

See back cover for an English
translation of this cover

2

91170M



911705



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

SUPERVISOR'S USE ONLY

Ahupūngao, Kaupae 2, 2014

91170M Te whakaatu māramatanga ki te ngaru

2.00 i te ahiahi Rātū 18 Whiringa-ā-rangi 2014
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 mehemea e ōrite ana te Tau Ākonga ā-Motu (NSN) kei tō pepa whakauru ki te tau kei runga ake nei.

Me whakautu e koe ngā pātai KATOA kei roto i te pukapuka nei.

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

Ki roto i ō whakautu, whakamahia ngā whiriwhiringa tohutu mārama, ngā kupu, ngā hoahoa hoki/rānei ki hea hiahiatia ai.

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

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te (ngā) whārangi kei muri i te pukapuka nei, ka āta tohu ai i ngā tau pātai.

Tirohia mehemea kei roto nei ngā whārangi 2–19 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

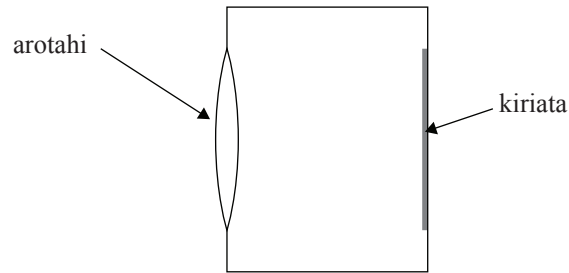
HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

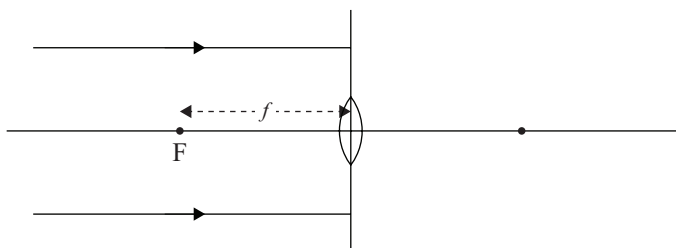
MĀ TE KAIMĀKA ANAKE

PĀTAI TUATAHI: TE KĀMERA

Kei te hararei a Moana i te ākau, ā, kei a ia tētahi kāmara raro wai maka atu. He rite te kāmara ki tētahi pouaka whai arotahi¹ i mua me tētahi kiriata i muri, e ai ki te hoahoa i raro.



- (a) Whakaotihia te hoahoa i raro ka whakaatu ka ahatia ngā hihi aho e rua.

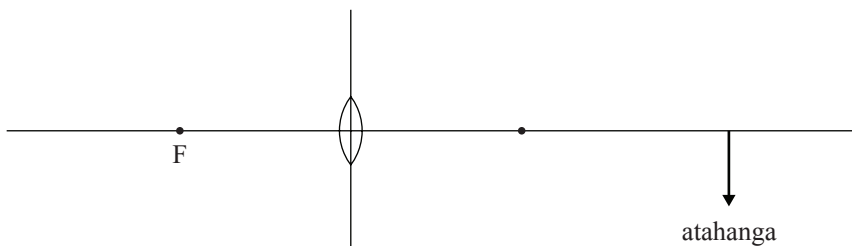


Ki te hiahia koe ki te tuhi anō i tēnei hoahoa, whakamahia te hoahoa i te whārangi 14.

- (b) E whakaatu ana te hoahoa i raro i te **atahanga** ka puta ki te kiriata ina tango whakaahua a Moana.

Tātuhia kia rua ngā hihi ki te hoahoa hei tohu i te pūwāhi o te **ahanoa**.

Tuhia te **āhua** o te atahanga (arā, tūturu, mariko RĀNEI).



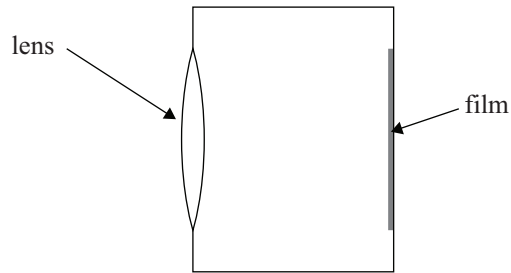
Ki te hiahia koe ki te tuhi anō i tēnei hoahoa, whakamahia te hoahoa i te whārangi 14.

Te āhua o te atahanga: _____

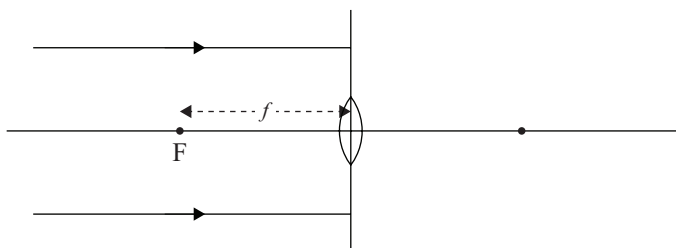
¹ mōhiti

QUESTION ONE: THE CAMERA

Moana is on holiday at the beach and has a disposable underwater camera. The camera is like a box with a lens at the front and a film at the back, as shown in the diagram below.



- (a) Complete the diagram below showing what happens to the two light rays.

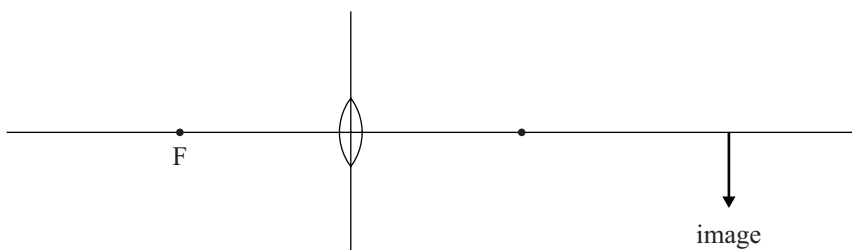


If you need to redraw this, use the diagram on page 15.

- (b) The diagram below shows the **image** formed on the film when Moana takes a picture.

Draw two rays to locate the position of the **object**.

State the **nature** of the image (real OR virtual).



If you need to redraw this, use the diagram on page 15.

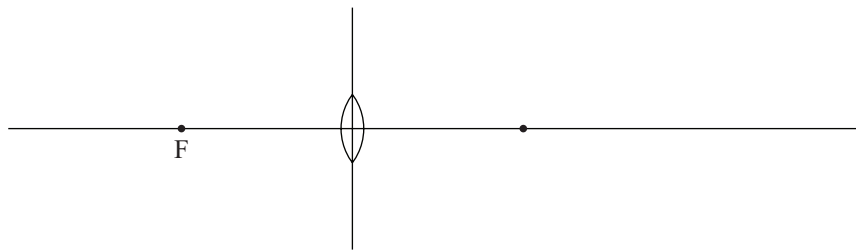
Nature of image: _____

- (c) Ka tango whakaahua anō a Moana. He 1.5 cm te teitei o te atahanga, ā, he 5.5 cm mai i te arotahi. Ko te roa ngahunga o te arotahi he 5.0 cm.

Tātaihia te teitei o te ahanua e whakaahuahia ana e ia.

- (d) Whakamāramahia mai he aha i kore ai e taea e Moana te whakaahua tētahi ahanua tata ake i te 5.0 cm.

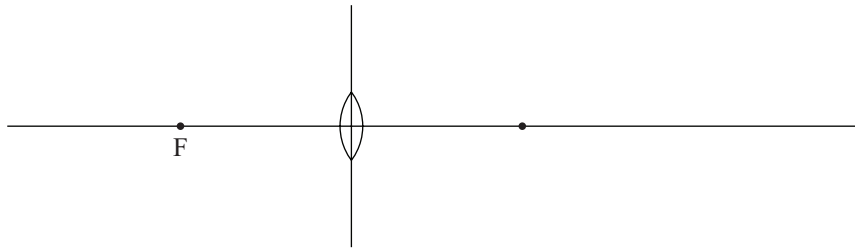
Whakamahia te hoahoa i raro hei whakamārama i tō whakautu.



- (c) Moana takes another picture. The image is 1.5 cm high and 5.5 cm from the lens. The focal length of the lens is 5.0 cm.

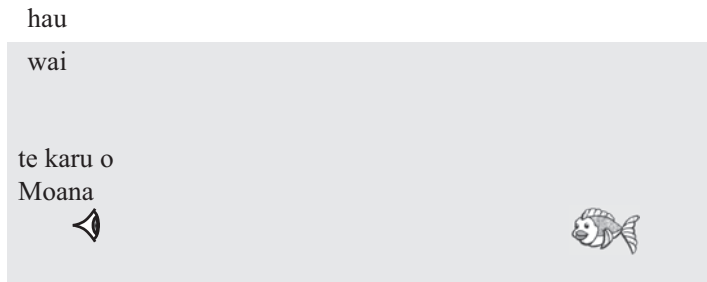
Calculate the height of the object that she is taking a picture of.

- (d) Explain why Moana cannot take a picture of any object closer than 5.0 cm.
Use the diagram below to explain your answer.



PĀTAI TUARUA: KEI TE ĀKAU

Kei te kaukau a Moana i raro i te wai. Kei te kite ia i tētahi ika, ā, kei te kite anō ia i tētahi atahanga o te ika ka puta nā te whakaata o te aho i te matawehe wai/hau.



Ki te hiahia koe ki te tuhi anō i tēnei hoahoa, whakamahia te hoahoa i te whārangi 14.

- (a) Tuhia te ingoa whānui o te tukanga e kite ai a Moana i te atahanga o te ika e whakaata ana i te matawehe wai/hau.

Tātuhia tētahi hihi ki te hoahoa i runga ake hei whakaatu i tēnei tukanga.

- (b) Ko te tino koki o te matawehe wai/hau he 47° . Ko 1.0 te taupū hakoko o te hau.

Tātaihia te taupū hakoko o te wai.

- (c) Ka puta he taiaho whero mai i te hau ki te wai.

Tātaihia te **roangaru** me te **auautanga** o te taiaho i te wā e rere ana i te wai.

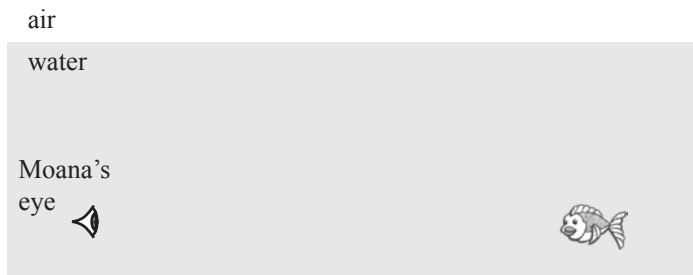
Ko te tere o te aho i roto i te hau ko te $3.0 \times 10^8 \text{ m s}^{-1}$.

Ko te roangaru o te aho whero i te hau he $6.5 \times 10^{-7} \text{ m}$.

QUESTION TWO: AT THE BEACH

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Moana is swimming under the water. She can see a fish, and she can also see an image of the fish caused by light reflecting at the water/air interface.



*If you need
to redraw this,
use the diagram
on page 15.*

- (a) State the full name of the process by which Moana can see the image of the fish reflecting at the water/air interface.

Draw one ray on the above diagram to show this process.

- (b) The critical angle at the water/air interface is 47° . The refractive index of air is 1.0.

Calculate the refractive index of the water.

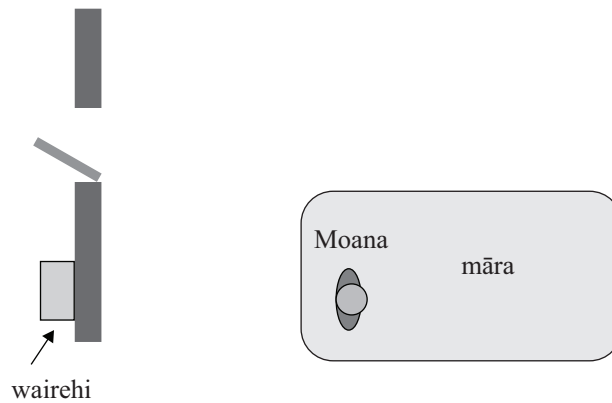
- (c) A beam of red light passes from the air into the water.

Calculate the **wavelength** and the **frequency** of the light beam as it travels through the water.

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

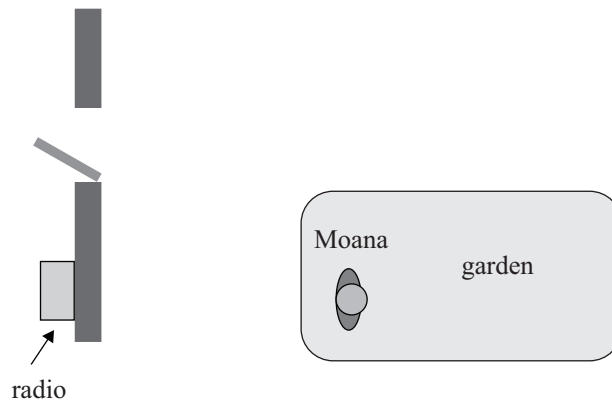
The wavelength of red light in air is $6.5 \times 10^{-7} \text{ m}$.

- (d) Kei roto a Moana i tana māra, kei waho tonu o tōna rūma. Kei te tangi he waerehi i roto i tōna rūma ka mutu kei te tuwhera te kūaha o tōna rūma.



Mā te whakataurite i ngā roangaru o te aho me ngā ngaru oro, matapakitia he aha i taea ai e Moana te rongo, ēngari kāore e kite, te waerehi.

- (d) Moana is in her garden, which is just outside her room. There is a radio playing in her room and the door of her room is open.



By comparing the wavelengths of light and sound waves, discuss why Moana can hear, but not see, the radio.

PĀTAI TUATORU: TE MĀTAKI I NGĀ NGARU

- (a) Kei te mātaki a Moana i ngā ngaru wai kei te kuhu mai ki te ākau. Ko tana whakataua tata mō te tere o te ngaru he 0.50 m s^{-1} me te roangaru he 1.2 m .

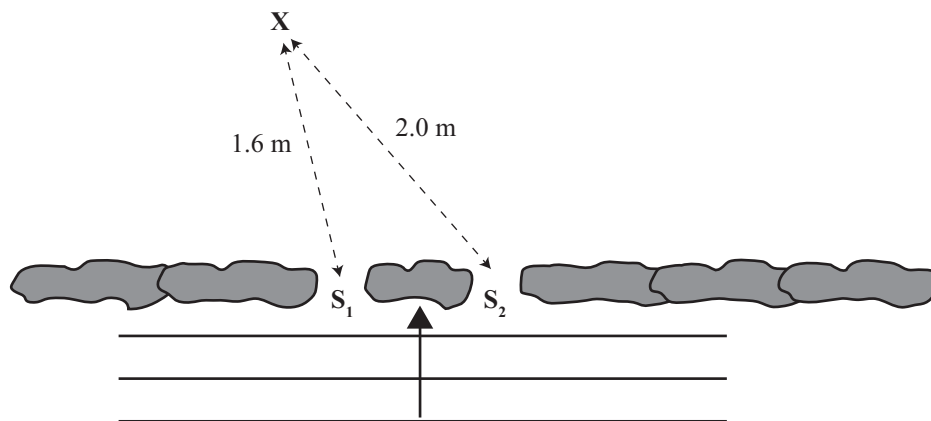
Tātaihia te auautanga o ngā ngaru.

Tuhia tō whakautu ki te waeine tōtika me te tau tika o ngā mati tāpua.

- (b) I tētahi atu wāhi, e rua ngā puare (i tapaina ko S_1 me S_2) kei te rārangi toka. Kei te hipa tētahi huinga ngaru mā ngā puare, e puta ai he tauira whakararuraru.

Ko te rerekētanga i waenga i ngā tawhiti mai i S_1 ki X me S_2 ki X he 0.40 m .

Ko te tere o te ngaru he 0.80 m s^{-1} ka mutu ka tae tētahi ngaru ki te pātū i ia hēkona.



Ko te pūwāhi X kei tētahi pona (node), kei tētahi pae mōrahi (antinode) rānei?

Whakamāramatia tō whakautu.

QUESTION THREE: WATCHING THE WAVESASSESSOR'S
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- (a) Moana is watching water waves coming into the beach. She estimates the wave speed to be 0.50 m s^{-1} and the wavelength to be 1.2 m .

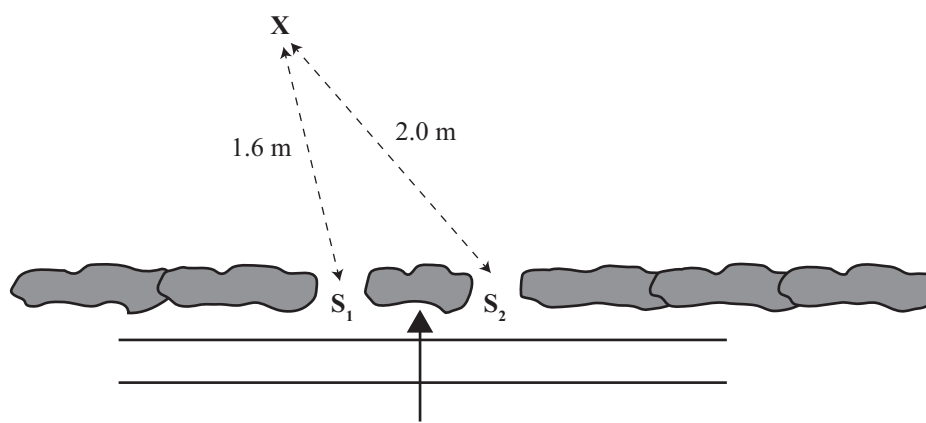
Calculate the frequency of the waves.

Give your answer with the correct unit and correct number of significant figures.

- (b) At another place there are two gaps (labelled S_1 and S_2) in the line of rocks. There is a set of waves passing through the gaps, creating an interference pattern.

The difference between the distances from S_1 to X and S_2 to X is 0.40 m .

The wave speed is 0.80 m s^{-1} and one wave reaches the wall every second.

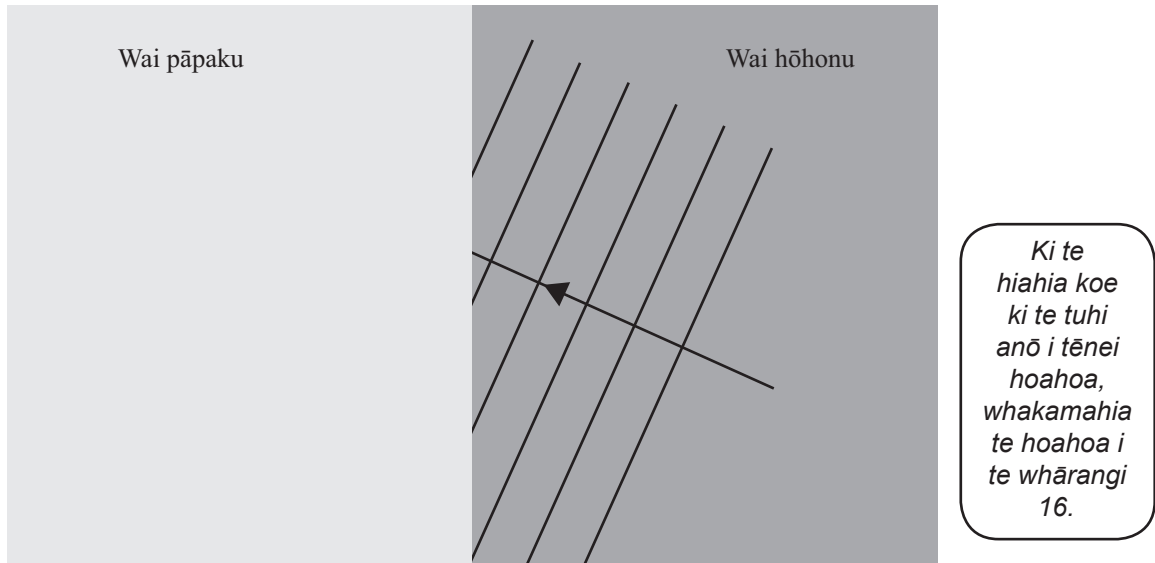


Is the point X at a node or an antinode?

Explain your answer.

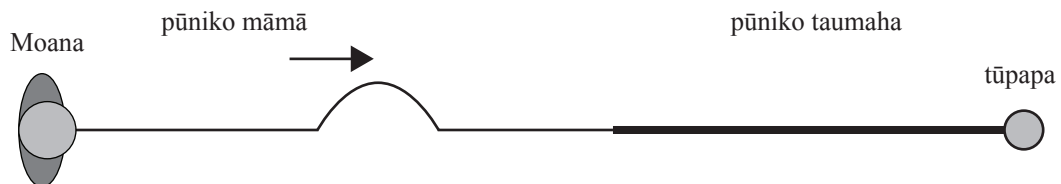
- (c) Ka mātaki a Moana i ngā ngaru e haere mai ana i te wai hōhonu ki te wai pāpaku. I te wai pāpaku, he pōturi ake te haere o ngā ngaru, tēnā i te wai hōhonu.

Whakaotihia te hoahoa e whakaatu ana i ngā **matangaru** me te **ahunga ngaru** i roto i te wai pāpaku.



- (d) I te kura, ka tūhurahura a Moana i ngā ngaru kei roto i ngā pūniko. Ka tūhono ia i tētahi pūniko māmā ki tētahi pūniko taumaha, ā, ka here i te pūniko taumaha ki te waewae o tētahi tūpapa. Ka tukuna e Moana tētahi tōiri kotahi ki te pūniko māmā, e ai ki te hoahoa i raro.

(He tere ake te rere o ngā ngaru i tētahi pūniko māmā i tētahi pūniko taumaha.)



E whakaatu ana te hoahoa i raro i te tōiri i muri i tana nekehanga atu ki te pūniko taumaha.



Ki taua hoahoa anō, tātuhia te tōiri e whakaatahia ana i te pūniko māmā e whakaatu ana i te:

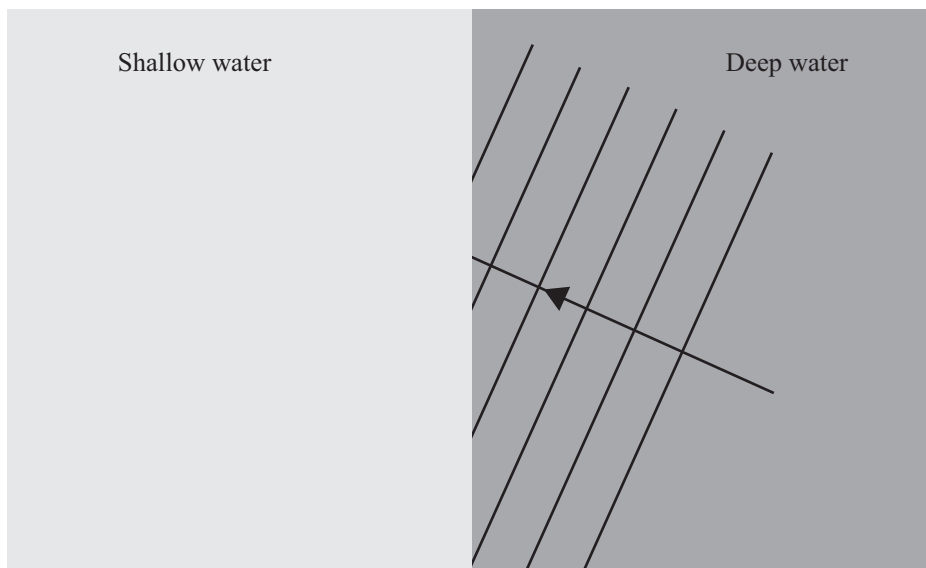
- **takanga** o te tōiri
- **tawhiti o te haere** o te tōiri.

Homai ētahi take mō tō whakautu.

Ki te hiahia koe ki te tuhi anō i tēnei hoahoa, whakamahia te hoahoa i te whārangi 16.

- (c) Moana watches the waves travel from deep to shallow water. In shallow water, the waves travel more slowly, compared to in deep water.

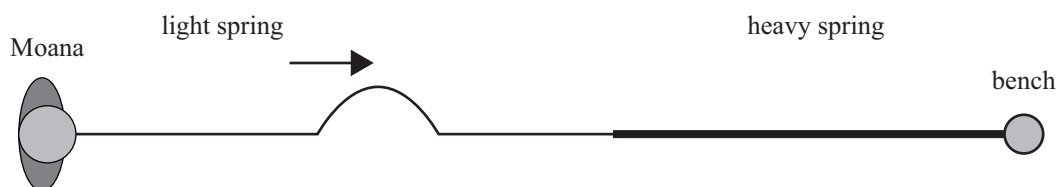
Complete the diagram showing the **wavefronts** and the **wave direction** in the shallow water.



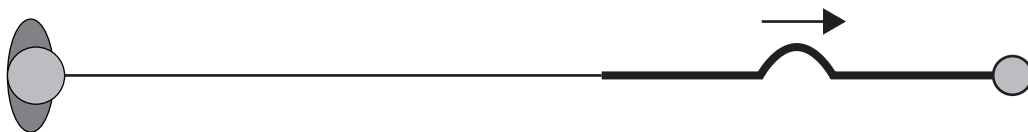
If you need to redraw this, use the diagram on page 17.

- (d) At school, Moana investigates waves in springs. She connects a light spring to a heavy spring, and ties the heavy spring to the leg of a bench. Moana sends a single pulse along the light spring, as shown in the diagram below.

(Waves travel faster in a light spring than in a heavy spring.)



The diagram below shows the pulse after it has moved into the heavy spring.



On the same diagram, draw the pulse reflected in the light spring showing:

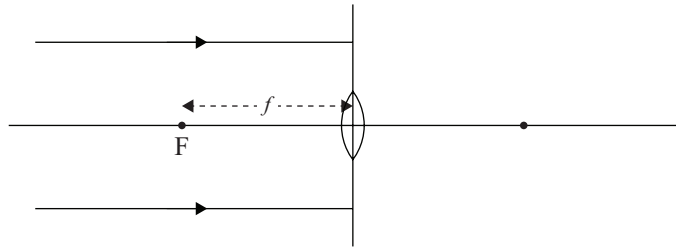
- the **phase** of the pulse
- the **distance travelled** by the pulse.

Give reasons for your answer.

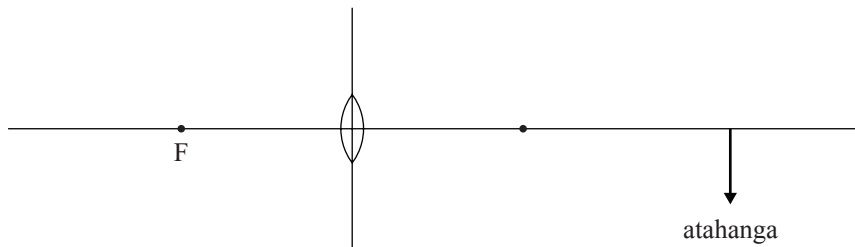
If you need to redraw this, use the diagram on page 17.

HE HOAHOA TĀPIRI

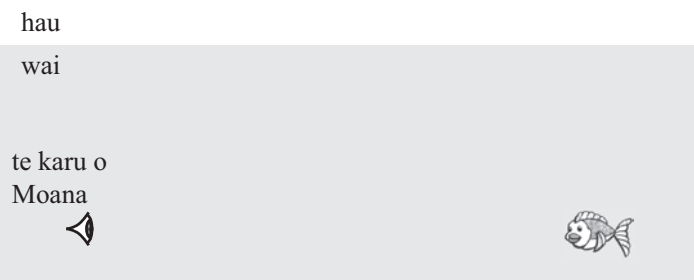
Ki te hiahia koe kia tuhia anō tō otinga o te hoahoa ki te Pātai Tuatahi (a), tuhia ki te hoahoa i raro nei. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.



Ki te hiahia koe ki te tuhi anō i te hihi mō te Pātai Tuatahi (b), tuhia ki ngā hoahoa i raro. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.

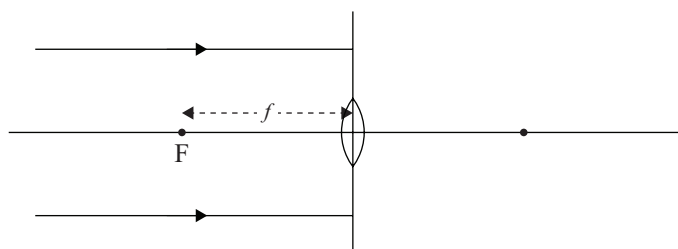


Ki te hiahia koe ki te tuhi anō i te hihi mō te Pātai Tuarua (a), tuhia ki te hoahoa i raro. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.

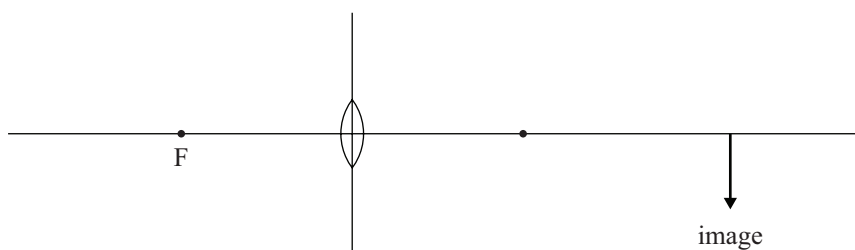


SPARE DIAGRAMS

If you need to redraw your completion of the diagram from Question One (a), draw it on the diagram below. Make sure it is clear which diagram you want marked.



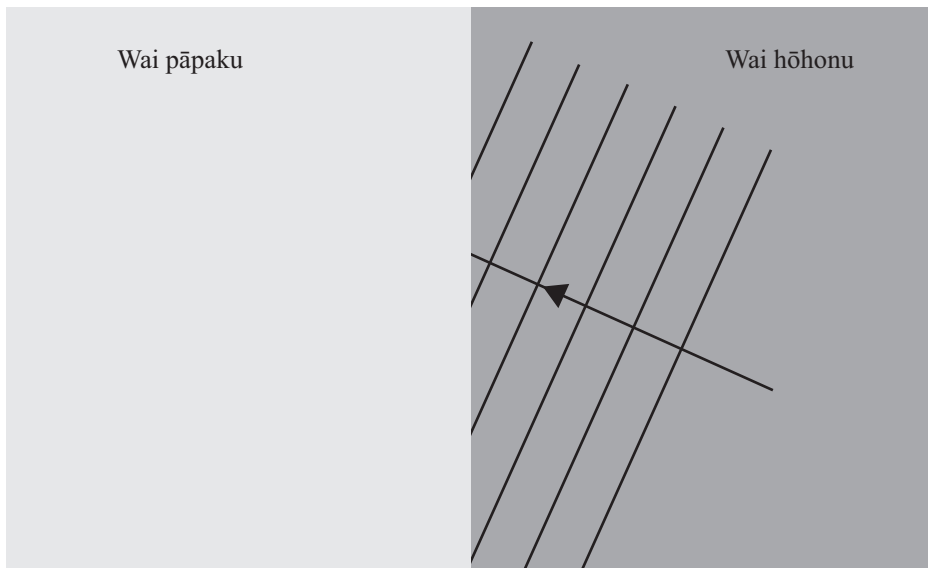
If you need to redraw the ray from Question One (b), draw it on the diagrams below. Make sure it is clear which diagram you want marked.



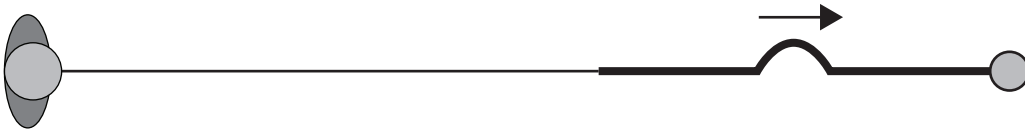
If you need to redraw the ray from Question Two (a), draw it on the diagram below. Make sure it is clear which diagram you want marked.



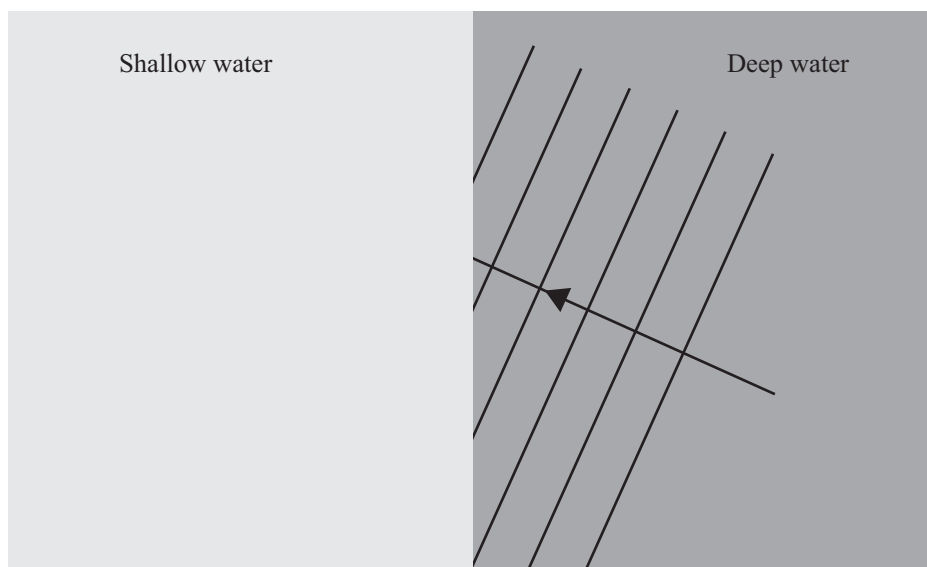
Ki te hiahia koe kia tuhia anō tō otinga o te hoahoa ki te Pātai Tuatoru (c), tuhia ki te hoahoa i raro nei. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.



Ki te hiahia koe ki te tuhi anō i te tōiri mō te Pātai Tuatoru (d), tuhia ki te hoahoa i raro. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.



If you need to redraw your completion of the diagram from Question Three (c), draw it on the diagram below. Make sure it is clear which diagram you want marked.



If you need to redraw the pulse from Question Three (d), draw it on the diagram below. Make sure it is clear which diagram you want marked.



He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tāu pātai mēnā e hāngai ana.

TAU PĀTAI

MĀ TE
KAIMĀKA
ANAKE

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

QUESTION
NUMBER

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English translation of the wording on the front cover

Level 2 Physics, 2014

91170 Demonstrate understanding of waves

2.00 pm Tuesday 18 November 2014

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–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 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 2–19 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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