91170

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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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SUPERVISOR'S USE ONLY

Level 2 Physics, 2012

91170 Demonstrate understanding of waves

2.00 pm Wednesday 14 November 2012
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 2–11 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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You are advised to spend 60 minutes answering the questions in this booklet.

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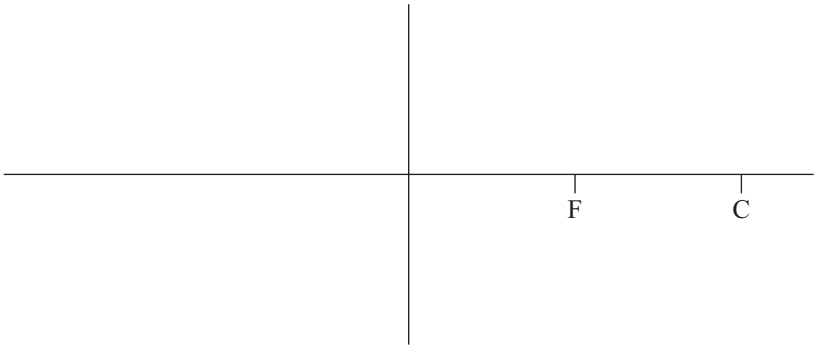
QUESTION ONE: CURVED MIRRORS AND LENSES

Sarah observed that it is possible to get a virtual image of an object using either a concave or a convex mirror.

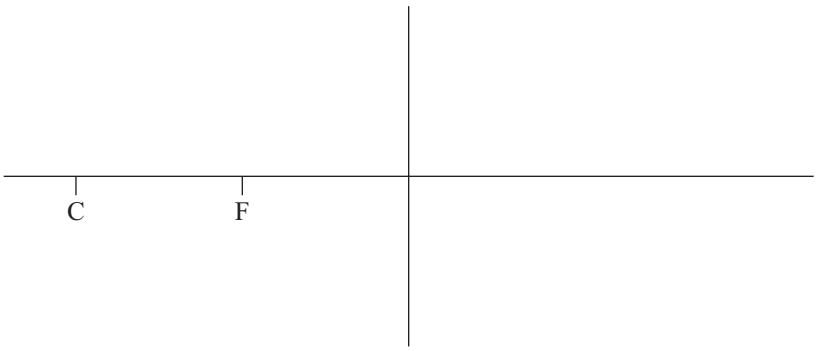
(a) On each of the diagrams below, use a ruler to draw the path of two rays of light from an object (draw this as an arrow) to produce a **virtual image** for both a concave as well as a convex mirror. The vertical line represents the curved mirror.

If you need to redraw the paths, use the diagrams on page 10.

(i) Concave mirror



(ii) Convex mirror



(b) Describe two characteristics of virtual images in mirrors.

(c) Sarah places a candle at a distance of 4.5 cm in front of the **convex** mirror. She uses a candle that is 2.0 cm high as the object. The focal length of the **convex mirror** is 6.0 cm.

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Calculate the height of the image formed by the convex mirror.

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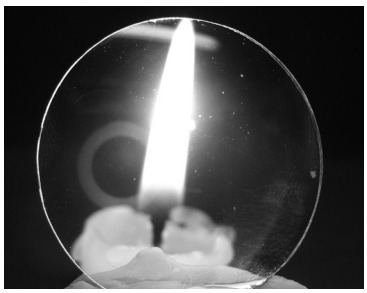
(d) Jack is given two convex lenses. The lenses are identical in shape, but have different refractive indices. Jack places the two lenses the same distance from a candle and sees a virtual image of the candle in each lens.

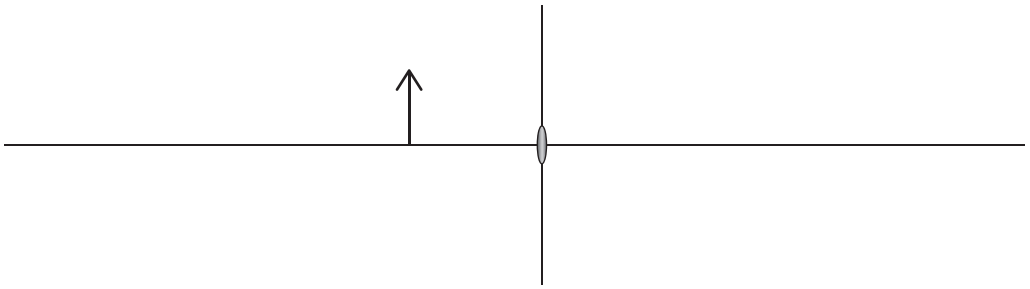




Explain why the images formed by the two lenses are **different in size.**

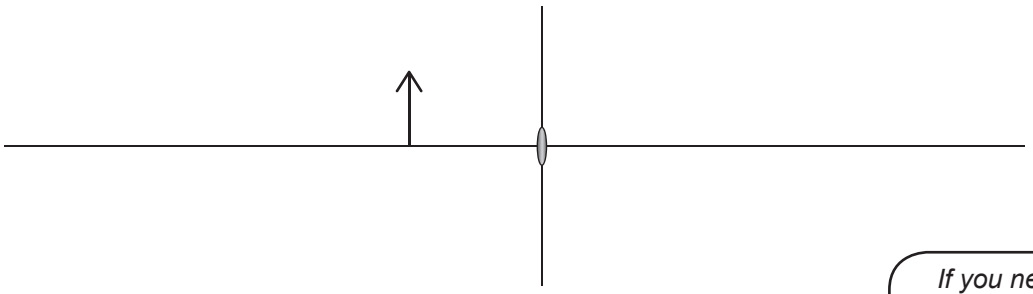
Draw diagrams to help your explanation.

The arrow represents the candle.

Lens with lower refractive index



Lens with higher refractive index



If you need to redraw the paths, use the diagrams on page 10.

QUESTION TWO: REFRACTION

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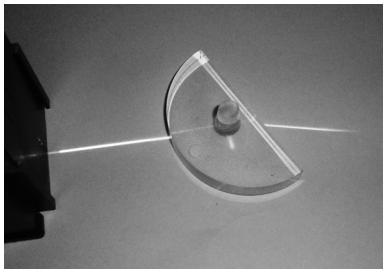
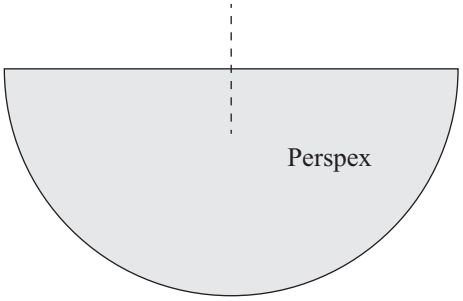
One way to determine the critical angle of Perspex (acrylic glass) is to use a semi-circular Perspex block, through which a ray of light is passed and an angle measured.



(a) Complete the diagram below to show the path of a ray of light when used to determine the critical angle of Perspex.

On your diagram **mark the critical angle**. The normal has been drawn for you.



(b) State two conditions necessary for total internal reflection to occur.

(c) In the above experiment, the critical angle of Perspex was found to be 42°.

Determine the refractive index of Perspex.

The refractive index of air is 1.0.

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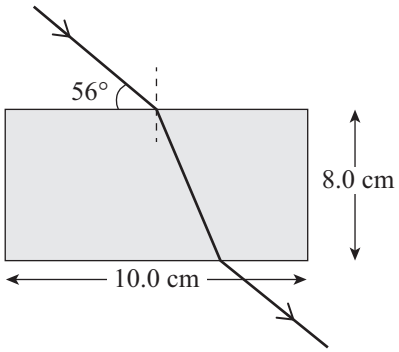
(d) A ray of light is shone through a rectangular block of glass at an angle of 56° to the surface of the glass, as shown in the diagram. The glass block is 10.0 cm long and 8.0 cm wide.

Calculate the distance the ray of light travels through the glass before emerging into the air.

Refractive index of air = 1.0

Refractive index of glass = 1.5



QUESTION THREE: WAVES

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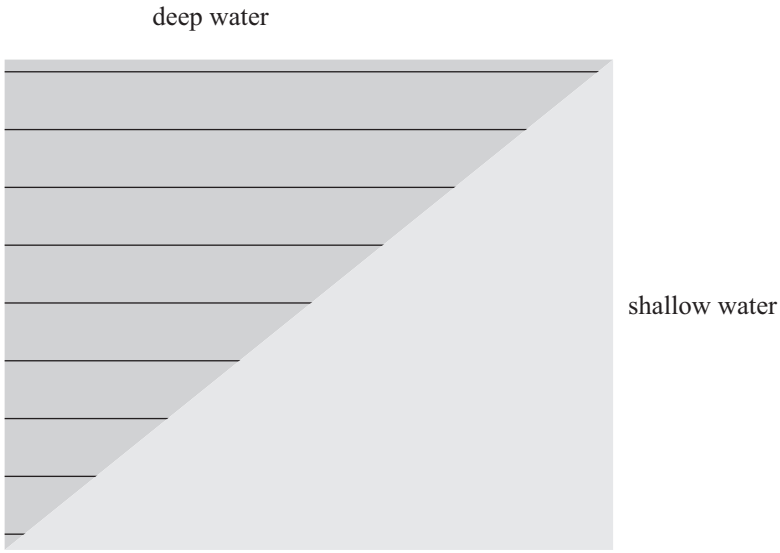
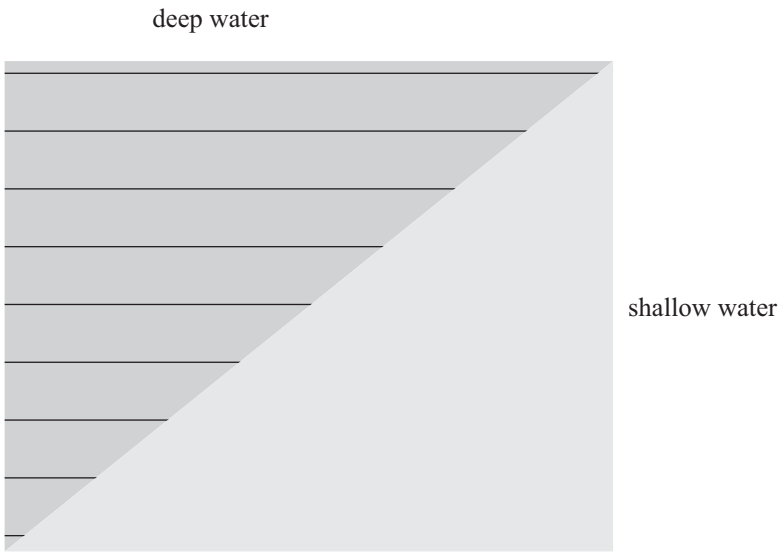
(a) The following diagram shows parallel wave fronts approaching shallow water. Waves travel slower in shallow water.

Complete the diagram with **labelled** arrows showing the following:

- direction of travel **of incident** wavefronts
- direction of travel of **reflected** wavefronts
- direction of travel of **refracted (transmitted**) wavefronts.



(b) Draw the **refracted wavefronts** for the same situation as given above, in the diagram below.



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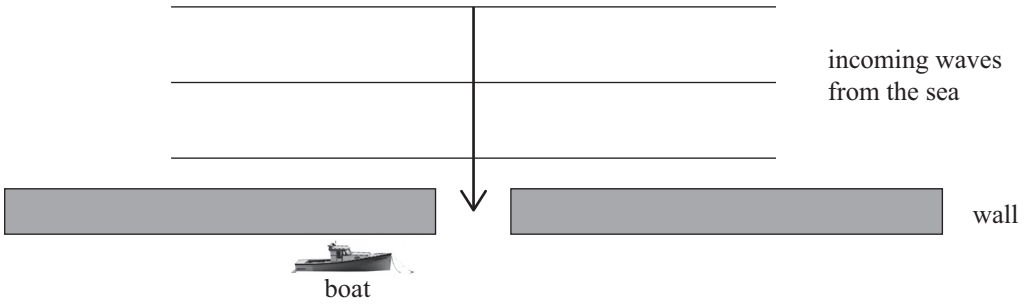
(c) A boat is anchored in a harbour behind a sea-wall separating it from the open sea. There is a gap in between two sea-walls as shown below. A sea-wall is a structure that is built to protect a harbour from waves.

Waves from the sea go towards the gap between the two sea-walls.

On the diagram below, show what happens to the waves once they go through the gap between the two sea-walls. Include direction of the waves in your drawing.

Describe and explain the effect the waves will have on the boat.



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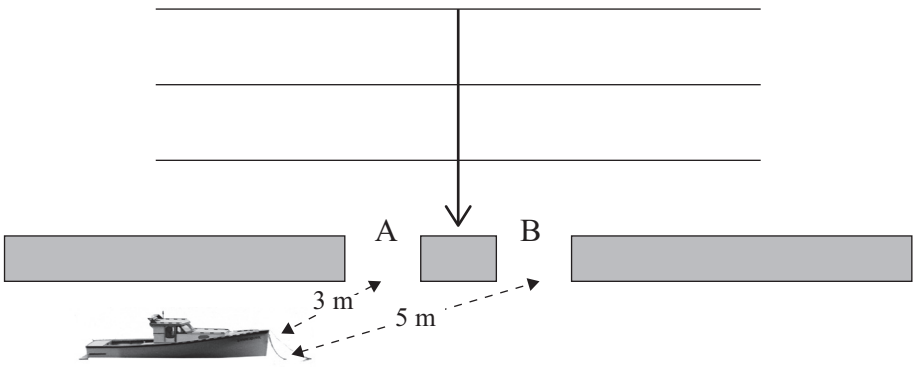
(d) The diagram below shows parallel wavefronts approaching TWO gaps. The wavelength of the waves is 4.0 m. A boat is anchored 3.0 m from gap A and 5.0 m from gap B.

Describe and explain the effect of the waves on the motion of the boat, giving reasons.

In your answer, state what happens to the wavefronts as they go through the two gaps.

Diagram is NOT to scale



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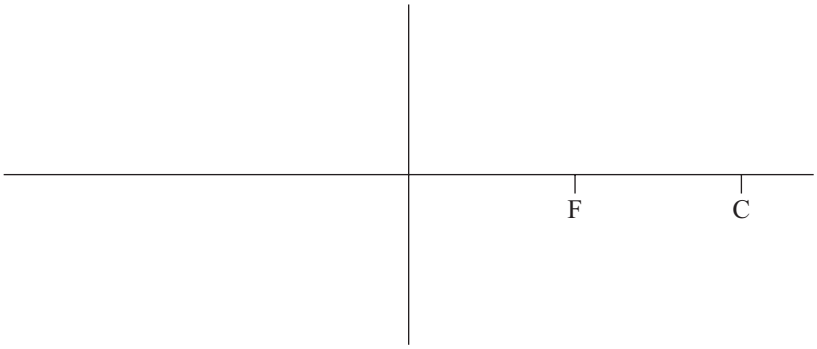
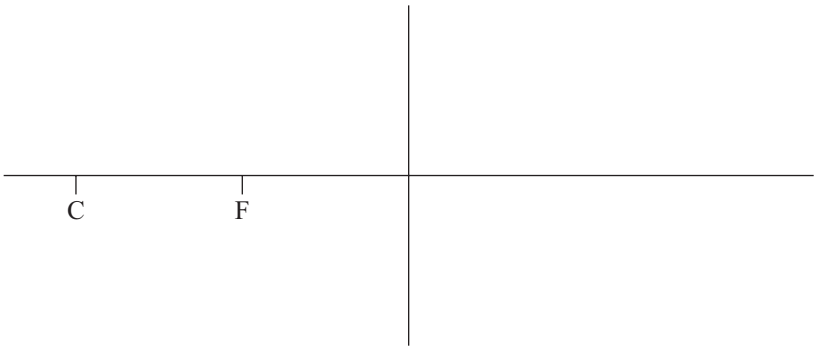
If you need to redraw the paths from Question One (a), draw them on the diagrams below.
Make sure it is clear which diagrams you want marked.

(i) Concave mirror

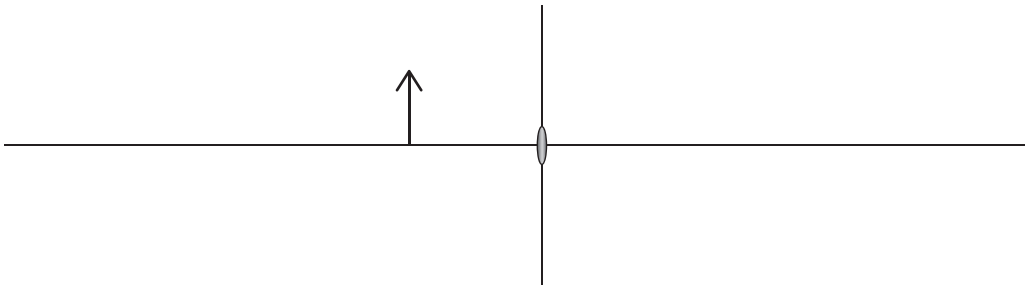


(ii) Convex mirror

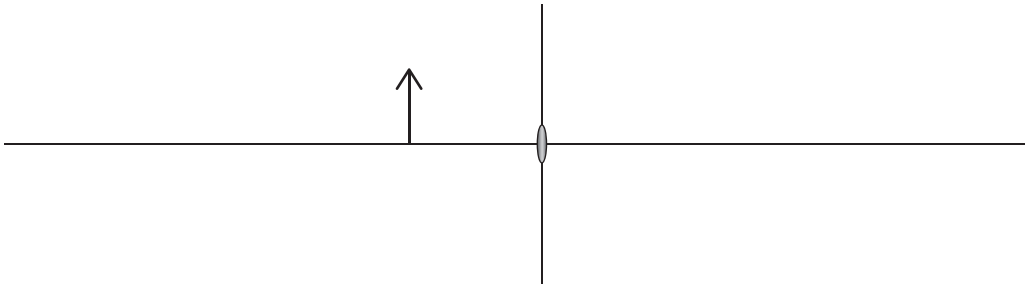


If you need to redraw the paths from Question One (d), draw them on the diagrams below.
Make sure it is clear which diagrams you want marked.

Lens with lower refractive index



Lens with higher refractive index



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

QUESTION NUMBER

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