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Level 1 Physics, 2017

90938 Demonstrate understanding of aspects of wave behaviour

9.30 a.m. Tuesday 28 November 2017
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.

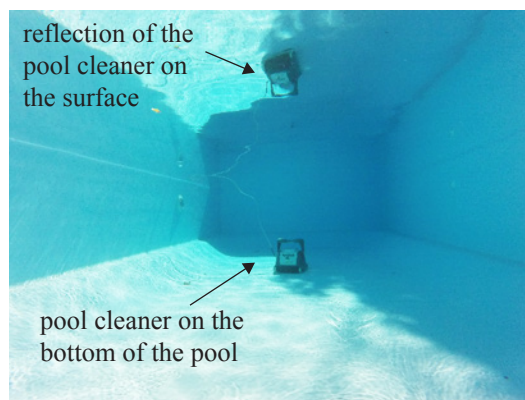
YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

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QUESTION ONE: UNDERWATER PICTURE

Mike was testing his new underwater camera. He decided to take a picture underwater in a swimming pool. On the right is a picture of a pool cleaner sitting on the bottom at the far end of the pool. An image of the pool cleaner can be seen reflected on the surface of the water.

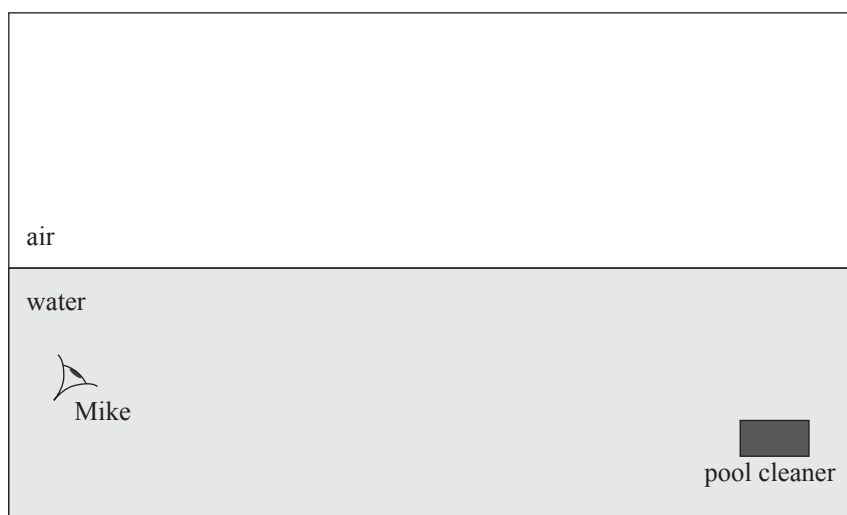


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- (a) (i) Name the physics phenomenon that allows Mike to see the image of the pool cleaner reflected on the surface of the water.

- (ii) On the diagram below, draw a ray diagram to show how light travels from the pool cleaner to Mike, allowing him to see the reflection.

Include arrows to show the direction the light travels, and the location of the image formed.



*If you
need to
redraw
your ray
diagram,
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10.*

- (b) State two properties of the image of the pool cleaner that Mike sees on the surface of the water.

- (i) _____
- (ii) _____

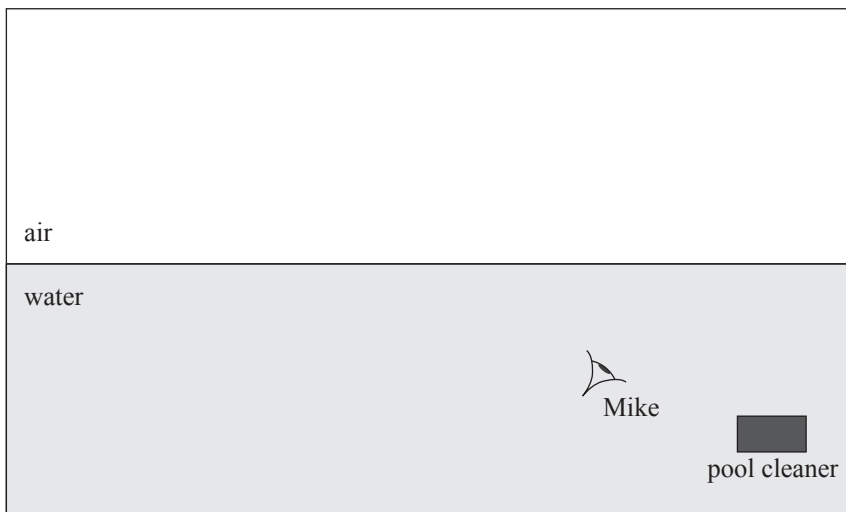
- (c) Mike then moved closer to the pool cleaner, and looked up at the surface. He noticed that he could no longer see the image of the pool cleaner, but he was now able to see trees around the pool, as shown.

Explain why Mike can no longer see the image of the pool cleaner when he has moved closer to the pool cleaner.

As part of your explanation, complete the diagram to show why light rays from the pool cleaner do not reflect from the surface to reach Mike.



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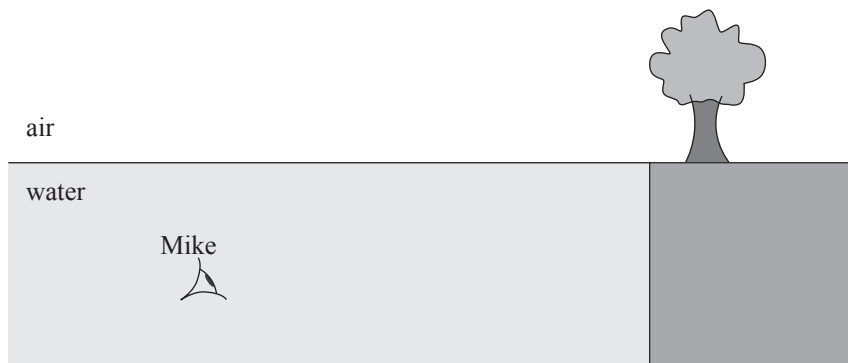


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- (d) While underwater and looking up, Mike notices that he can see the trees around the edge of the pool.

Draw a ray on the diagram below to show how the tree above water appears to be in a different position than its actual position.

Indicate the position of the image on the diagram.



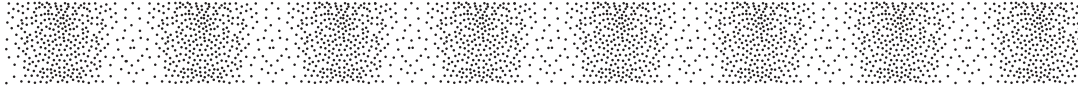
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use the
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page 10.*

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QUESTION TWO: SOUNDSASSESSOR'S
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- (a) A sound wave can be represented as shown in the diagram below.

Name the type of wave shown below, and draw a labelled arrow to show its wavelength.



Type of wave: _____

Mike has a waterproof speaker that can be used in a swimming pool.

- (b) Mike gets into the swimming pool with the speaker. It is 25 m from one end of the pool to the other. If the sound takes less than 0.1 s to travel to the far end and back, the echo is indistinguishable from the original sound.

If Mike and the speaker are underwater at one end of the swimming pool, determine whether he would be able to distinguish the echo of the sound off the far end of the pool.

The speed of sound in water is 1480 m s^{-1} .



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- (c) (i) While still underwater, the radio plays a sound with a frequency of 1500 Hz.

Calculate the wavelength of the sound wave.

State your answer in centimetres.

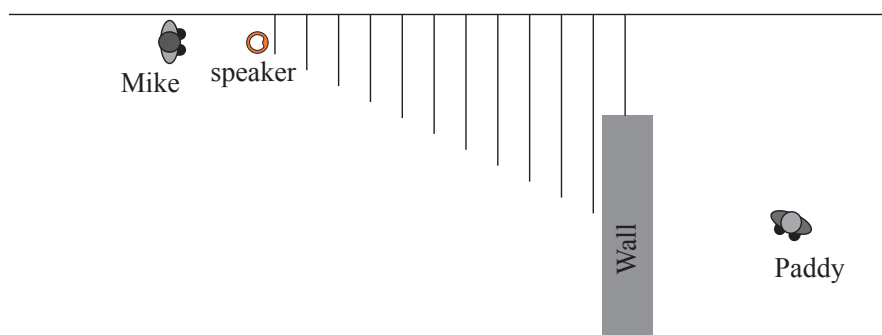
Wavelength = _____ cm

- (ii) When the speaker is floating on the surface of the water, it emits sound waves into the air and into the water.

Describe how the sound waves in the water are different to the sound waves in the air, and explain why this happens.

- (d) Mike gets out of the pool. He decides to experiment and asks his friend Paddy to stand behind a wall.

Complete the diagram below to show how the sound waves travel from the speaker to Paddy, and explain why Paddy can hear the sound from the speaker, even though the wall is in the way.



If you need to redraw your response, use the diagram on page 11.

QUESTION THREE: REFRACTION

A test tube is made of glass, which has a higher optical density than air.

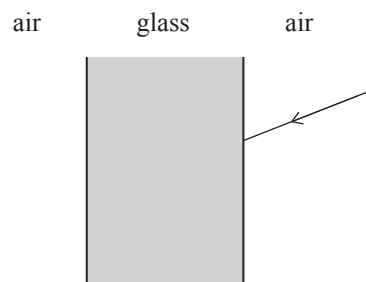
- (a) Describe how the speed of light changes as it enters a material with higher optical density.



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- (b) As light travels through the test tube, it passes through different mediums.

Complete the diagram to show the path a ray of light will follow as it passes from air to glass to air.

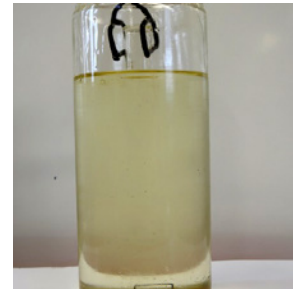
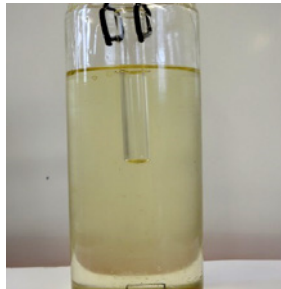


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redraw your
response,
use the
diagram on
page 11.*

- (c) A glass test tube is placed in peanut oil, and gradually filled with the same type of peanut oil. The test tube on the left has air inside it, and the test tube on the right is filled with peanut oil. As the test tube is filled with oil, it seems to disappear. The glass and the peanut oil have the **same** optical density (light travels at the same speed in both mediums). Air has a lower optical density than the glass and peanut oil.



test tube filled
with air

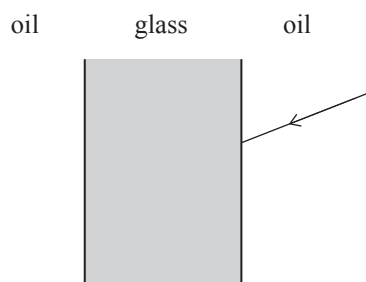


test tube filled
with oil

The test tube on the right is filled with peanut oil, and it looks like the part of the test tube submerged in oil has disappeared.

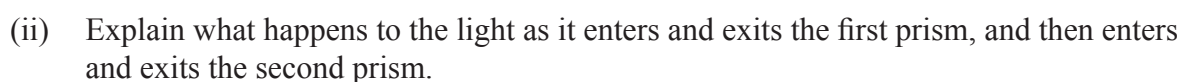
Explain why the test tube cannot be seen when it is filled with oil.

As part of your answer, complete the ray diagram showing the path light follows through the oil-glass-oil interface.



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response, use
the diagram
on page 11.*

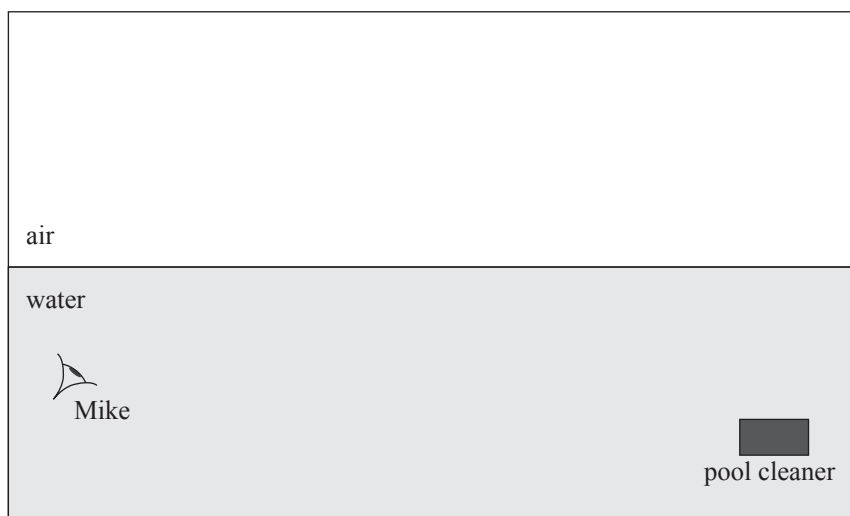
- If you need to redraw your ray diagram, use the diagram on page 11.*



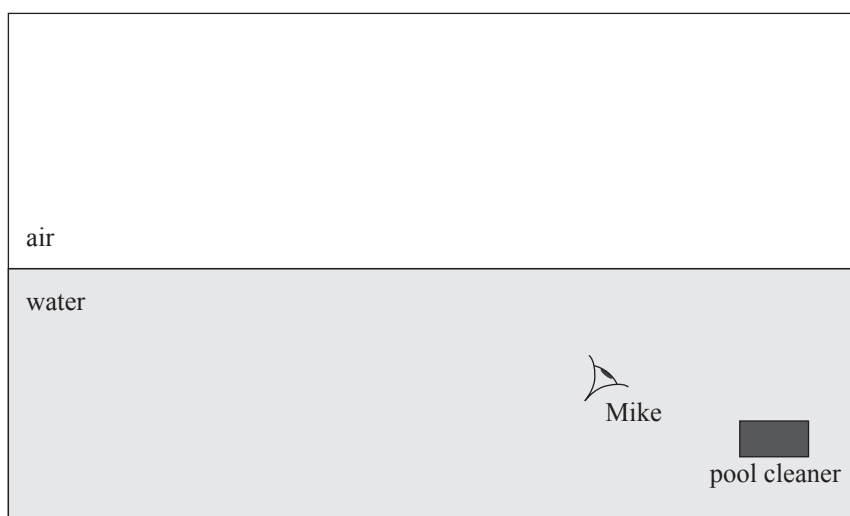
- the colour, or colours, of the light as it exits the first prism
- the colour, or colours, of the light as it exits the second prism
- the name of the phenomenon occurring as it enters the first prism
- an explanation for why this phenomenon occurs.

SPARE DIAGRAMS

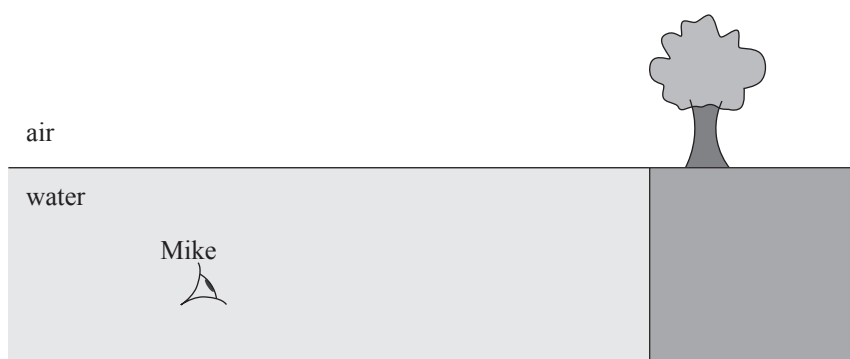
If you need to redraw your ray diagram for Question One (a)(ii), use the diagram below. Make sure it is clear which answer you want marked.



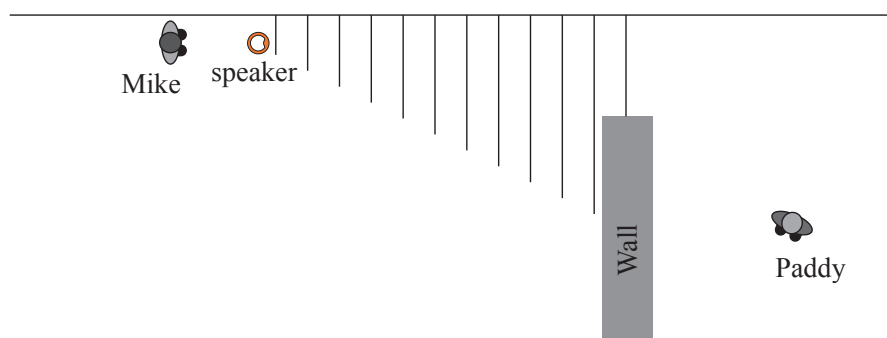
If you need to redraw your response to Question One (c), use the diagram below. Make sure it is clear which answer you want marked.



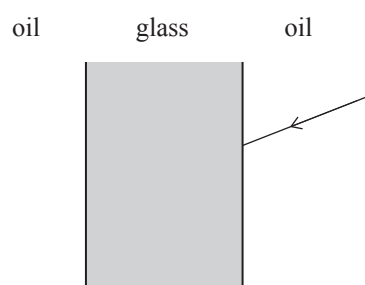
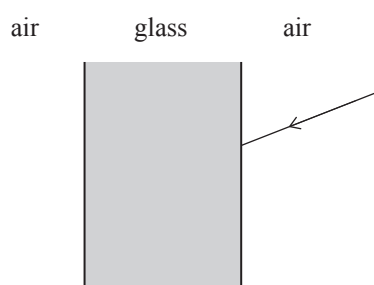
If you need to redraw your response to Question One (d), use the diagram below. Make sure it is clear which answer you want marked.



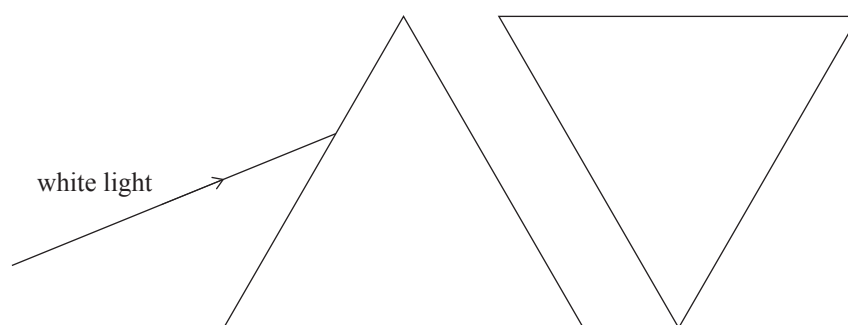
If you need to redraw your response to Question Two (d), use the diagram below. Make sure it is clear which answer you want marked.



If you need to redraw your responses to Question Three (b) and/or Question Three (c), use the diagrams below. Make sure it is clear which answers you want marked.



If you need to redraw your ray diagram for Question Three (d), use the diagram below. Make sure it is clear which answer you want marked.



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

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