

91170



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SUPERVISOR'S USE ONLY

Level 2 Physics, 2016

91170 Demonstrate understanding of waves

9.30 a.m. Tuesday 15 November 2016
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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QUESTION ONE: LIGHT

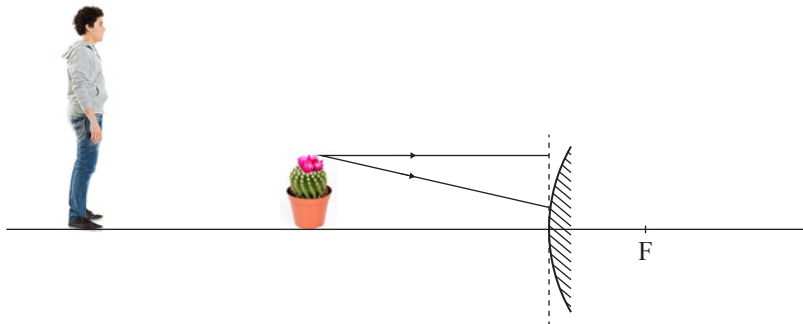
Tim was looking into a convex mirror ball in his garden.

Standing behind a small plant, he noticed that when he looked at the reflection of the plant in the convex mirror, it appeared smaller than it really was.



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If you need to redraw your ray diagram, use the diagram on page 8.

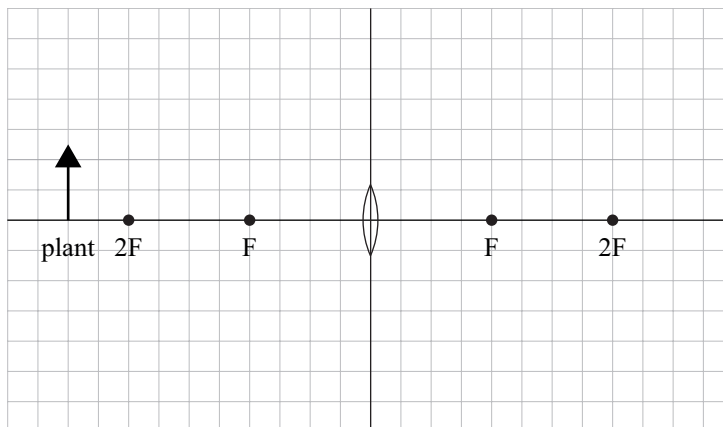


- (a) Complete the simplified ray diagram above (not to scale) to show where the image of the small plant would appear.

Tim used a convex lens to create an image of the small plant. The convex lens has a focal length of 40.0 cm.

- (b) Draw TWO appropriate rays on the diagram below to show where the image of the plant would be formed.

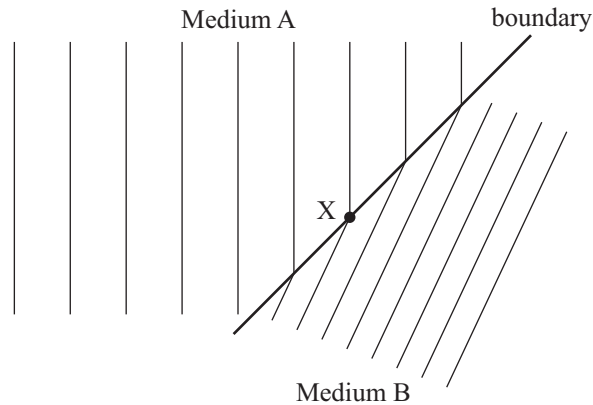
Draw the image in the correct position.



If you need to redraw your ray diagram, use the diagram on page 8.

QUESTION TWO: WATER

Tim looked at the pond in the garden and noticed a pattern in the water caused by the wind. The diagram below shows a simplified pattern of the water waves being refracted as the depth of the water in the pond changes. Refraction occurs at the boundary between the two depths of the pond. The **incident waves** are on the **left** of the boundary.



If you need to redraw your arrows, use the diagram on page 9.

- (a) Draw an arrow to mark on the diagram the direction of the incident wave as it reaches point X. Draw an arrow to mark on the diagram the direction of the refracted wave after it leaves point X.

- (b) (i) Which property of a wave does not change when it is refracted?

- (ii) The wavelength of the wave gets smaller as it enters medium B.

Explain what this tells you about the speed of the wave in medium B.

- (c) If the wavelength of the wave in medium A is 0.300 m, and the speed of the wave in medium A is 3.30 m s^{-1} , calculate the wave speed in medium B if the wavelength of the waves in medium B is 0.200 m.

QUESTION THREE: WASHING THE CAR

Ana is washing her car and notices that she can see drops of water on the windscreen, even though both the glass and the water drops are transparent.



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- (a) Why is Ana able to distinguish between the glass and the water?

Ana tries to sketch a drawing of a large bead of water on the windscreen to help her understand what is happening.

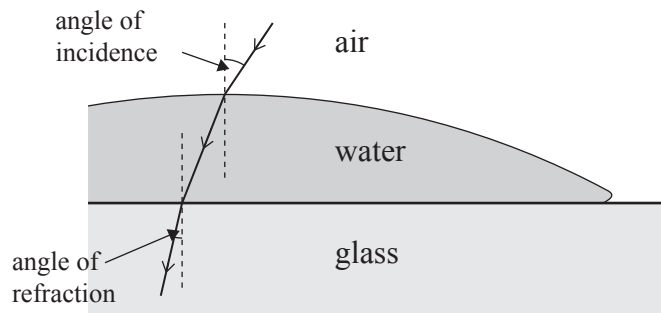
Use the information below to answer part (b).

Refractive index of air = 1.00

Refractive index of water = 1.33

Refractive index of glass = 1.52

Angle of incidence at air-water interface = 32° .



- (b) If the air-water interface and the water-glass interface are roughly parallel, calculate the angle of refraction in the glass (as labelled).

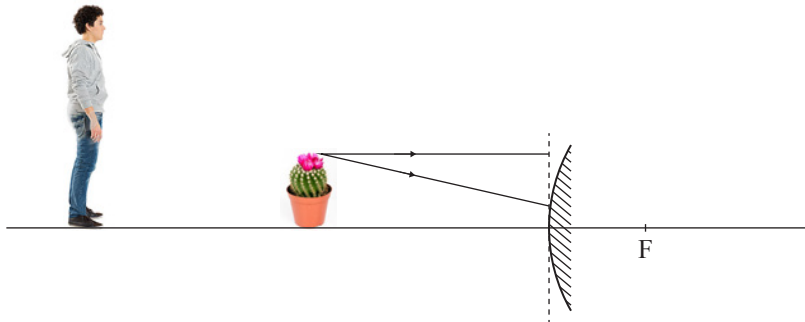
Ana experiments with a red laser, a perspex bottle, and a stream of water, to create total internal reflection.



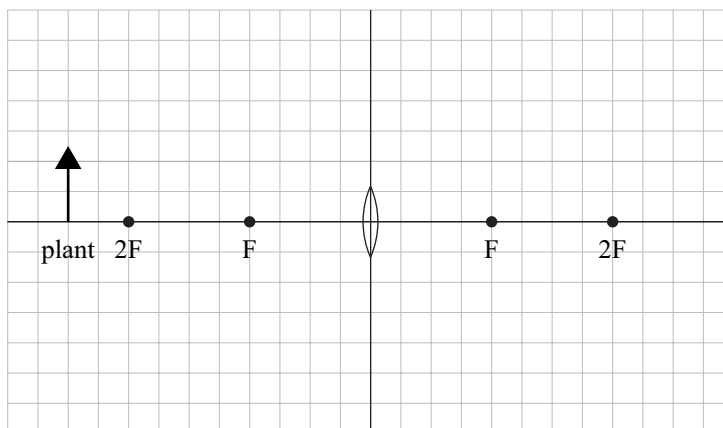
<http://www.aapt.org/programs/contests/winnersfull.cfm?id=2687&theyear=2011>

SPARE DIAGRAMS

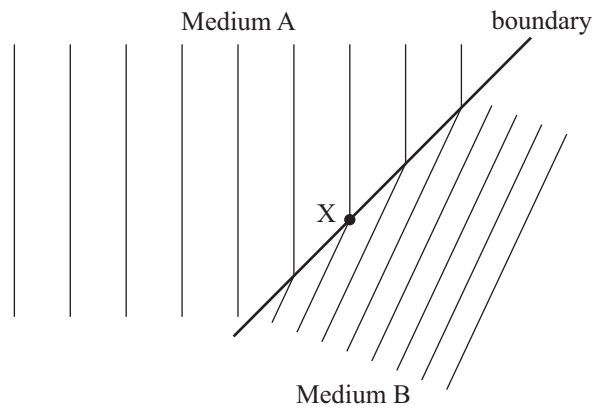
If you need to redraw your ray diagram for Question One (a), use the diagram below. Make sure it is clear which diagram you want marked.



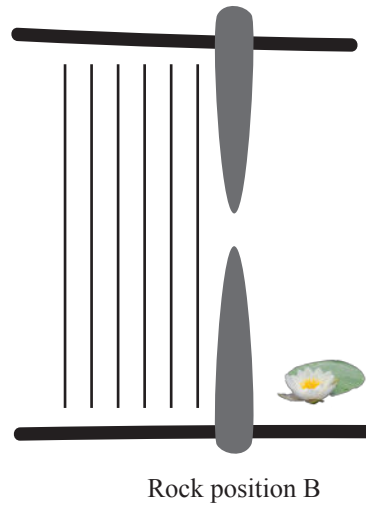
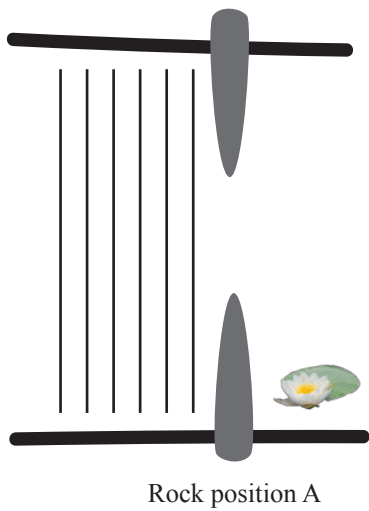
If you need to redraw your ray diagram for Question One (b), use the diagram below. Make sure it is clear which diagram you want marked.



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



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



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