant locations on the Earth's surface is possible due to the existence of the ionised layer of the Earth's atmosphere. Two radio waves, A and B, are broadcast from the surface of the Earth. When the radio waves reach the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

refraction.

(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.

Radio wave B is being transmitted at an aggle where it will refract and bounce back to earth, as radio wave A is still refracting, the because of the aggle it is hitting the ionised layer at it goes through. The earths atmosphere is also optically denser than the space outside and air inside it, meaning it has higher refractive properties than the air inside and space outside it, helping it to refract objects and bounce them back to earth when it is 'hit' at specific angles.

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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.

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Adapted from: http://jeweell.com/data_images/out/75/1134759-earth.jpg

(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.

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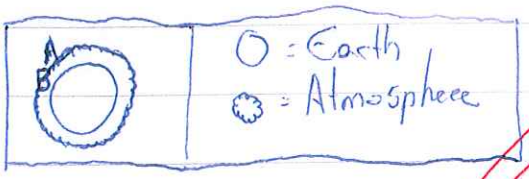
(iii) The angle of incidence of the light hitting the atmosphere decreases from sunrise to midday.

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.

The apparent position appears where the sunray it refracting off the atmosphere, meaning through the day although the Sun's true position may be point A in the diagram at 6pm, it looks to us as if it is at Point B



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N2

Not Achieved exemplar for 90938 2014		Total score	02
Q	**Grade score**	**Annotation**	
1	N0	(a) **Not Achieved.** For Achievement, the description of the wave needs to include the term disturbance or the idea that waves carry energy. (b) **Not Achieved.** For Achievement, the direction of movement of air particles needs to be both to the right and the left OR the wavelength needs to be the length of the waves shown (2.7) divided by the number of waves (3) = 0.90. (c) **Not Achieved.** For Achievement, there has to be an attempt to calculate the distance using the information given. (d) **Not Achieved.** For Achievement, there has to be clear decreasing of amplitude of the wave or a description of the wave losing energy .	
2	N0	(a) **Not Achieved.** For Achievement, the diagram should show the wave diffracting. (b) **Not Achieved.** For Achievement, there needs to be discussion of wavelength as a key factor e.g. lower wavelength diffract more than shorter wavelength. (c) **Not Achieved.** For Achievement, there needs to be discussion of diffraction versus reflection, ideally with some comparison of its effect on different frequencies. (d) **Not Achieved.** For Achievement, there needs to be discussion of the effects both of reflection and diffraction on the amplitude OR the effects both of reflection and diffraction on the direction of the wave.	
3	N2	(a) **Achievement.** Correctly states one of the phenomena (refraction). (b) **Achievement.** Correctly identifies position of red and green rays. (c) **Not Achieved.** For Achievement, needs to identify phenomena as Total Internal Reflection or describe one aspect of Total Internal Reflection. (d) **Not Achieved.** For Achievement, needs to complete the diagram or draw the apparent position or explain the change in apparent position.	