See back cover for an English translation of this cover

3

91523M

915235

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

SUPERVISOR'S USE ONLY

Ahupūngao, Kaupae 3, 2014

91523M Te whakaatu māramatanga ki ngā pūnaha ngaru

2.00 i te ahiahi Rātū 25 Whiringa-ā-rangi 2014
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā pūnaha ngaru.	Te whakaatu māramatanga hōhonu ki ngā pūnaha ngaru.	Te whakaatu māramatanga matawhānui ki ngā pūnaha 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 L3–PHYSMR.

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

Me hōmai te whakautu me tētahi waeine o te Pūnaha Waeine ā-Ao (SI) ki ngā tau tika o ngā tau tāpua.

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

Tirohia mehemea kei roto nei ngā whārangi 2–15 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

MĀ TE KAIMĀKA ANAKE

PĀTAI TUATAHI: TE ŌKENA MOANA

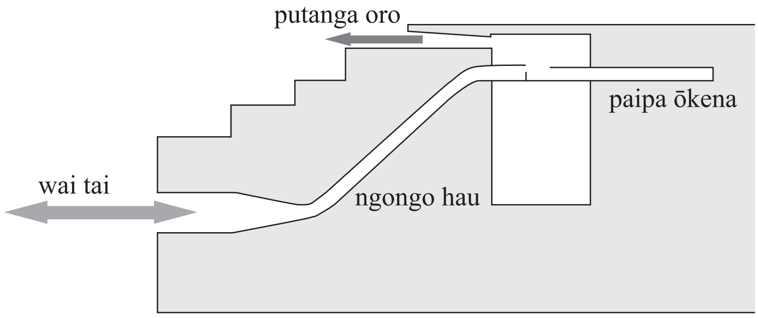
He taonga puoro te Ōkena Moana i Zadar, Koroātia, e hanga nei i ōna ake rangi puoro mā te tuki o ngā ngaru moana ki ngā paipa kei raro i te arapiki, e whakaaturia ana i te pikitia. Ka puta mai te oro i ngā paipa mai i ngā hahae auau kei te wāhanga poutū o te kaupae o runga rawa.

He tapu tēnei rauemi. E kore taea te tuku atu. Aata tirohia ki ngā kupu kei raro iho i te pouaka nei.

http://travelforsomeday.wordpress.com/2012/03/06/the-sea-organ-morske-orgule-zadar-croatia/

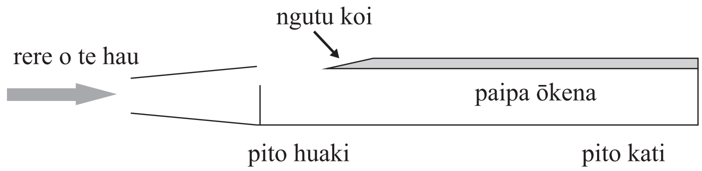
Mō te whakaputa i tētahi oro, me mātua pupuhi te hau ki roto i ngā paipa ōkena, ā, e honoa ana ia paipa ōkena ki te pito whakarunga o tētahi ngongo, e ai ki te hoahoa i te taha matau.

Ko te mahi a ngā ngaru he pei atu i te wai ki roto me waho o tētahi ngongo, e rere ai te hau ki te taha whakarunga o te ngongo.

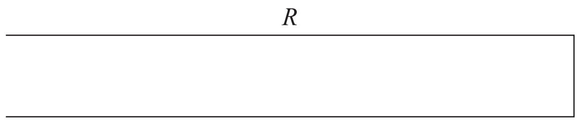


E whakaatu ana te hoahoa i te taha matau i roto o tētahi paipa ōkena.

Kei te kati tētahi pito o ēnei paipa ōkena.



(a) Tātaihia te roa, R, o tētahi paipa ōkena, me tētahi pito kei te kati, e whakaputaina ai tētahi ngaru tū taketake o te roangaru 2.60 m.



Tērā pea he āwhina kei te hoahoa i te taha matau ki a koe.

(b) E kōkirihia ana te hau ki tētahi ngutu koi, e whakaputaina ai ngā kōpiupiutanga i roto i te hau, me ētahi auautanga maha rerekē.

Whakamāramahia he aha i kore ai e whakaputaina e ngā auautanga katoa ngā ngaru tū i roto i te paipa.

(c) Kei roto i te Ōkena Moana ngā paipa ōkena o ngā roa maha rerekē.

Whakamāramahia he aha i awea ai ngā oro e rongohia ana e ngā rerekētanga o ngā roanga paipa ōkena.

(d) He pōturi ake te tere o te oro i te hau makariri tēnā i te hau mahana.

Tātaihia te rerekētanga i waenga i te auautanga hawarite tuatoru (ororunga 1) ka rongohia i te raumati (35°C), me te auautanga hawarite tuatoru ka rongohia i te takurua (–2°C).

Te tere o te oro i te hau i te 35°C = 353 m s^{-1}
Te tere o te oro i te hau i te –2°C = 330 m s^{-1}

Tērā pea he āwhina kei te hoahoa kei te taha matau ki a koe.

R

QUESTION ONE: THE SEA ORGAN

ASSESSOR'S USE ONLY

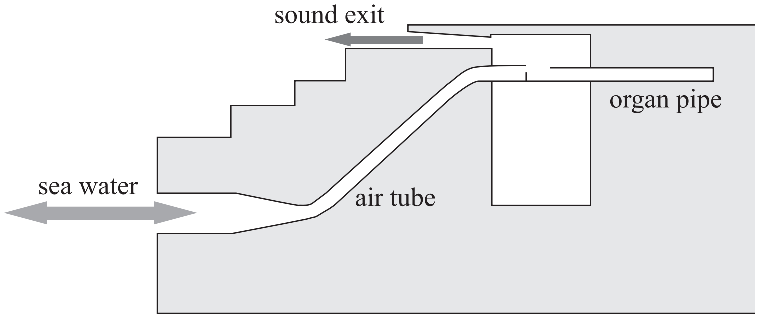
The Sea Organ in Zadar, Croatia, is a musical instrument that creates its musical notes through the action of sea waves on a set of pipes that are located underneath the steps shown in the picture. The sound from the pipes comes out through the regular slits in the vertical part of the top step.

For copyright reasons, this resource cannot be reproduced here.

http://travelforsomeday.wordpress.com/2012/03/06/the-sea-organ-morske-orgule-zadar-croatia/

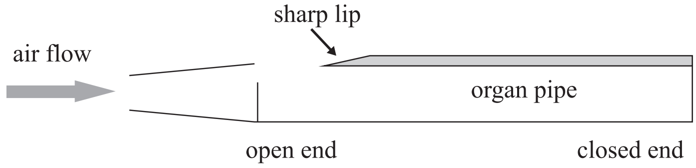
To produce a sound, the organ pipes must have air blown into them, so each organ pipe is connected to the top end of a tube, as shown in the diagram on the right.

The action of the waves pushes water in and out of a tube, creating a flow of air at the upper end of the tube.



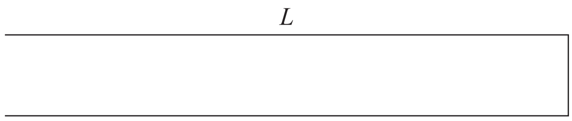
The diagram on the right shows the inside of an organ pipe.

These organ pipes have one closed end.



(a) Calculate the length, L, of an organ pipe, with one closed end, that produces a fundamental standing wave of wavelength 2.60 m.

You may find the diagram on the right useful.



(b) Air is driven against a sharp lip, producing oscillations in the air, with a range of frequencies.

Explain why not all frequencies produce standing waves in the pipe.

(c) The Sea Organ contains organ pipes of several different lengths.

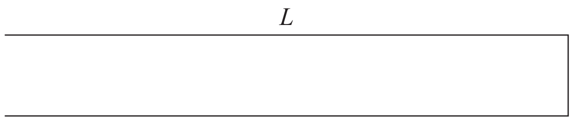
Explain why the differences in length of the organ pipes affect the sounds that are heard.

(d) The speed of sound in cold air is slower than it is in warm air.

Calculate the difference between the 3rd harmonic frequency (1st overtone) heard in summer (35°C), and the 3rd harmonic frequency heard in winter (–2°C).

Speed of sound in air at 35°C = 353 m s^{-1}
Speed of sound in air at –2°C = 330 m s^{-1}

You may find the diagram on the right useful.

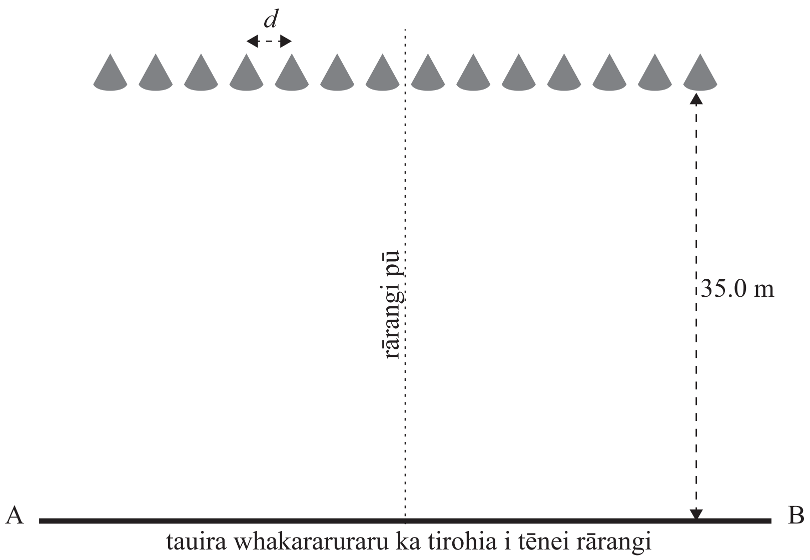


ASSESSOR'S USE ONLY

MĀ TE KAIMĀKA ANAKE

PĀTAI TUARUA: WHAKARARURARUTANGA

E whakaatu ana te hoahoa i te rangatū tukuoro e hono tahitia ana, ka mutu ki tētahi pūwhakaputa auautanga e whakaputa ana i tētahi auautanga kotahi. Ko te mahi a ngā tukuoro he pēnei i te tukutuku roraha.



(a) Ko te roangaru o te rangi e whakaputahia ana e te puna ngaru oro he 0.600 m.

Ko te tawhiti i waenga i ngā tukuoro me te rārangi AB he 35.0 m.

Ina hīkoi tētahi tangata i te rārangi AB, ko te tawhiti i waenga i ngā pūwāhi tīwerawera e rua he 7.40 m.

Tātaihia te wehenga o ngā tukuoro, *d*.

(b) Whakamāramahia he pēhea te puta mai o ngā pūwāhi whakararuraru tukutahi, orotā hoki i te rārangi AB, i te rerekē o te ara o ngā ngaru.

MĀ TE KAIMĀKA ANAKE

(c) Whakamāramahia te pānga ki te tauira whakararuraru o te whakaiti i te tawhiti i waenga i ngā tukuoro.

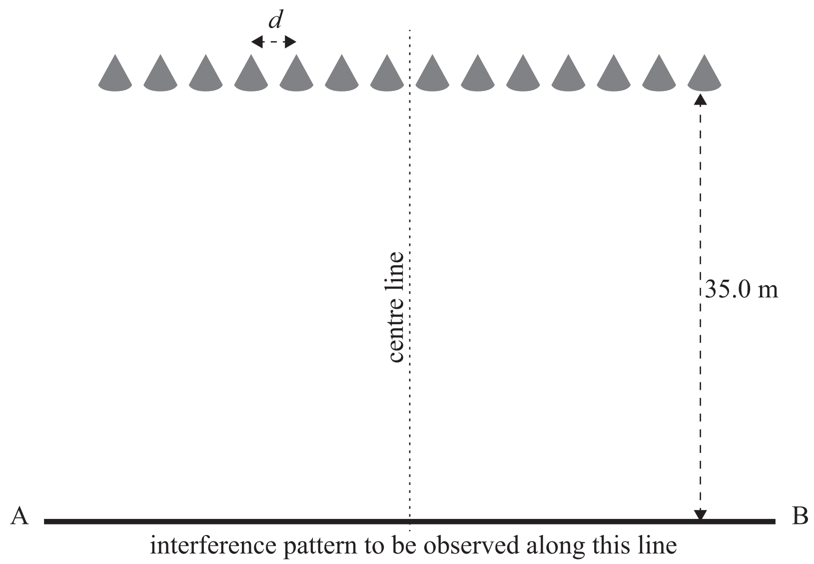
(d) Kua whakaritea te pūwhakaputa auautanga ināianei kia puta ai ngā auautanga rerekē maha i ia tukuoro.

Whakamāramahia he pēhea te rerekē o te oro ka rongohia e tētahi tangata e hīkoi ana i AB ki tērā i whakaahuahia i te wāhanga (b) o tēnei pātai.

ASSESSOR'S USE ONLY

QUESTION TWO: INTERFERENCE

The diagram shows a series of speakers connected together, and to a frequency generator producing a single frequency. The speakers act like a diffraction grating.



(a) The sound wave source is producing a note of wavelength 0.600 m.
The distance between the speakers and the line AB is 35.0 m.
When a person walks along the line AB, the distance between two loud positions is 7.40 m.

Calculate the separation of the speakers, *d*.

(b) Explain how the path difference of the waves causes positions of constructive and destructive interference along the line AB.

(c) Explain the effect on the interference pattern of reducing the distance between the speakers.

(d) The frequency generator is now set so that several different frequencies are emitted by each speaker.

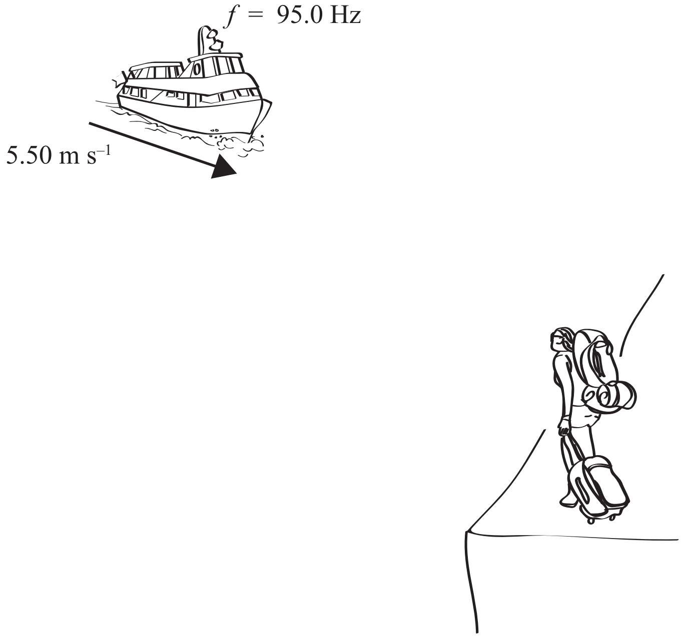
Explain how the sound heard by someone walking along AB would differ from that described in part (b) of this question.

ASSESSOR'S USE ONLY

PĀTAI TUATORU: TE PĀNGA O DOPPLER

Kei te mātakitaki tētahi tūruhi i te waka kōpiko moana e haere mai ana ki a ia. Ko te tere o te waka kōpiko he 5.50 m s^{-1}. Ka whakatangihia e te waka kōpiko tana tētere, e whakaputaina ana he auautanga 95.0 Hz.

Ko te tere o te oro i te hau takiwā he 3.50×10^2 m s^{-1}.



(a) Tātaihia te auautanga o te rangi ka rongohia e te tūruhi.

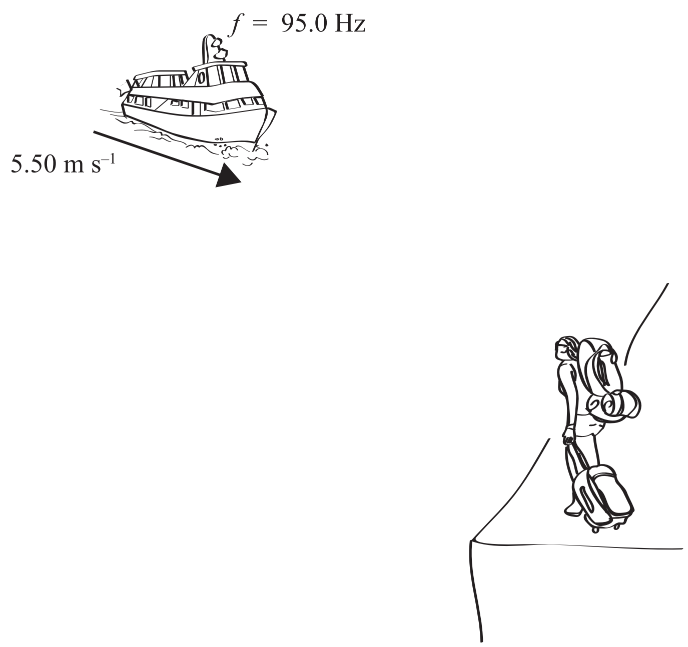
(b) Whakamāramahia he aha i kore ai e ōrite te hauoro o te tētere i rongo te tūruhi ki te oro e whakaputaina ana e te tētere.

QUESTION THREE: THE DOPPLER EFFECT

ASSESSOR'S USE ONLY

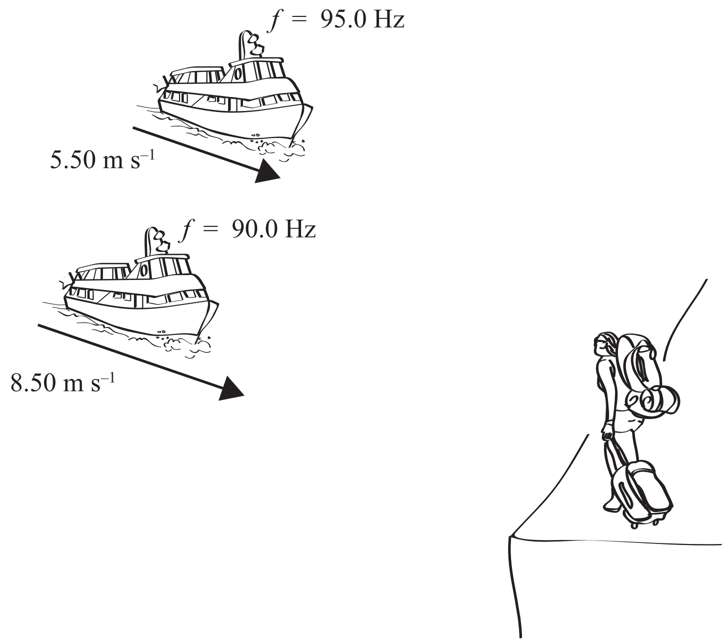
A tourist is watching a ferry boat coming towards her. The speed of the ferry is 5.50 m s^{-1}. The ferry sounds its horn, producing a note of frequency 95.0 Hz.

The speed of sound in the air over the water is 3.50×10^2 m s^{-1}.



(a) Calculate the frequency of the note that the tourist hears.

(b) Explain why the sound of the horn heard by the tourist does not have the same pitch as the sound emitted by the horn.



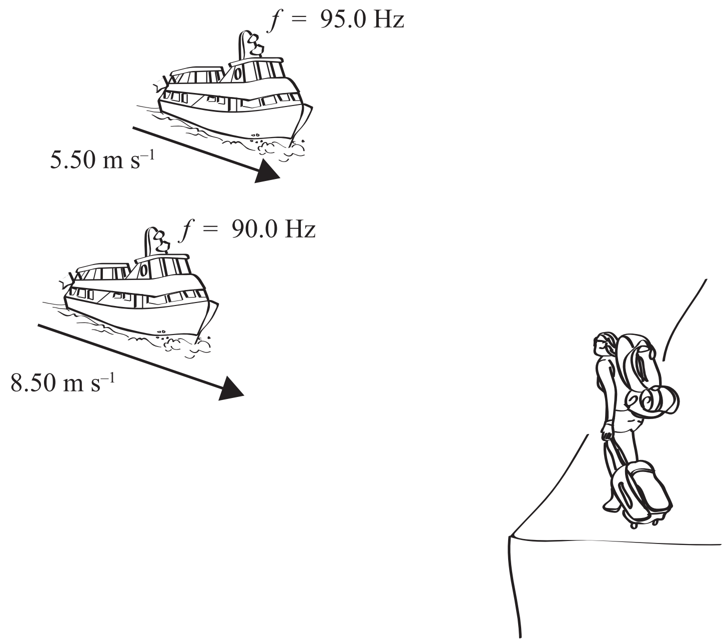
MĀ TE KAIMĀKA ANAKE

(c) Ka whakatangihia anō e tētahi atu waka kōpiko tana tētere, ā, e whakahipa ana i te waka kōpiko tuatahi, ko te auau o te rangi ka puta he 90.0 Hz. Mō ētahi hākona noa, he ōrite te tawhiti o ngā waka kōpiko e rua mai i te tūruhi, he tino piri tata hoki, ā, kei te whakatangihia tahitia ngā tētere e rua. Ka rongo te tūruhi i ngā taki.

(i) Tātaihia te auautanga o ngā taki e rongohia ana e te tūruhi.

(ii) Whakaahuahia he aha tēnei mea te taki, ā, whakamāramahia he pēhea tōna waihangatanga mai.

ASSESSOR'S USE ONLY



(c) A second ferry, which is overtaking the first, also sounds its horn, producing a note of frequency 90.0 Hz. For a few moments, both ferries are the same distance from the tourist, quite close together, and both are sounding their horns. The tourist hears beats.

(i) Calculate the frequency of the beats that are heard by the tourist.

(ii) Describe what beats are, and explain how they are created.

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

ASSESSOR'S USE ONLY

English translation of the wording on the front cover

Level 3 Physics, 2014

91523 Demonstrate understanding of wave systems

2.00 pm Tuesday 25 November 2014
Credits: Four

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

91523M

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 Booklet L3–PHYSMR.

In your answers use clear numerical working, words and / or diagrams as required.

Numerical answers should be given with an SI unit, to an appropriate number of significant figures.

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 2–15 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.