

91170



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

2

SUPERVISOR'S USE ONLY

Level 2 Physics, 2013

91170 Demonstrate understanding of waves

2.00 pm Wednesday 13 November 2013

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of waves.	Demonstrate in-depth understanding of waves.	Demonstrate comprehensive understanding of waves.

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 L2-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.

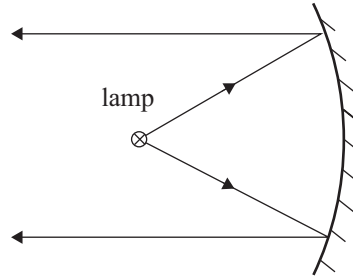
TOTAL

ASSESSOR'S USE ONLY

You are advised to spend 60 minutes answering the questions in this booklet.

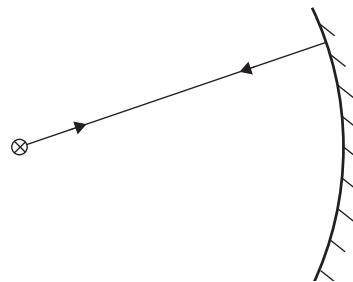
QUESTION ONE : MOANA'S SPOTLIGHT

Moana is trying to design a spotlight for her school production. She experiments with a lamp in front of a mirror, as shown in the diagram below.



- (a) State the name of the position where she has placed the lamp.

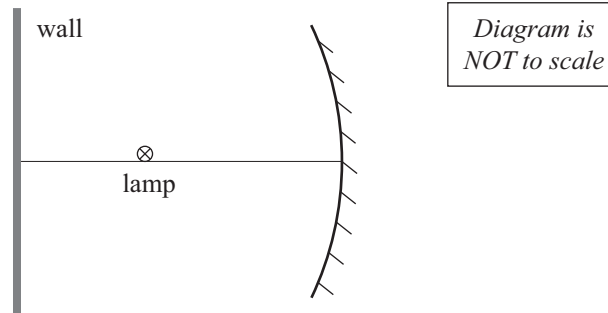
- (b) She then places the lamp further from the mirror and notices that a light ray from the lamp reflects straight back to the lamp, as shown in the diagram below.



- (i) State the name of the position of the lamp.

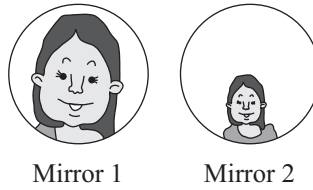
- (ii) Explain why the light ray reflects as shown.

- (c) Moana now moves the lamp closer to the mirror, as shown in the diagram below. She sees a clear image of the lamp on the wall. The height of the image is twice the height of the lamp. The focal length of the mirror is 25 cm.



Calculate the distance from the mirror to the lamp.

- (d) Moana attaches her mirror to the wall beside another, different mirror. When she looks at the mirrors, she sees two different images of herself as shown in the diagram below.



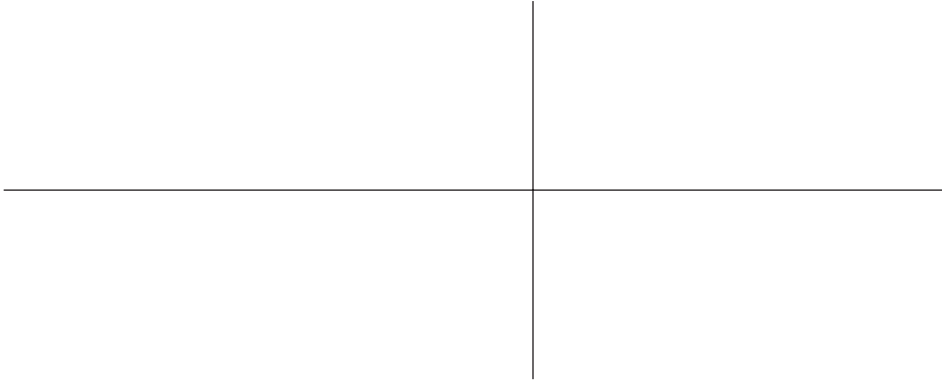
- (i) What type of mirror is:

Mirror 1 _____

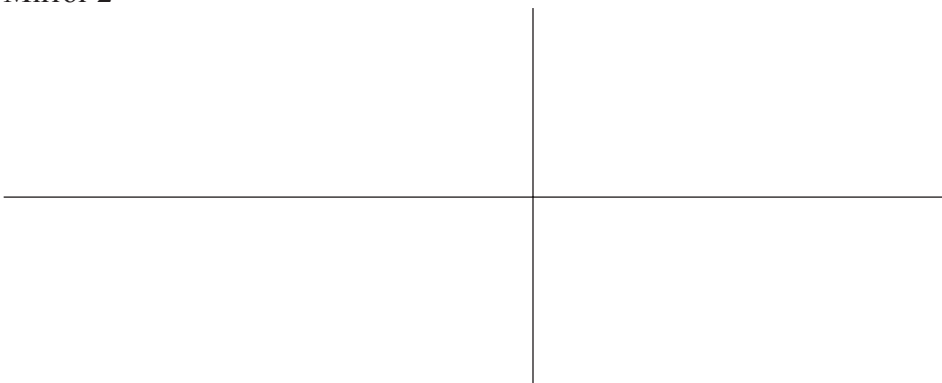
Mirror 2 _____

- (ii) Draw ray diagrams to justify your answers to part (i).
You will need to draw the appropriate mirror for each diagram.

Mirror 1

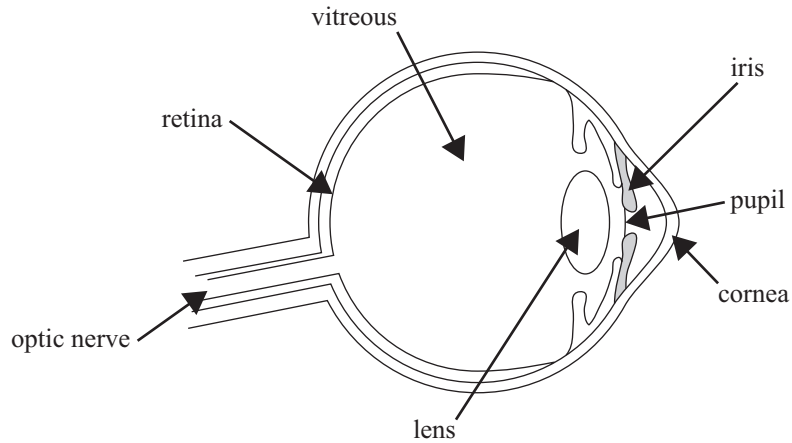


Mirror 2



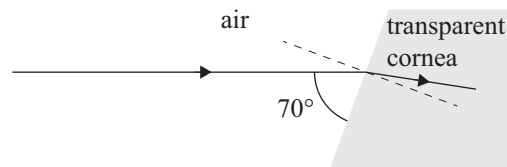
*If you need
to redraw the
paths, use the
diagrams on
page 11.*

QUESTION TWO: FRANKIE GOES TO THE OPTICIAN



The above diagram is a simplified anatomy of the eye. Light enters through the transparent cornea, and passes through the pupil to enter the lens. The position of the lens is fixed. However, the shape, and hence the focal length, of the lens can change in order for us to be able to see objects that are far away (distant), as well as objects that are near (close). The lens focuses the light onto the retina, where an image of the object is formed.

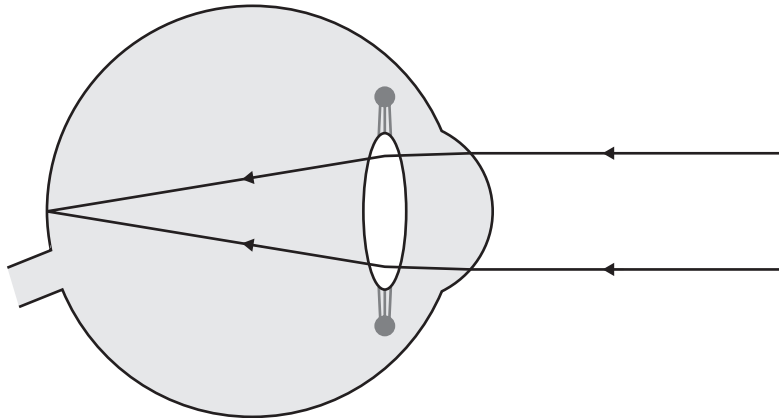
Frankie goes to the optician for an eye examination. The optician shines a ray of light into his cornea (at the front of his eye), as shown below.



- (a) State the size of the angle of incidence.

- (b) The diagram below shows Frankie's eye looking at a **distant** object.

Explain what must happen to the shape of the lens in Frankie's eye, in terms of focal length and curvature, if he looks at a **nearby** object.



- (c) The lens in the eye is surrounded by liquid.

Explain what would happen to the focal length of the lens if it was surrounded by air.

Assume the lens is the same shape.

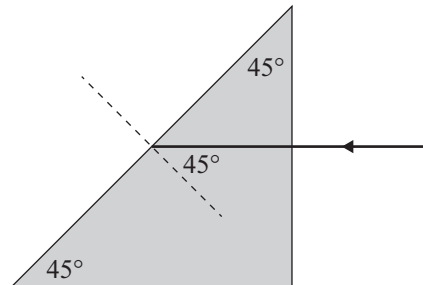
$$n_{\text{air}} = 1.0, \quad n_{\text{liquid}} = 1.3, \quad n_{\text{lens}} = 1.4$$

- (d) The optician looks at the inside of Frankie's eye with an instrument that uses red light. This device contains a glass prism like the one shown in the diagram below.

The speed of red light in air is $3.0 \times 10^8 \text{ m s}^{-1}$.

The speed of red light in the glass prism is $2.0 \times 10^8 \text{ m s}^{-1}$.

$$n_{\text{air}} = 1.0, \quad n_{\text{glass}} = 1.5$$



Explain what happens to a beam of red light that shines into the glass prism as shown in the diagram above. (You will need to carry out a calculation to answer this question.)

Draw the path of the beam of red light to support your answer.

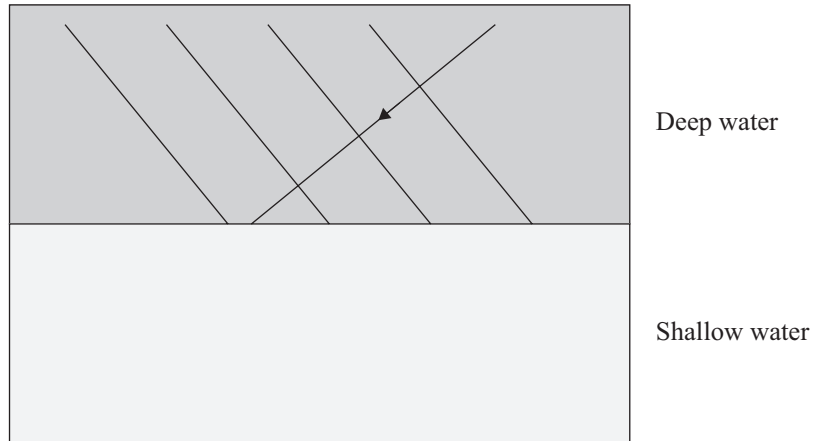
QUESTION THREE: AT THE SWIMMING POOL

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Jess and Rima are at the local pool. They notice that there is a shallow region at the edge of the pool. Waves travel through the deep water and change direction as they slow down moving into the shallow water.

- (a) On the diagram below, draw waves that have entered the shallow water.

Also draw an arrow showing the new wave **direction**.

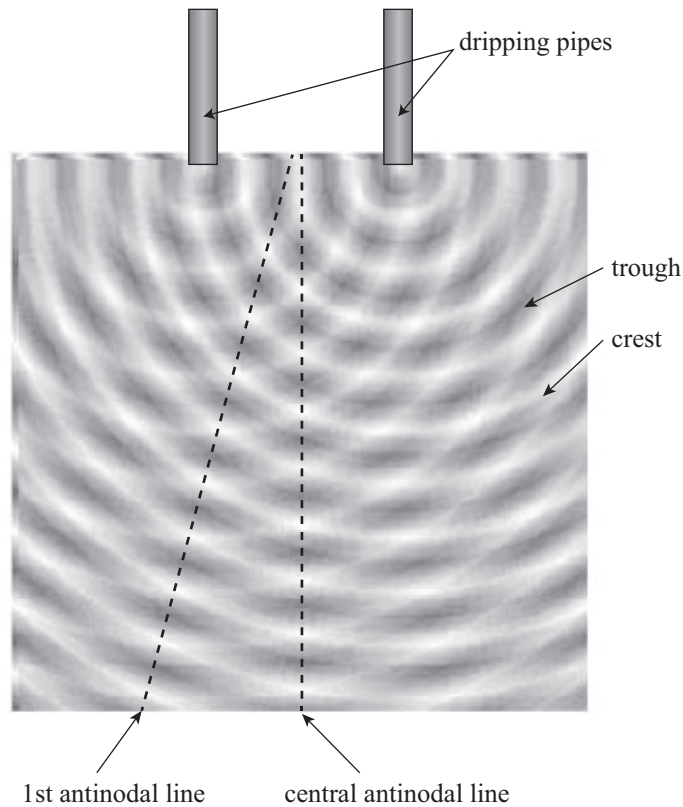


- (b) State what happens to the **frequency** and **wavelength** of the waves when they enter the shallow water.

frequency: _____

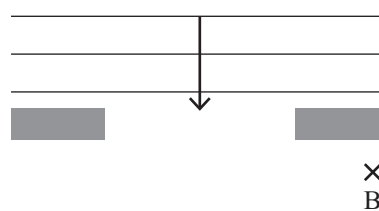
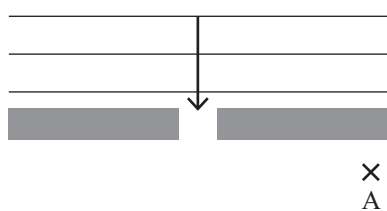
wavelength: _____

There are two pipes that drip water into the shallow pool, making circular waves. Rima notices that the dripping water produces an interference pattern in the pool, as shown in the picture below.



- (c) Explain what would happen to the position of the first antinodal line, with respect to the central antinodal line, if the **frequency** of the drips from both pipes **increased** and they remain in phase.

- (d) The diagrams show waves approaching two different-sized gaps in a harbour wall.



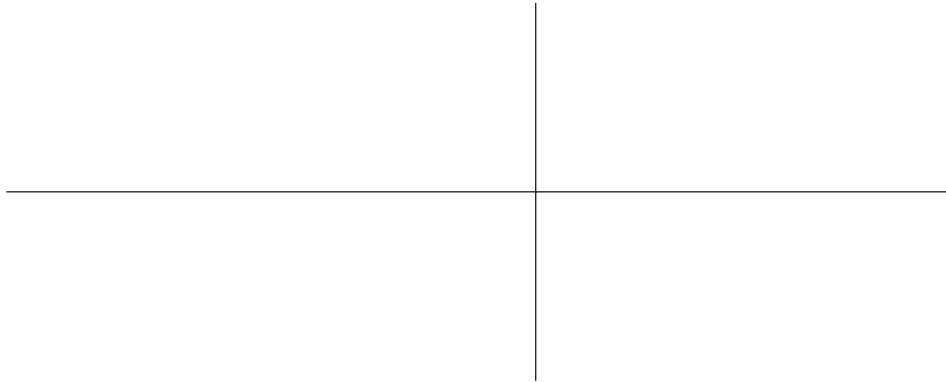
- (i) Name the process by which waves could reach positions A and B.

- (ii) Explain whether the owner of a boat would do better to anchor his boat at A or B. Support your answer by completing the wave patterns in the above diagrams.

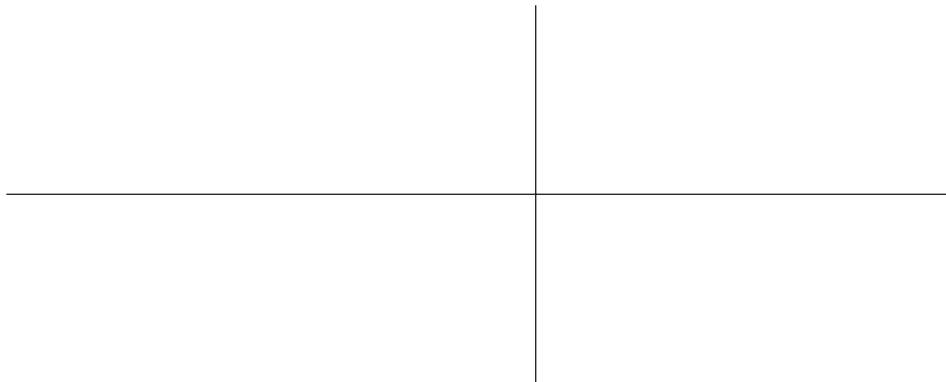
If you need to redraw diagrams, use the diagrams on page 11.

If you need to redraw the paths from Question One (d), draw them on the diagrams below. Make sure it is clear which diagrams you want marked.

Mirror 1



Mirror 2



If you need to redraw the wave patterns from Question Three (d), use the diagrams below. Make sure it is clear which diagrams you want marked.

