See back cover for an English translation of this cover

2

91173M

911735

SUPERVISOR'S USE ONLY

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 tuhi kōrero ki tēnei pukapuka

Mātai Ahupūngao, Kaupae 2, 2022

91173M Te whakaatu māramatanga ki te hiko me te autōhiko

Ngā whiwhinga: E ono

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki te hiko me te autōhiko.	Te whakaatu i te hōhonu o te māramatanga ki te hiko me te autōhiko.	Te whakaatu i te tōtōpū o te māramatanga ki te hiko me te autōhiko.

Tirohia kia kitea ai 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 kia kitea ai kei a koe te Pukapuka Rauemi L2–PHYSMR.

I ō tuhinga, whakaatuhia kia mārama ngā whiriwhiringa tohutau, ngā kupu, ngā hoahoa hoki/rānei, ki ngā wāhi me pērā.

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

Mēnā ka hiahia whārangi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka.

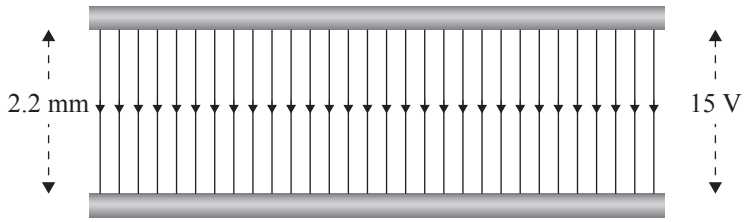
Tirohia kia kitea ai e tika ana te raupapatanga o ngā whārangi 2–19 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi ki tētahi wāhi e kitea ai te kauruku whakahāngai (⁘). Ka poroa pea taua wāhanga ka mākahia ana te pukapuka.

HOATU TĒN EI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

TE TŪMAHI TUATAHI: NGĀ WHAITUA HIKO

Kua whakaritea ngā papana whakarara e rua kia 2.2 mm te āputa, kia 15 V i waenganui.



(a) Whakaaturia mai e 6.8×10^3 V m^{-1} nei te kaha o te whaitua hiko i waenga i ngā papana.

(b) Ka tukuna tētahi irahiko e whakangā ana i te papana tōraro, kātahi ka tere neke atu ki te papana tōrunga.

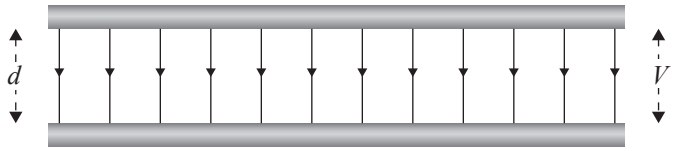
Tātaihia te tere mōrahi ka tae ana te irahiko ki te papana tōrunga.

(c) Ka kī tētahi tauira, mā te whakarahi ake i te āputa i waenganui i ngā papana, me te mau tonu i te ngaohiko kia ōrite, ka roa ake te whakahohoro a te irahiko whakangā ka tukuna i te papana tōraro, ā, nā konā ka tere ake te rere i tēnā i te wāhanga (b) ka tae ana ki te papana tōrunga.

(i) Whakamahia ngā mātāpono mātai ahupūngao hei whakamārama i te take e hē ana tēnei.

(ii) Tuhia mai tētahi mea kotahi ka mahia pea e piki ake ai te tere mōrahi o te irahiko.

(d) E whakaaturia ana ki te hoahoa i raro te whaitua hiko i waenganui i tētahi huinga papana whakarara e d mita te āputa, e V te ngaohiko i waenganui.



Kua rearuatia te tawhiti o ngā papana e rua, ā, kua hauruatia te ngaohiko o waenganui.

(i) Tuhia mai te hua ka puta ki te kaha o te whaitua hiko.

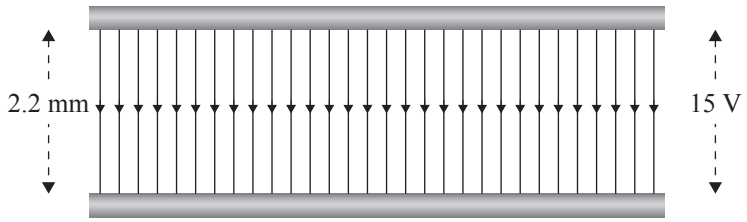
Me whakauru koe i tētahi nama ki tō tuhinga.

(ii) Mā te whakamahi tonu i tēnei āwhata, tuhia ngā rārangi whaitua ki te hoahoa i raro iho nei hei whakaatu i te whaitua hiko hou i waenganui i ngā papana.

Ki te hiahia koe ki te tā anō i tō urupare, whakamahia te hoahoa i te whārangi 14.

QUESTION ONE: ELECTRIC FIELDS

Two parallel plates are set up 2.2 mm apart with 15 V between them.



(a) Show that the electric field strength between the plates is 6.8×10^3 V m^{-1}.

(b) An electron at rest is released from the negative plate and accelerates towards the positive plate.

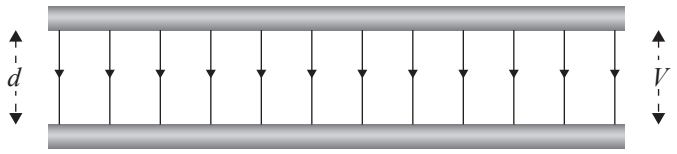
Calculate the maximum speed of the electron when it reaches the positive plate.

(c) A student states that increasing the distance between the plates while keeping the voltage the same, will mean that an electron released from rest at the negative plate is accelerating over a longer distance, and will therefore reach a higher speed than in part (b) when it reaches the positive plate.

(i) Use physics principles to explain why this is incorrect.

(ii) State one thing that could be done to increase the maximum speed of the electron.

(d) The diagram below shows the electric field between a set of parallel plates d metres apart with V volts between them.



The distance between the plates is now doubled, and the voltage between them is halved.

(i) State what happens to the strength of the electric field.

Your answer should include a number.

(ii) Using the same scale, draw in the field lines on the diagram below to show the new electric field between the plates.

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

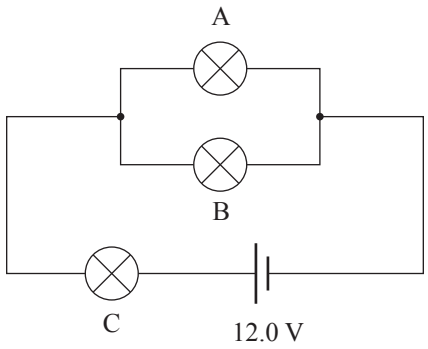
TE TŪMAHI TUARUA: NGĀ ARA IAHIKO

Ka kite tētahi tauira i ētahi ramamua motokā kua tapaina ki te 12.0 V, 55.0 W.

Te mātāpuna: www.wired.com/story/texas-instruments-headlights/

(a) Whakaaturia mai te pare-iahiko o te ramamua kotahi kia 2.62 Ω.

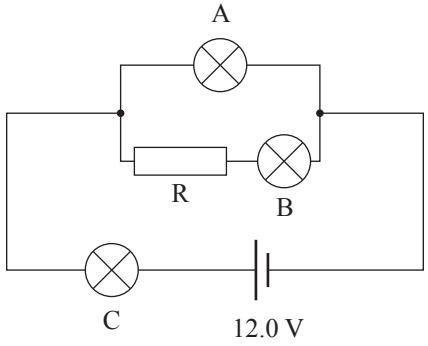
(b) Ka tūhonoa e te tauira ngā ramamua e rua (kua tapaina ki te A me te B), me tētahi atu rama (C), kua whakamahia hei tūrama i te tauwaka i te ara iahiko i raro iho nei. Ko te 1.22 Ω te pare-iahiko o rama C.



Tātaihia te tapeke o te pare-iahiko o tēnei ara iahiko.

Ka tūhonoa e te tauira tētahi reo irirangi ki te ara iahiko, ko te R te pare-iahiko.

Te mātāpuna: www.techinn.com/en/kenwood-kdc-bt450dab-car-radio/137796349/p



(c) Whakamahia ngā mātāpono mātai ahupūngao hei whakaahua i te pānga o te āpiti i te reo ririangi ki te tiaho o rama A.

Me kī, e rere ana ngā reo ririangi me ngā rama katoa. Tīmata mā te whakaahua i te pānga o te āpiti i te reo ririangi ki te pare-iahiko o te ara iahiko.

(d) Homai ngā take, ka mutu, me kaua e iti iho i te toru o ērā, i kore ai te huarahi e kitea ana i te wāhanga (c) i pai hei tūhono i ngā ramamua 12 V i tētahi motokā.

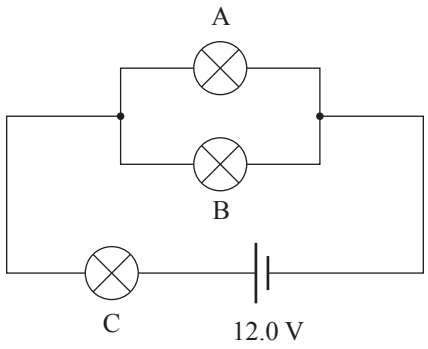
QUESTION TWO: CIRCUITS

A student finds some car headlamps that are labelled 12.0 V, 55.0 W.

Source: www.wired.com/story/texas-instruments-headlights/

(a) Show the resistance of a single headlamp is 2.62 Ω.

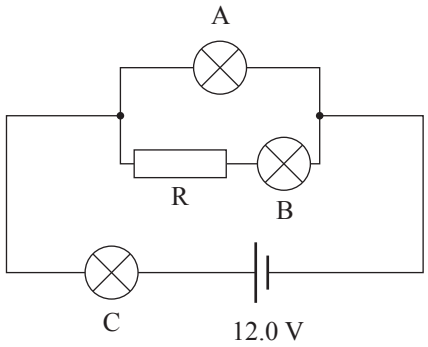
(b) The student connects two of these headlamps (labelled A and B), and another lamp (C), which is used to light up the number plate in the circuit below. The resistance of lamp C is 1.22 Ω.



Calculate the total resistance of this circuit.

The student connects a radio with resistance R to the circuit.

Source: www.techinn.com/en/kenwood-kdc-bt450dab-car-radio/137796349/p



(c) Use physics principles to describe the effect adding the radio would have on the brightness of lamp A.

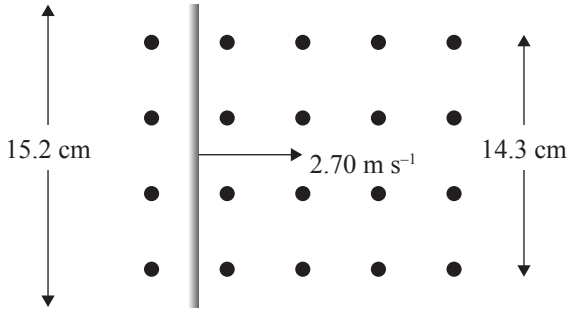
Assume the radio and lamps are all operating. Start by describing what effect adding the radio would have on the circuit resistance.

(d) Give at least three reasons why the circuit in part (c) would not be a good way to connect the 12 V headlamps in a car.

TE TŪMAHI TUATORU: NGĀ WHAITUA AUTŌ

Ka peia tētahi waea ki waenganui i tētahi whaitua autō kia 2.70 m s^{-1} te tere pūmau.

Te roa o te waea = 15.2 cm
Te kaha o te whaitua autō = 1.2 mT
Te whānui o te whaitua autō = 14.3 cm

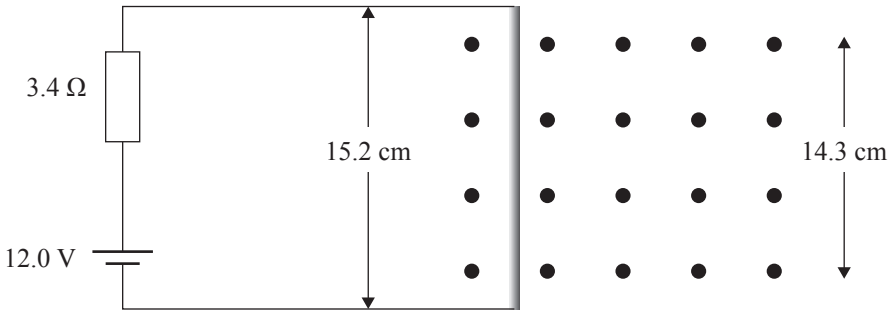


Ki te hiahia koe ki te tā anō i tō urupare, whakamahia te hoahoa i te whārangi 14.

(a) Kia mārama te tohu i te pito tōrunga o te waea i te hoahoa i runga nei.

(b) Tātaihia te ngaohiko ka kōpanatia i te waea.

(c) I tēnei wā, kua tūhonotia te waea e tū noa ana ki tētahi ara iahiko e 3.40 Ω te pare-iahiko, ā, 12.0 V te whana o te pūhiko.

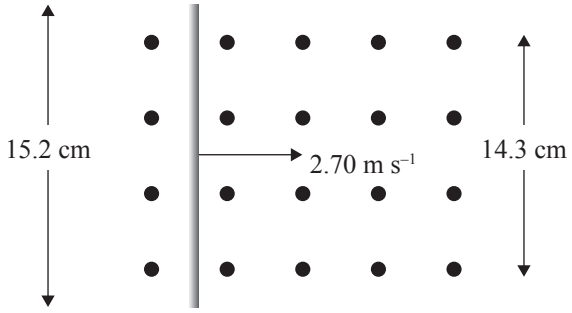


(i) Tātaihia te tōpana autō i te waea.

QUESTION THREE: MAGNETIC FIELDS

A wire is pushed through a magnetic field at a constant speed of 2.70 m s^{-1}.

Length of the wire = 15.2 cm
Magnetic field strength = 1.2 mT
Width of the magnetic field = 14.3 cm

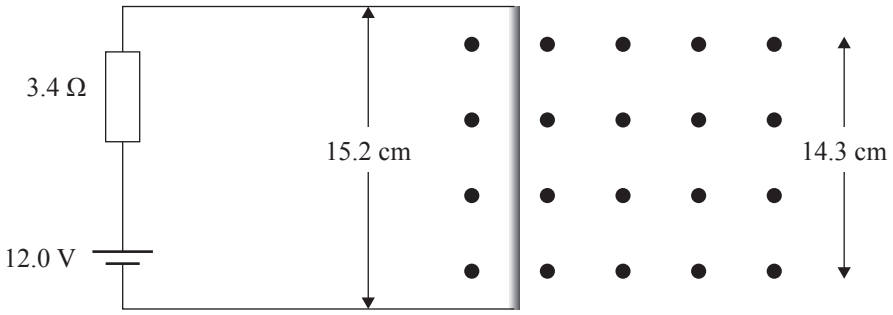


If you need to redraw your response, use the diagram on page 15.

(a) Clearly mark the positive end of the wire on the diagram above.

(b) Calculate the voltage induced in the wire.

(c) The wire is now stationary and connected to a circuit that contains a 3.40 Ω resistor and a 12.0 V battery.



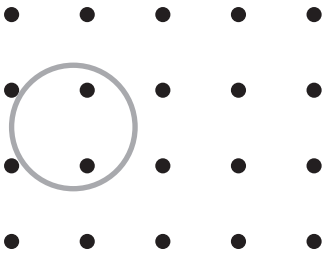
(i) Calculate the magnetic force on the wire.

(ii) Tuhia mai te ahunga o te tōpana autō i runga i te waea kia ahu rānei:

Ki runga o te whārangi (↑) **Ki raro o te whārangi (↓)** **Ki te mauī (←)** **Ki te matau (→)**

Ki waho o te whārangi **Ki roto i te whārangi** **Kāore he tōpana**

(d) Ka rongo tētahi irahiko e tapahi ana i te whaitua autō i tētahi tōpana e porowhita ai te ara ka whāia e ia.



Te mātāpuna: http://boomeria.org/physicslectures/secondsemester/nuclear/nuclear1/nuclear1.html

Ki te hiahia koe ki te tā anō i tō urupare, whakamahia te hoahoa i te whārangi 14.

E rere ana te irahiko mai i te taha mauī ki te whaitua.

(i) Ki te hoahoa o runga nei, kia mārama te tohu i te āhua o te ahunga o te irahiko i te porowhita.

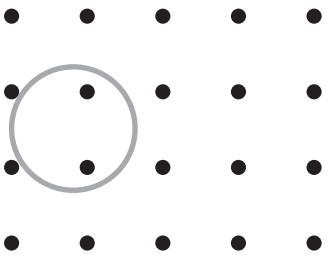
(ii) Whakamahia ngā mātāpono mātai ahupūngao hei whakamārama i te take he tōpana kei runga i te irahiko i te wā ka tapahia te whaitua autō.

(ii) State the direction of the magnetic force on the wire as either:

Up page (↑) **Down page (↓)** **Left (←)** **Right (→)**

Out of the page **Into the page** **No force**

(d) An electron cutting the magnetic field experiences a force that makes it follow a circular path.



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

Source:http://boomeria.org/physicslectures/secondsemester/nuclear/nuclear1/nuclear1.html

The electron is travelling from the left into the field.

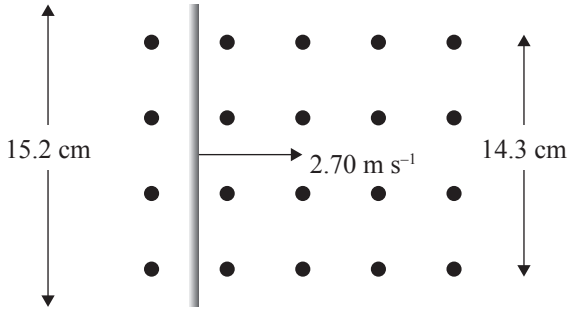
(i) Clearly mark on the diagram above the direction the electron moves around the circle.

(ii) Use physics principles to explain why there is a force on the electron as it cuts the magnetic field.

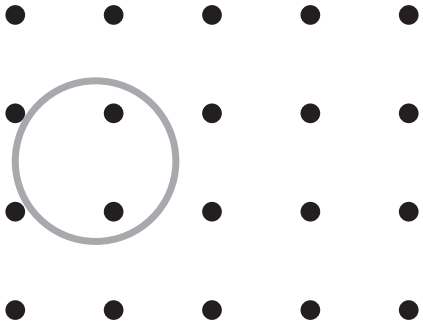
HE HOAHOA WĀTEA

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



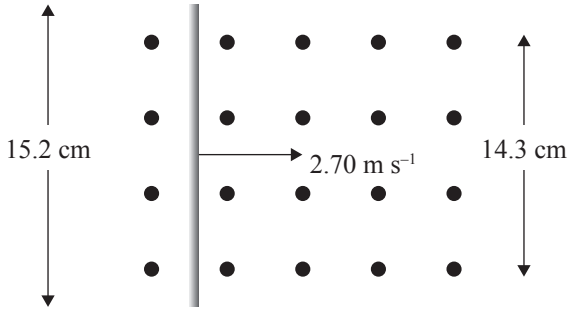
Ki te hiahia koe ki te tā anō i tō urupare ki te Tūmahi Tuatoru (d)(i), whakamahia te hoahoa i raro nei. Kia mārama te tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.



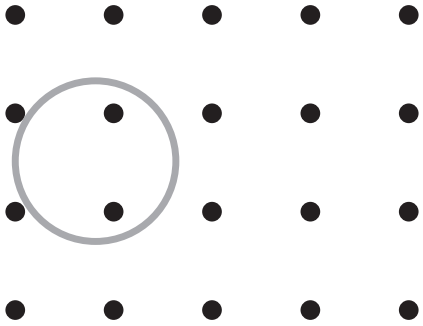
SPARE DIAGRAMS

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

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



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



He whārangi anō ki te hiahiatia.
Tuhia te tau tūmahi mēnā e hāngai ana.

TE TAU TŪMAHI

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

QUESTION NUMBER

He whārangi anō ki te hiahiatia.
Tuhia te tau tūmahi mēnā e hāngai ana.

TE 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 2022

91173M Demonstrate understanding of electricity and electromagnetism

Credits: Six

91173M

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of electricity and electromagnetism.	Demonstrate in-depth understanding of electricity and electromagnetism.	Demonstrate comprehensive understanding of electricity and electromagnetism.

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 2–19 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.