See back cover for an English translation of this cover

2

SUPERVISOR'S USE ONLY

91170M

911705

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Tohua tēnei pouaka mēnā KĀORE koe i tuhituhi i roto i tēnei pukapuka

Ahupūngao, Kaupae 2, 2021

91170M Te whakaatu māramatanga ki te ngaru

Ngā whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki te ngaru.	Te whakaatu māramatanga hōhonu ki te ngaru.	Te whakaatu māramatanga matawhānui ki te ngaru.

Tirohia mēnā e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

Me whakamātau koe i ngā tūmahi KATOA kei roto i tēnei pukapuka.

Tirohia mēnā kei a koe te Puka Rauemi L2–PHYSMR.

Ki roto i ō tuhinga, whakamahia ngā whiriwhiringa tohutau mārama, ngā kupu, ngā hoahoa hoki, tētahi, ētahi rānei o ēnei, ki hea hiahiatia ai.

Me hoatu te wae tika o te Pūnaha o te Ao (SI) ki ngā whakautu tohutau.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te wāhi wātea kei muri i te pukapuka nei.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–23 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

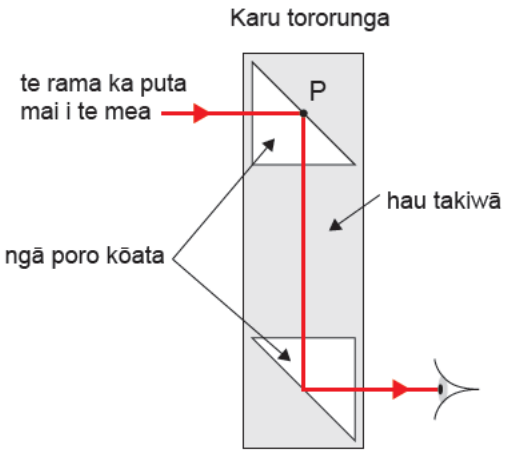
Kaua e tuhi ki roto i tētahi wāhi kauruku whakahāngai (✂). Ka tapahia pea tēnei wāhi ina mākahia te pukapuka.

ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

TŪMAHI TUATAHI: HE HAERENGA KI TE ĀKAU

Ka hīkoi a Fred rāua ko tana tuahine tamariki ake a Mary i te ara pātū o te whanga kia titiro atu ai rāua mai i te pito. He teitei rawa te pātū moana mō Mary ki te titiro atu ki tua, nō reira ka hoatu e Fred he karu tororunga ki a Mary kia titiro atu ia ki tua o te pātū. Whakamahia ai e te karu tororunga ngā poro kōata e rua.

Mātāpuna: www.gettyimages.co nz/detail/photo/brighton-marina-harbour-wall-royalty-free-image/1145994471?adppopup=true



Ko te taupū hakoko o te hau takiwā: 1.00

Ko te taupū hakoko o te kōata: 1.52

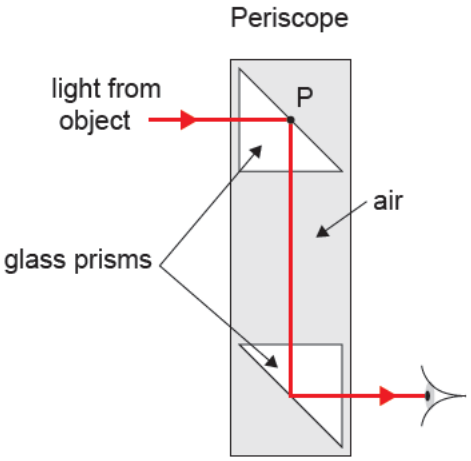
(a) Whakaingoatia te tītohunga ahupūngao e pā mai ai i te paenga kōata/hau takiwā i te pūwāhi P kei te hoahoa i runga.

(b) Tātaihia te tino koki e hiahiatia ana e pā mai ai taua tītohunga i te karu tororunga.

QUESTION ONE: TRIP TO THE COAST

Fred and his younger sister Mary walk along the harbour wall path to look at the view from the end. The sea wall is too high for Mary to see over, so Fred gives Mary a periscope to look over the wall. The periscope uses two glass prisms.

Source: www.gettyimages.co nz/detail/photo/brighton-marina-harbour-wall-royalty-free-image/1145994471?adppopup=true



Refractive index of air: 1.00
Refractive index of glass: 1.52

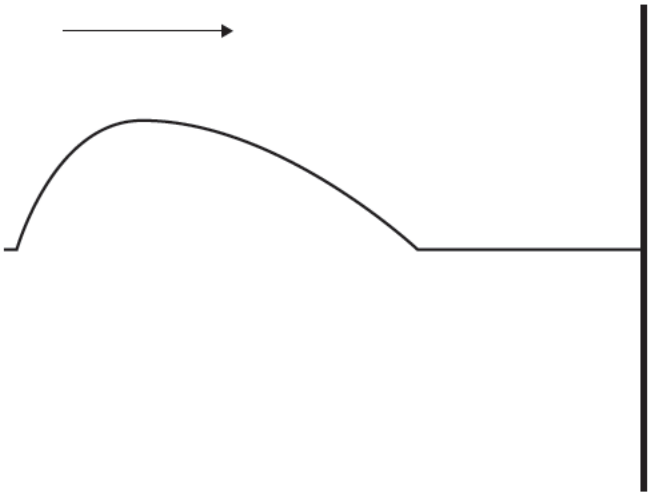
(a) Name the physics phenomenon that is occurring at the glass / air boundary at point P in the above diagram.

(b) Calculate the critical angle required for this phenomenon to take place in the periscope.

(c) **I te pito o te pātū he pōhi kei reira e mau ana tētahi taura.**

Ka hopukina atu e Mary rāua ko Fred te pito tawhiti o te taura ka tuku i tētahi ngātere[1] e ai ki te whakaaturanga i raro. Ka mātakitaki rāua ka aha.

Source: www.pxfuel.com/en/free-photo-enbfm



Ki te hiahia koe ki te tātuhi anō i tō urupare, whakamahia te hoahoa i te whārangi 18.

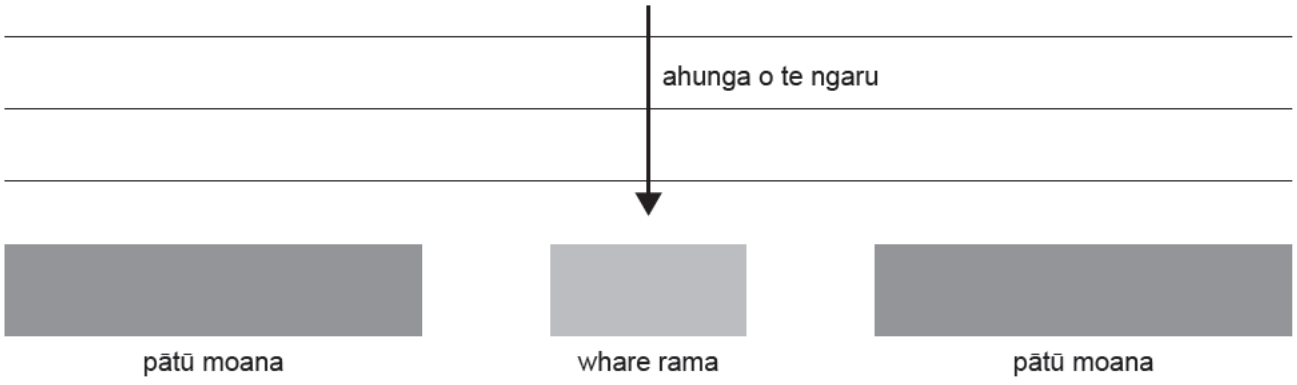
Whakaotihia te hoahoa i runga nei hei whakaatu i te ngātere whakaata.

(d) I a rāua e titiro atu ana ki tua o te pātū, ka kite rāua he nui ngā ngaru i ētahi wāhi, ā, kāore he wāhi i ētahi atu wāhi o te whanga.

E whakaaturia ana te tauira o te whanga i roto i te hoahoa i raro.

(i) Whakaotihia te hoahoa hei whakaatu i ngā ngaru i muri i te putanga atu mā ngā āputa i waenga i ngā pātū moana me te whare rama.

Ki te hiahia koe ki te tātuhi anō i tō urupare, whakamahia te hoahoa i te whārangi 18.

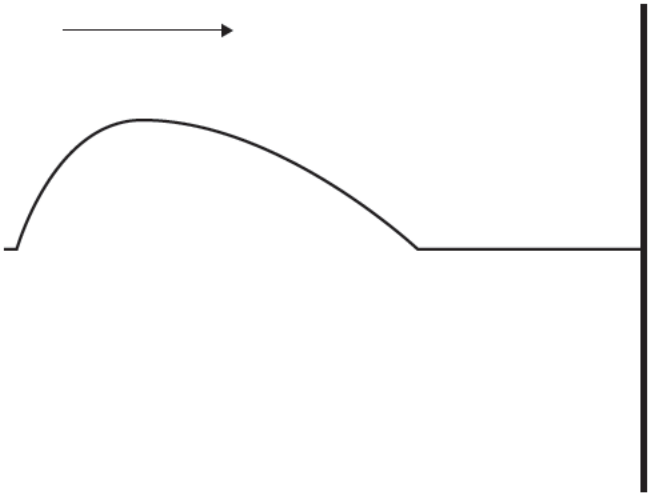


[1] tōiriiri

(c) **At the end of the wall there is a post with a rope attached.**

Mary and Fred grab the far end of the rope and send a pulse down the rope as shown below. They observe what happens.

Source: www.pxfuel.com/en/free-photo-enbfm



If you need to redraw your response, use the diagram on page 19.

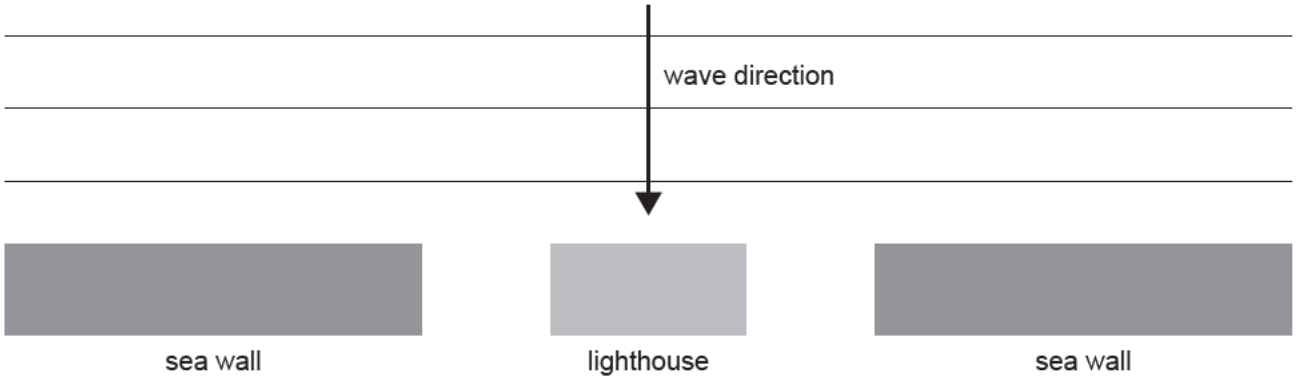
Complete the diagram above to show the reflected pulse.

(d) As they look over the wall, they notice that there are large waves in some areas, and no waves at all in other areas of the harbour.

The harbour has the design shown in the diagram below.

(i) Complete the diagram to show the waves after they pass through the gaps between the sea walls and the lighthouse.

If you need to redraw your response, use the diagram on page 19.

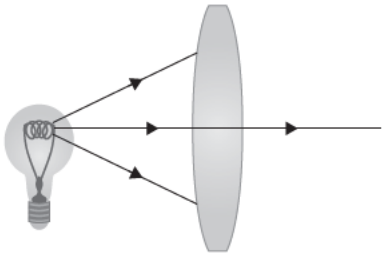


(ii) Whakamahia ngā mātāpono ahupūngao hei whakamārama he aha te pūtake e nui ai ngā ngaru i ētahi wāhanga o te whanga, ā, kāore he ngaru i ētahi atu wāhanga.

(ii) Use physics principles to explain what causes some parts of the harbour to have large waves and other parts to have none.

TŪMAHI TUARUA: WHARE RAMA

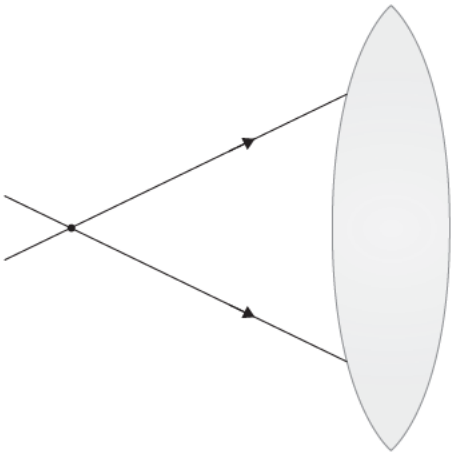
Ka kite a Fred i tētahi whare rama i te taha o te whanga ka whakamātau ia ki te whiriwhiri he pēhea te puta o tētahi haeata. Ka kite ia ka whakawhiti ngā hihi mai i tētahi pūtake rama mā tētahi arotahi[2] ka whakaputa hei haeata whakarara.



(a) Tautuhia te momo arotahi ka whakatau ki hea tū ai te pūrama kia puta ai he haeata whakarara.

(b) Ka taea te hoahoa hihi te whakarūnā hei whakaatu i ngā hihi tūrama e rua anake kia pēnei:

Ki te hiahia koe ki te tātuhi anō i tō urupare, whakamahia te hoahoa i te whārangi 20.

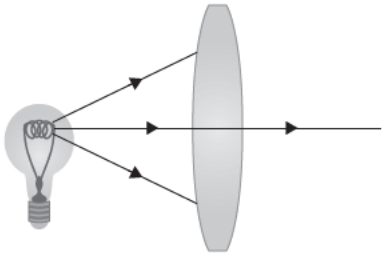


Whakaotihia te hoahoa hihi i runga ake kia tika te whakaatu he pēhea te rere o te tūrama i te kuhunga atu **me te** putanga mai o te arotahi.

[2] mōhiti

QUESTION TWO: THE LIGHTHOUSE

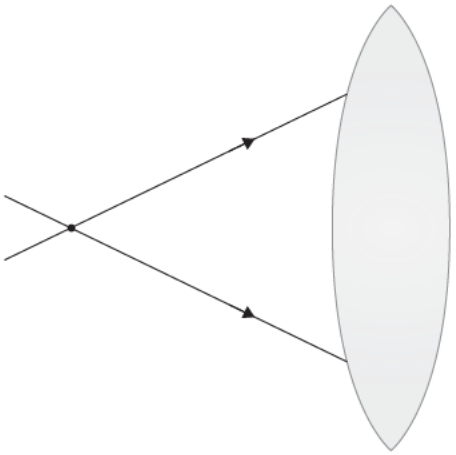
Fred sees a lighthouse by the harbour and tries to work out how it creates the beam of light. He discovers that rays from a point source of light pass through a lens and emerge as a parallel beam.



(a) Identify the type of lens and state where the lamp must be positioned in order to get a parallel beam out.

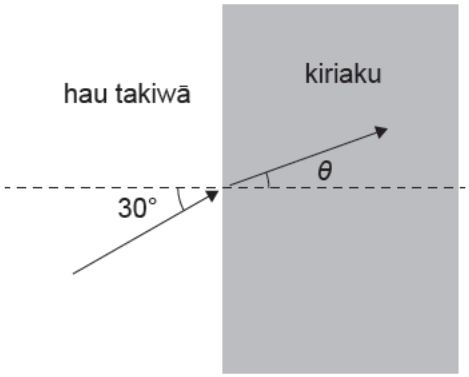
(b) The ray diagram can be simplified to show just two rays of light as follows:

If you need to redraw your response, use the diagram on page 21.



Complete the ray diagram above accurately to show how the light travels as it enters **and** exits the lens.

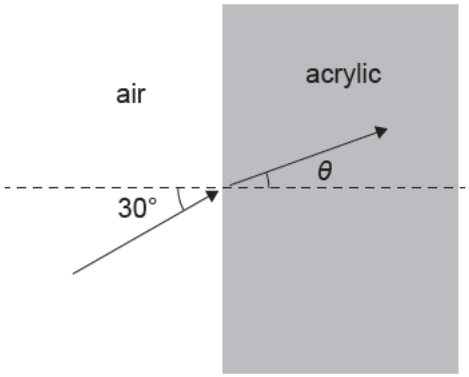
(c) I roto i te taiwhanga, ka whakatīaho a Fred i tētahi hihi tūrama ki te koki whakapā o te 30° ki tētahi poraka kiriaku kōata. Ko 1.0 te taupū hakoko o te hau. He 3.0×10^8 m s^{-1} te tere o te tūrama i te hau takiwā, ā, he 2.0×10^8 m s^{-1} te tere o te tūrama i te kiriaku kōata.



(i) Me whakaatu ko te taupū hakoko o te kiriaku kōata he 1.5.

(ii) **Tātaihia a** θ, te koki o te hihi hakoko i te kiriaku kōata.

(c) Back in the laboratory, Fred shines a ray of light at an angle of incidence of 30° into an acrylic block. The refractive index of air is 1.0. The speed of light in air is 3.0×10^8 m s^{-1}, and the speed of light in acrylic is 2.0×10^8 m s^{-1}.



(i) Show that the refractive index of acrylic is 1.5.

(ii) **Calculate** θ, the angle of the refracted ray in the acrylic.

(d) Ka raua e Fred tētahi mea kia 7.0 cm te tawhiti i mua o tētahi arotahi koropuku me te roa ngahunga o te 5.0 cm.

(i) Tātaihia te tawhiti i waenga i te mātātuhi me te arotahi.

(ii) Tātaihia te whakarahi.

(iii) Whakamahia ngā kupu e tika ana i tīpakohia mai i

tūturu, mariko, whakaiti, whakarahi, poutū, kōaro

hei whakaahua i ngā āhuatanga o te mātātuhi kua puta mai.

(d) Fred places an object 7.0 cm in front of a convex lens with focal length 5.0 cm.

(i) Calculate the distance of the image from the lens.

(ii) Calculate the magnification.

(iii) Use appropriate words selected from

real, **virtual**, **diminished**, **enlarged**, **upright**, **inverted**

to describe the properties of the image formed.

TŪMAHI TUATORU: TE MOTOKĀ

Ka kite a Fred i te whakatūpato "He tata ake te mea tūturu i te mea i rō whakaata" kua tāngia ki te whakaata **koropuku** kei te taha o tōna motokā.

Mātāpuna: www.dreamstime.com/stock-photo-wing-mirror-view-passenger-side-car-view-wing-mirror-car-driving-road-image98162488

(a) Whakaahuatia te momo mātātuhi kua puta i ngā whakaata koropuku.

(b) Whakamāramatia te take he koretake noa iho ngā whakaata **kōpapa** hei whakaata motokā kia kite ai i ngā mea mamao.

(c) Whakaotihia te hoahoa hihi i raro hei kimi i te mātātuhi ka puta i tētahi whakaata **koropuku**.

Ki te hiahia koe ki te tātuhi anō i tō urupare, whakamahia te hoahoa i te whārangi 20.

QUESTION THREE: THE CAR

Fred notices the warning "Objects in mirror are closer than they appear" printed on a **convex** side mirror of his car.

Source: www.dreamstime.com/stock-photo-wing-mirror-view-passenger-side-car-view-wing-mirror-car-driving-road-image98162488

(a) Describe the type of image always formed by convex mirrors.

(b) Explain why **concave** mirrors would be no good as car mirrors to see distant objects.

(c) Complete the ray diagram below to locate the image formed by a **convex** mirror.

If you need to redraw your response, use the diagram on page 21.

(d) Ko tētahi motokā 1.5 m te teitei, he 5.0 m te tawhiti i muri i a Fred. Ina titiro a Fred ki tana whakaata **koropuku** he 20 cm te roa ngahunga, ka kite ia i tētahi mātātuhi o te waka.

Tātaihia te tawhiti ME te teitei o te mātātuhi e kitea ana e Fred i te whakaata.

Tawhiti o te mātātuhi = _____

Teitei o te mātātuhi = _____

(d) A car 1.5 m high is 5.0 m behind Fred. When Fred looks in his **convex** mirror of focal length 20 cm, he sees an image of the car.

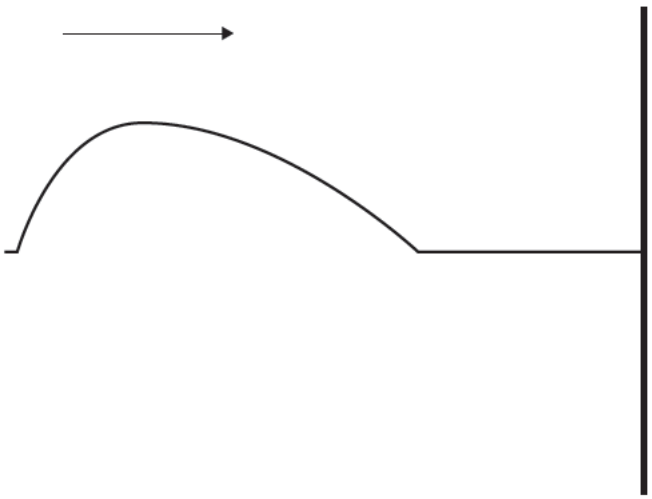
Calculate the distance AND height of the image that Fred sees in the mirror.

Image distance = _____

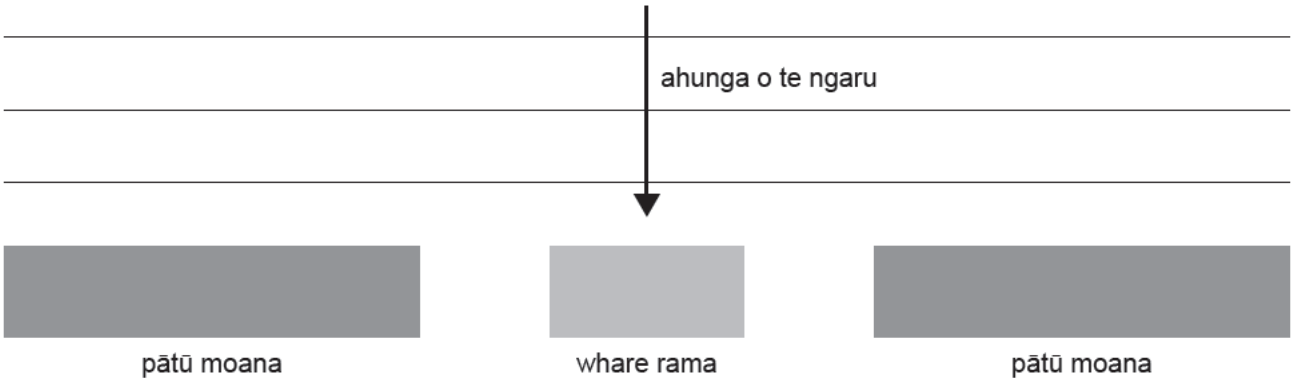
Image height = _____

HE HOAHOA WĀTEA

Ki te hiahia koe ki te tātuhi anō i tō urupare ki te Tūmahi Tuatahi (c), whakamahia te hoahoa i raro nei. Kia mārama te tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.

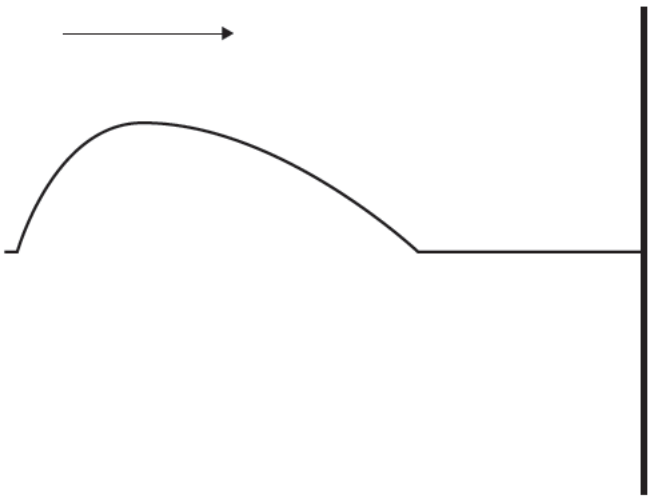


Ki te hiahia koe ki te tātuhi anō i tō urupare ki te Tūmahi Tuatahi (d)(i), whakamahia te hoahoa i raro nei. Kia mārama te tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.

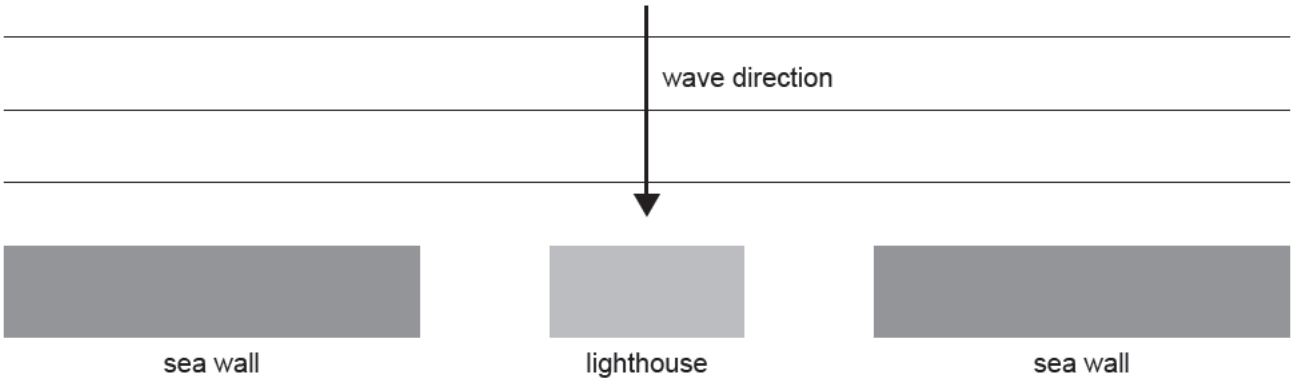


SPARE DIAGRAMS

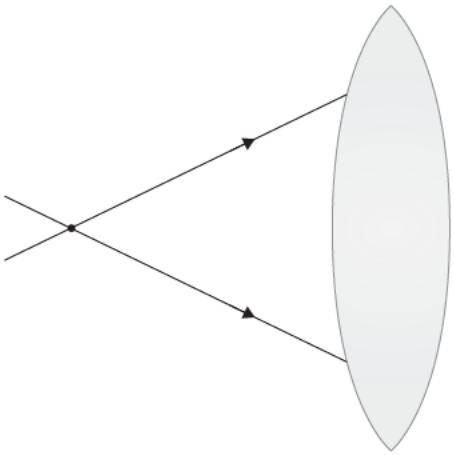
If you need to redraw your response to Question One (c), use the diagram below. Make sure it is clear which answer you want marked.



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

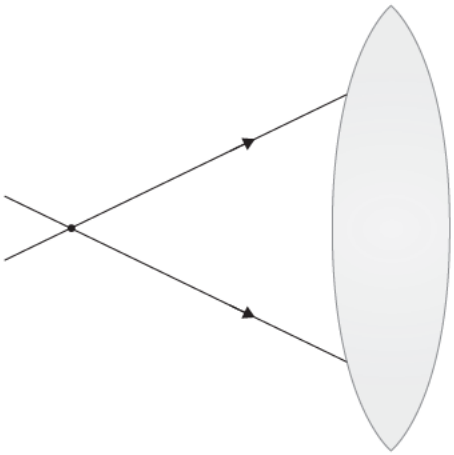


Ki te hiahia koe ki te tātuhi anō i tō urupare ki te Tūmahi Tuarua (b), whakamahia te hoahoa i raro nei. Kia mārama te tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.



Ki te hiahia koe ki te tātuhi anō i tō urupare mō te Tūmahi Tuatoru (c), whakamahia te hoahoa i raro nei. Kia mārama te tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.

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



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

He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

TAU TŪMAHI

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

QUESTION NUMBER

English translation of the wording on the front cover

Level 2 Physics 2021

91170M Demonstrate understanding of waves

Credits: Four

91170M

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–PHYSMR.

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 room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–23 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (//). This area may be cut off when the booklet is marked.

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