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Level 1 Physics, 2015

90938 Demonstrate understanding of aspects of wave behaviour

9.30 a.m. Thursday 19 November 2015
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 2–10 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.

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QUESTION ONE: SOUND WAVES

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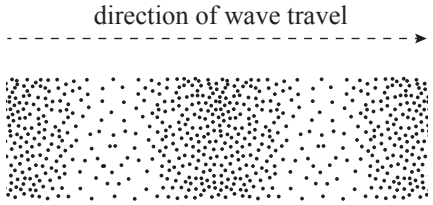
The diagram below represents sound waves travelling through a medium.



(a) (i) What **type** of wave is a sound wave?

(ii) How many **full** wavelengths are shown in the diagram above?

Give a reason for your answer.

(b) How does the direction of motion of particles in the medium compare to the direction of the wave travel?

Bottlenose dolphins use echolocation to locate their prey. They make clicking sounds and then listen to the echo of the sound waves reflected off objects in front of them.

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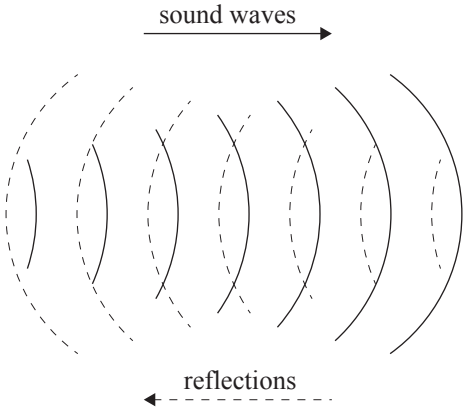

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http://ioniandolphinproject.org/species-guide/common-bottlenose-dolphin
http://fishingrigz.com/fish/snapper.html

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(c) A bottlenose dolphin produces a sound wave of frequency 150 kHz.

Calculate the **period** of this wave.

Period: _____

(d) A dolphin sends out a clicking sound and receives an echo from a fish 0.060 s later. The speed of sound in water is 4.5 times faster than the speed of sound in air. The speed of sound in air is 343 m s^{-1}.

(i) Calculate the distance from the dolphin to the fish.

Distance: _____

(ii) Explain how a dolphin is able to distinguish a near object and a distant one by using echolocation.

QUESTION TWO: WAVE BEHAVIOUR

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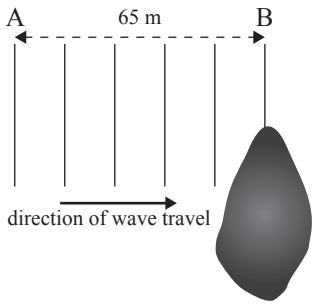
The diagram below shows water waves travelling towards a large rock near the shore line.



(a) On the diagram above draw the wave pattern produced as the waves pass the tip of the rock.

(b) Name the physics concept that is related to this situation.

_____

(c) The lines on the diagram represent wave crests. The distance from wave crest A to wave crest B is 65 m.

(i) Calculate the wavelength of the water waves.

_____

_____

_____

Wavelength: _____

(ii) The frequency of the water waves is 0.25 Hz.

Calculate the speed of the waves in water.

_____

_____

_____

Speed: _____

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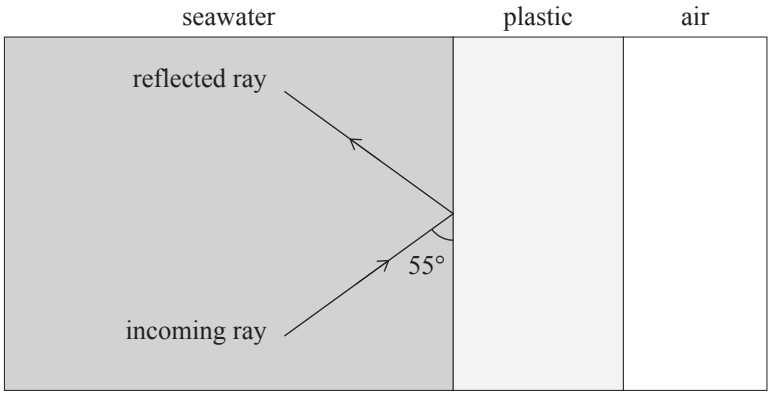
(d) When a person does underwater diving, light travels from the seawater through the plastic of a diver's mask to the eyes of the diver. The space between the mask and the diver's face contains air.

The diagram below shows a ray of light travelling from the seawater to the plastic of a diver's mask. Part of the incoming ray is reflected.

For copyright reasons, this resource cannot be reproduced here.

http://underwaterdive.com/about/instructors/john-german/



(i) The incoming ray strikes the seawater-plastic boundary at 55°, as shown in the diagram.

State why the angle of reflection in the above situation is 35°.

(ii) Plastic is optically denser than seawater, and air is optically less dense than plastic.

On the diagram above, draw the path of the refracted ray through the plastic into the air.

(iii) Compare the speed of the **reflected ray** in seawater with the speed of the **incoming ray** in seawater.

Explain your answer.

QUESTION THREE: REFLECTION

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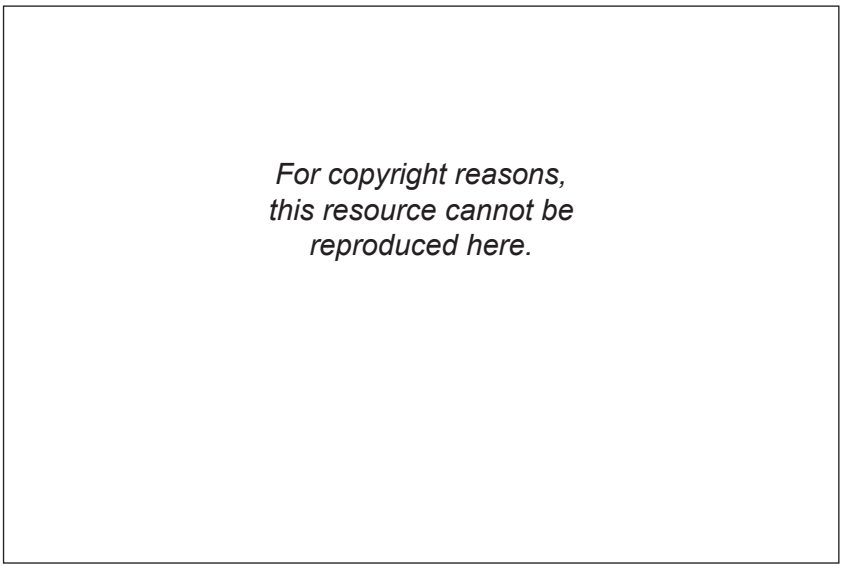
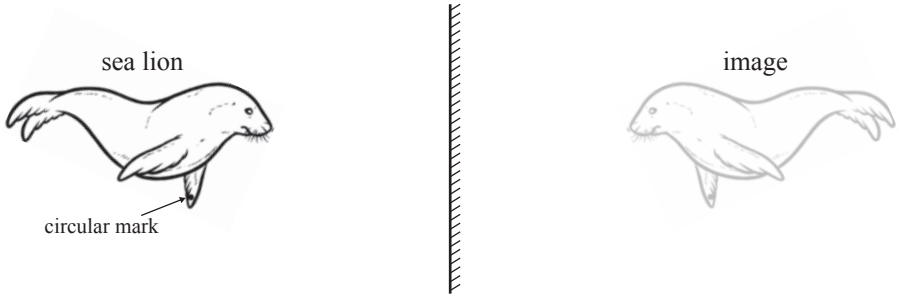
The photograph below shows a sea lion being reflected by the glass window of an underwater camera.



www.wodumedia.com/wp-content/uploads/2012/10/An-Australian-Sea-Lion-becomes-enchanted-when-it-sees-its-reflection-for-the-first-time-in-the-lens-of-the-giant-IMAXR-3D-camera-for-the-filming-of-the-IMAX-3D-film-Under-the-Sea-3D.-Photo-2008-Michele-Hall-used-with-permissi-1.jpg

(a) On the diagram below, draw rays to show how the sea lion can see the circular mark on the tip of its flipper in the glass window.



(b) The image formed by the glass window is a virtual image.

State how a virtual image is different from a real image.

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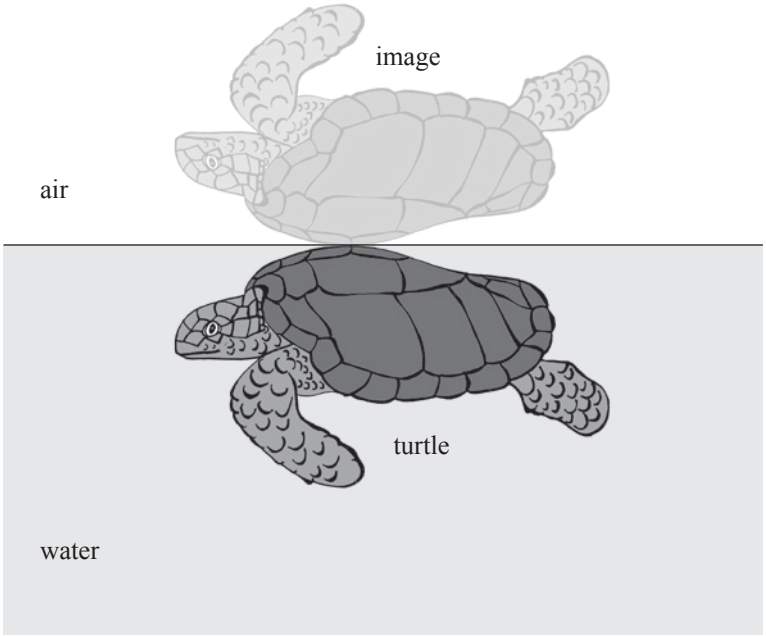
A turtle floats just under the surface of water. An underwater diver sees an inverted image of the turtle directly above it. This image is caused by total internal reflection. The diagram below shows the turtle and its image.



(c) Describe TWO conditions needed for total internal reflection to occur in the above diagram.

(1) _____

_____

_____

(2) _____

_____

_____

Question Three continues on the following page.

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(d) When the turtle paddles on the surface of water, it produces waves. The turtle produces 6.0 surface waves in 12 seconds. Each wave travels 15 m in 30 s.

(i) Calculate the wavelength of the waves produced.

Wavelength: _____

(ii) When the turtle begins to paddle faster, the frequency of the waves produced **doubles**, but the velocity remains constant.

Explain how the wavelength of the waves changes when the frequency of the wave doubles.

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

QUESTION NUMBER

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