See back cover for an English translation of this cover

2

SUPERVISOR'S USE ONLY

91173M

911735

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

91173M Te whakaatu māramatanga ki te hiko me te autōhiko

Ngā whiwhinga: Ono

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki te hiko me te autōhiko.	Te whakaatu māramatanga hōhonu ki te hiko me te autōhiko.	Te whakaatu māramatanga matawhānui ki te hiko me te autōhiko.

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 – 19 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

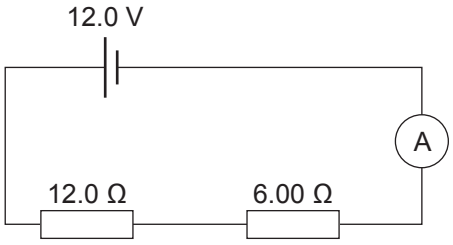
Kaua e tuhi ki roto i tētahi wāhi kauruku whakahāngai (⁘). Ka tapahia pea tēnei wāhi ina mākahia te pukapuka.

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

TŪMAHI TUATAHI: NGĀ ARA IAHIKO

Kei te tūhurahura a Bob i ngā ara iahiko i roto i te taiwhanga pūtaiao, ā, ka tīmata me te ara iahiko i raro.

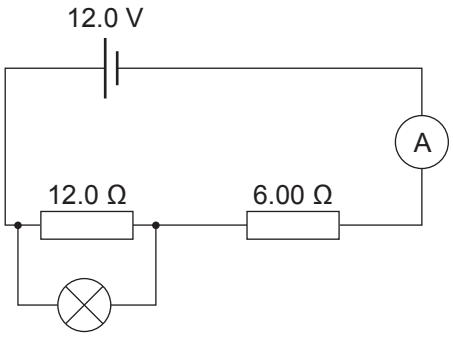
Ko te ngaohiko ka whakawhiti i te pare-iahiko 12.0 Ω ko te 8.00 V.



(a) Tātaihia te iahiko i roto i te ara iahiko.

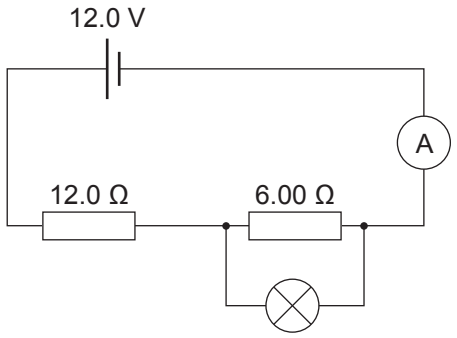
(b) Tātaihia te maha o te pūngao ka hurihia hei wera i roto i te kotahi hāora i te pare-iahiko 6.00 Ω.

(c) He rama tā Bob ka mahi noa anake ina tūhono ki te 8.00 V. Kātahi ka tūhonoa whakararatia e ia ki te pare-iahiko 12.0 Ω .



Mā te kore tātaitanga atu anō, whakamāramahia te take kāore e mahi noa te rama a Bob ina pēnei te tūhono.

(d) Ka kitea e Bob tētahi atu rama me te parenga iahiko o te 4.57 Ω. Ka tūhono ia i tana rama ki te ara iahiko taketake kia whakarara ki te pare-iahiko 6.00 Ω.

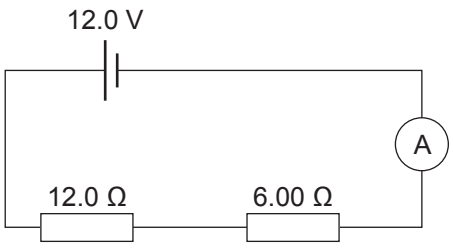


Tātaihia te ngaohiko e whakawhiti ana i tēnei rama.

QUESTION ONE: CIRCUITS

Bob is investigating circuits in the laboratory and starts with the circuit shown below.

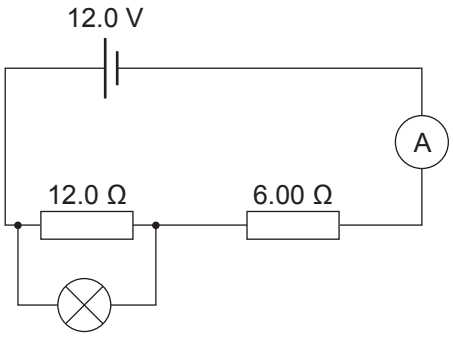
The voltage across the 12.0 Ω resistor is 8.00 V.



(a) Calculate the current in the circuit.

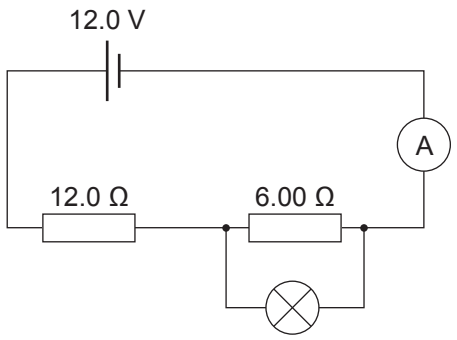
(b) Calculate the amount of energy converted to heat in one hour in the 6.00 Ω resistor.

(c) Bob has a lamp that operates normally only when connected to 8.00 V. He connects it in parallel with the 12.0 Ω resistor.



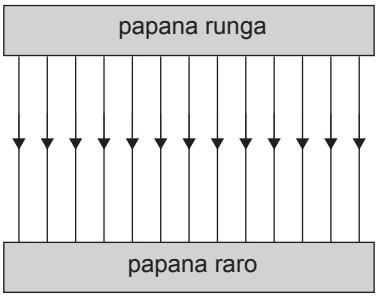
Without further calculation, explain why Bob's lamp will not operate normally when connected this way.

(d) Bob finds another lamp that has resistance of 4.57 Ω. He connects this lamp in the original circuit in parallel with the 6.00 Ω resistor.



Calculate the voltage across this lamp.

TŪMAHI TUARUA: NGĀ WHAITUA HIKO



Ki te hiahia koe ki te tātuhi anō i tō urupare, whakamahia te hoahoa i te whārangi 16.

E whakaaturia i runga nei ko ngā rārangi whaitua hiko i waenga i ngā papana whakarara e rua.

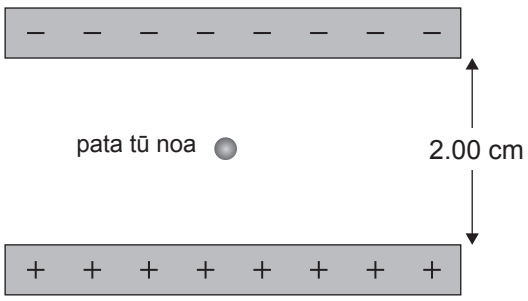
(a) Kia mārama te tapa i te papana tōrunga kei te hoahoa i runga ake.

(b) Whakaahuatia te whaitua i waenga i ngā papana ka whakamārama he pēhea te whakaatu a te hoahoa i tēnei.

(c) Ka whakahaerehia he whakamātau ki te papa o Papatūanuku (g = 9.8 m s^{-2}) ina ka tū noa tētahi pata hihiko me te 5.87 × 10^{-10} kg te papatipu i waenga i tētahi huinga **rerekē** o ngā papana whakarara.

Ko te ngaohiko i waenganui i ngā papana he 240 V.

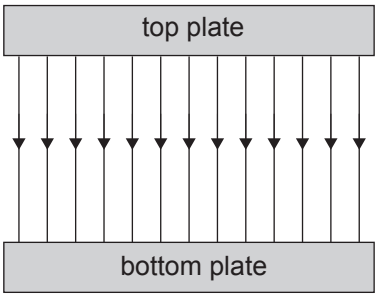
Ko te tawhiti i waenga i ngā papana he 2.00 cm.



(i) Tāpirihia ngā pere whai tapanga hei whakaatu i ngā tōpana E RUA ka pā ki te pata tū noa.

Ki te hiahia koe ki te tātuhi anō i tō urupare, whakamahia te hoahoa i te whārangi 16.

QUESTION TWO: ELECTRIC FIELDS



The electric field lines between two parallel plates are shown above.

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

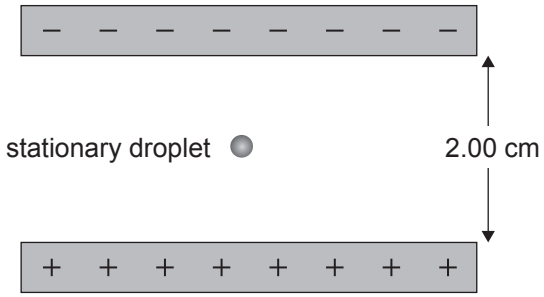
(a) Clearly label the positive plate on the above diagram.

(b) Describe the field between the plates and explain how the diagram shows this.

(c) An experiment is carried out on the surface of the Earth ($g = 9.8$ m s^{-2}) where a charged droplet of mass 5.87×10^{-10} kg is held stationary between a **different** set of parallel plates.

The voltage across the plates is 240 V.

The distance between the plates is 2.00 cm.



(i) Add labelled arrows to show the TWO forces acting on the stationary droplet.

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

(ii) Tātaihia te maha o ngā whana māmā ka pā ki te pata tū noa.

Me tīmata koe mā te tātai i te taumaha o te pata mā te whakamahi i te $F_w = mg$.

Whana māmā: $+1.61 \times 10^{-19}$ C

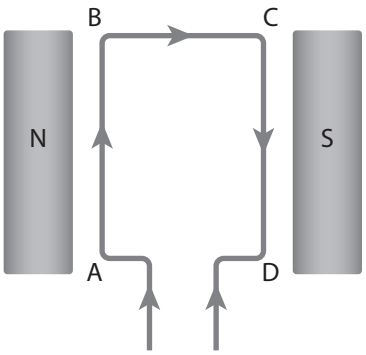
(ii) Calculate the number of elementary charges on the stationary droplet.

You should start by calculating the weight of the droplet by using $F_w = mg$.

Elementary charge: $+1.61 \times 10^{-19}$ C

TŪMAHI TUATORU: NGĀ PŪKAHA ME NGĀ PUKUHIKO

E whakaatu ana te hoahoa o raro i tētahi pūkaha hiko māmā. E whakaatu ana ngā pere i te ahunga o te iahiko māori i te waea.



Roanga AB = 5.0 cm

Roanga BC = 2.0 cm

Roanga CD = 5.0 cm

Ko te kaha o te whaitua autō i waenga i ngā autō = 4.7×10^{-3} T

Ko te iahiko i te waea = 2.3 A

(a) Tātaihia te uara o te tōpana i te taha AB.

(b) Mō ia wāhanga o te waea, tuhia te ahunga o te tōpana hei:

ki mauī (←), **ki matau** (→), **ki runga** (↑), **ki raro** (↓), **ki waho o te whārangi**, **ki roto i te whārangi**, **kāore he tōpana**.

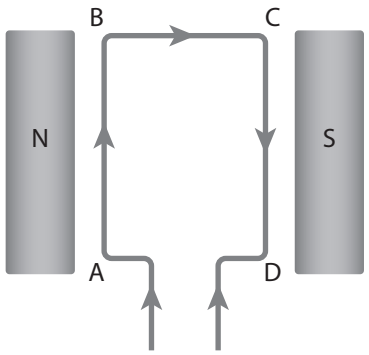
Ahunga o te tōpana ki AB: _____

Ahunga o te tōpana ki BC: _____

Ahunga o te tōpana ki CD: _____

QUESTION THREE: MOTORS AND GENERATORS

The diagram below shows a simple electric motor. The direction of the conventional current through the wire is shown by the arrows.



Length AB = 5.0 cm

Length BC = 2.0 cm

Length CD = 5.0 cm

Magnetic field strength between magnets = 4.7×10^{-3} T

Current in wire = 2.3 A

(a) Calculate the value of the force on side AB.

(b) For each part of the wire, state the direction of the force as either:

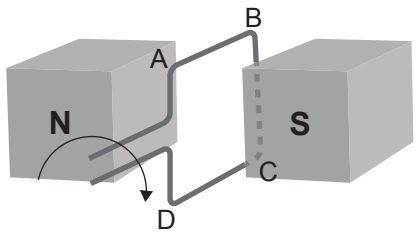
left (←), **right** (→), **up** (↑), **down** (↓), **out of the page**, **into the page**, **no force**.

Direction of force on AB: _____

Direction of force on BC: _____

Direction of force on CD: _____

(c) E whakaatu ana te hoahoa o raro i tētahi pukuhiko māmā. Kei te pōkai he **huringa waea e 60**, ā, ka takahuria whakatekarakatia te pōkai.



Roanga AB = 5.0 cm

Roanga BC = 2.0 cm

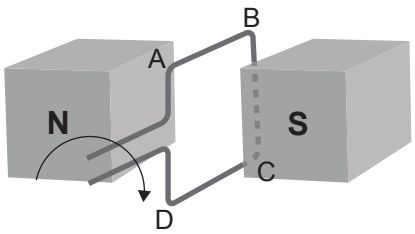
Roanga CD = 5.0 cm

Kaha o te whaitua autō = 4.7×10^{-3} T

Tātaihia te uara o te ngaohiko ka puta i te pōkai ina tapahi ana te waea AB i te whaitua 6.2 m s^{-1}.

Ka haere tonu te Tūmahi Tuatoru i te whārangi 14.

(c) The diagram below shows a simple generator. The coil contains **60 turns** of wire and is rotated clockwise.



Length AB = 5.0 cm

Length BC = 2.0 cm

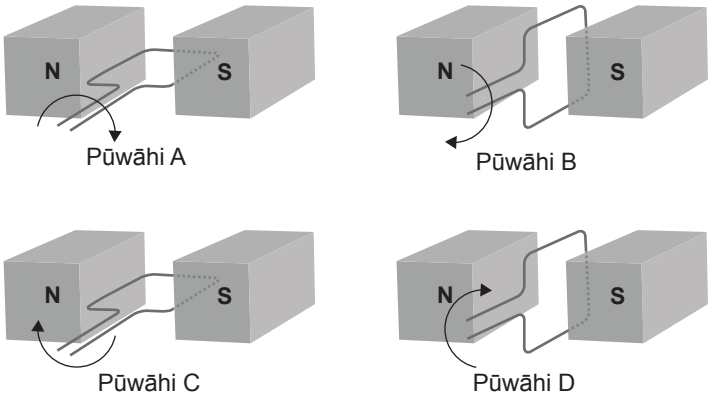
Length CD = 5.0 cm

Magnetic field strength = 4.7×10^{-3} T

Calculate the value of the induced voltage in the coil when the wire AB is cutting the field at 6.2 m s^{-1}.

Question Three continues on page15.

(d) Kei ngā hoahoa i raro e whakaaturia ana te takahuringa whakatekaraka a te pōkai i te pukuhiko.



(i) Kei (t)ēhea o ngā pūwāhi e whā kua tapaia A ki te D i runga ake:

ka puta te ngaohiko nui rawa?_____

kāore e puta he ngaohiko?_____

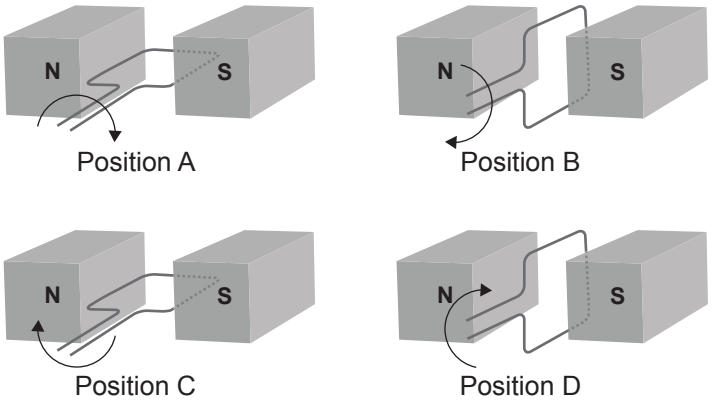
(ii) Whakamahia ngā mātāpono ahupūngao hei whakamārama i tō tuhinga ki te wāhanga (i).

(iii) Me āta whakamārama ki ia hoahoa e tika ana te ahunga o te nekehanga irahiko ka puta i te wehenga whana ina ka huri te pōkai.

.

Ki te hiahia koe ki te tātuhi anō i tō urupare, whakamahia te hoahoa i te whārangi 16.

(d) The diagrams below show the coil in the generator being rotated clockwise.



(i) In which position(s) of the four positions labelled A to D above would:

the largest voltage be generated?_____

no voltage be generated?_____

(ii) Use physics principles to explain your answer to part (i).

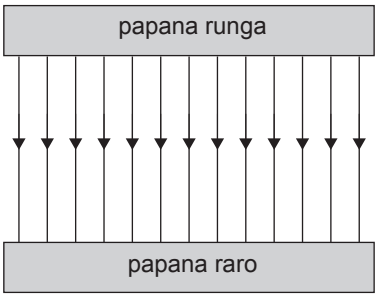
(iii) Clearly indicate on each appropriate diagram(s) the direction of any electron movement caused by charge separation when the coil rotates.

.

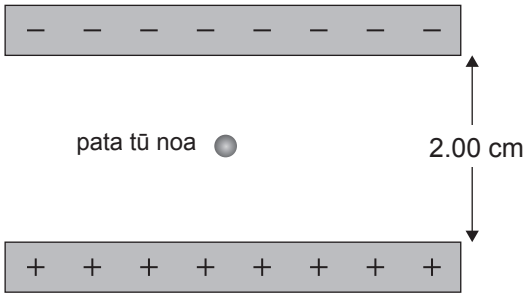
If you need to redraw your response, use the diagram on page 17.

HE HOAHOA WĀTEA

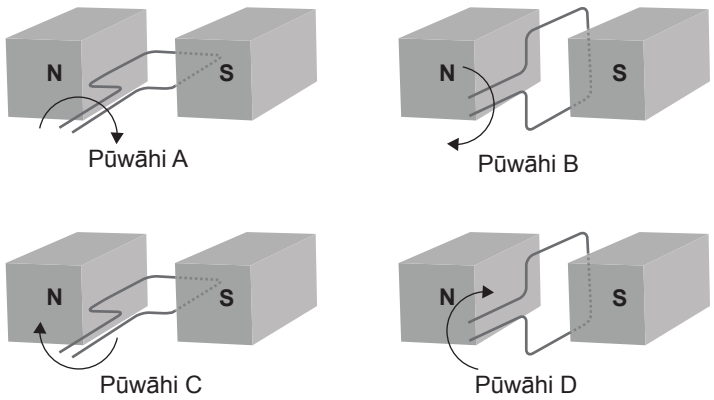
Ki te hiahia koe ki te tātuhi anō i tō urupare ki te Tūmahi Tuarua (a), whakamahia te hoahoa i raro nei. Kia mārama te tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.



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

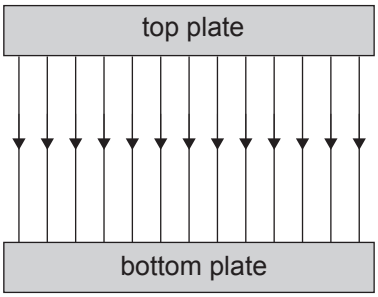


Ki te hiahia koe ki te tātuhi anō i tō urupare ki te Tūmahi Tuatoru (d)(iii), whakamahia te hoahoa i raro nei. Kia mārama te tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.

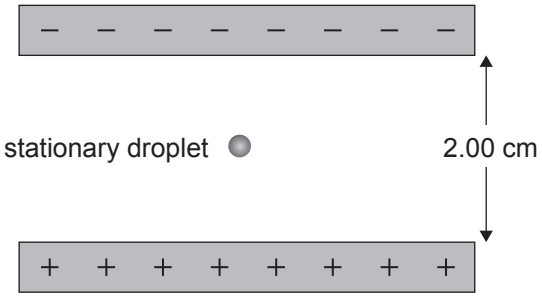


SPARE DIAGRAMS

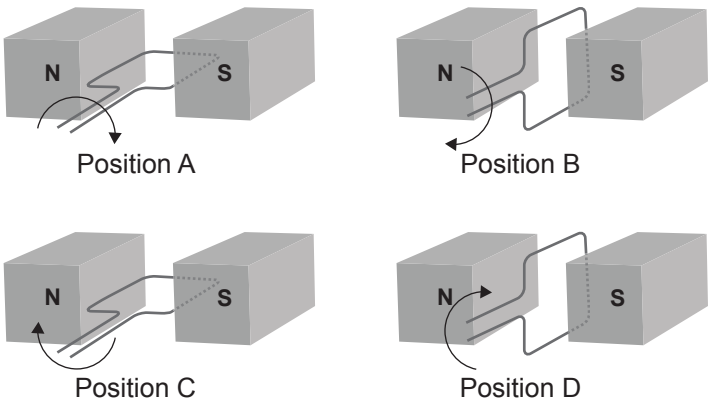
If you need to redraw your response to Question Two (a), use the diagram below. Make sure it is clear which answer you want marked.



If you need to redraw your response to Question Two (c)(i), 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)(iii), 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

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.