90937M

909375

1

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!

Ahupūngao, Kaupae 1, 2018

90937M Te whakaatu māramatanga ki ētahi āhuatanga o te hiko me te autō

2.00 i te ahiahi Rāmere 23 Whiringa-ā-rangi 2018
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ētahi āhuatanga o te hiko me te autō.	Te whakaatu māramatanga hōhonu ki ētahi āhuatanga o te hiko me te autō.	Te whakaatu māramatanga matawhānui ki ētahi āhuatanga o te hiko me te autō.

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 Rau Rauemi L1–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 Waeine ā-Ao (SI) ki ngā tuhinga tohutau.

Mēnā ka hiahia whārangi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

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

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

TAPEKE

MĀ TE KAIMĀKA ANAKE

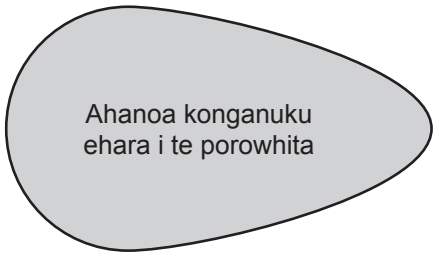
TŪMAHI TUATAHI: WHAKAHIKO VAN DE GRAAFF

MĀ TE KAIMĀKA ANAKE

(a) E rua ngā ahanoa konganuku kua whai whana **tōrunga**. E ōrite ana te tuari o te whana i te mata o te ahanoa porowhita, e ai ki te whakaaturanga.

Tātuhia te tuaritanga whana hei whakaatu he pēhea te tuari i ngā whana tōrunga i te mata o te ahanoa konganuku ehara i te porowhita.

Ki te hiahia koe ki te tuhi anō i tēnei hoahoa, whakamahia te hoahoa i te whārangi 20.



(b) Me whakamārama he aha i pai ai te konukura hei pūkawe hiko, ā, he koretake te karāhe hei pūkawe hiko.

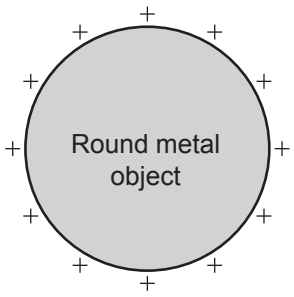
QUESTION ONE: VAN DE GRAAFF GENERATOR

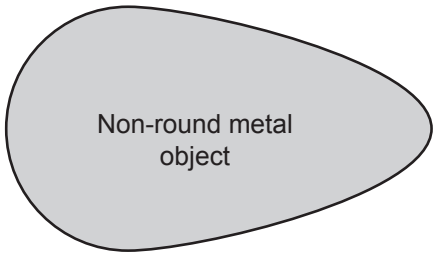
ASSESSOR'S USE ONLY

(a) Below are two **positively** charged metal objects. The round object has charge evenly distributed over the surface, as shown.

Draw the charge distribution to show how the positive charges are distributed along the surface of the non-round metal object.

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





(b) Explain why copper is a good conductor of electricity, whereas glass is a poor conductor of electricity.

He whakahiko hikotū te whakahiko Van de Graaff e whakamahi ana i tētahi tātua nekeneke hei whakaemi whana hiko kei tētahi poi konganuku hākaro, e noho ana i runga i tētahi pou ārai hiko. I hangaia te whakahiko Van de Graaff ārai ā-hau nui rawa o te ao i ngā tau 1930. Kei te Whare Taonga Pūtaiao o Boston e whakaaturia ana ināianei.

Ka taea e te whakahiko Van de Graaff te whakaputa te 2.0 MV (2.0×10^6 V). I te wā o tētahi whakaaturanga, he 0.001 s te roa o te kā o tētahi kora. He 100 kJ (1.0×10^5 J) te pūngao i kawea e taua kora.

https://en.wikipedia.org/wiki/Van_de_Graaff_generator#/media/File:Boston_Museum_of_Science,_Theater_of_Electricity.jpg

(c) (i) Me tātai i te rahinga o te iahiko e rere ana i te kora.

(ii) He tino mōrearea ngā iahiko i runga ake i te 100 mA mō te tangata.

Me whakamārama mēnā he haumaru te iahiko ka puta i tēnei whakaaturanga, kāore rānei.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

A Van de Graaff generator is an electrostatic generator that uses a moving belt to accumulate electric charge on a hollow metal globe, which sits on the top of an insulated column. The largest air-insulated Van de Graaff generator in the world was built in the 1930s. It is now on display at Boston's Museum of Science.

The Van de Graaff generator can generate 2.0 MV (2.0×10^6 V). During a demonstration, a spark was measured to last for 0.001 s. The spark carried 100 kJ (1.0×10^5 J) of energy.

https://en.wikipedia.org/wiki/Van_de_Graaff_generator#/media/File:Boston_Museum_of_Science,_Theater_of_Electricity.jpg

(c) (i) Calculate the amount of current that flows during the spark.

(ii) Electrical currents above 100 mA are extremely hazardous for humans.

Explain whether or not the current created by this demonstration is safe.

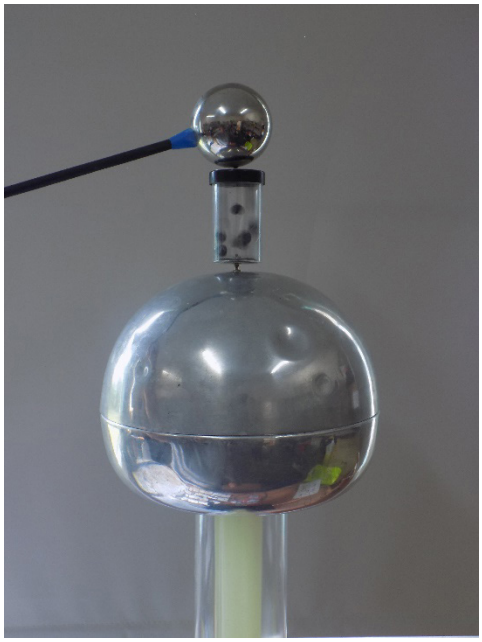
(d) Ka whakamahia he whakahiko Van de Graaff iti ake mō tētahi mahinga akomanga. Ka raua e te kaiako he ipu me ngā pōro pūkawe hiko i roto ki runga ake i te whakahiko Van de Graaff, e ai ki te pikitia. He kōpae konganuku kei runga me raro o te ipu. Kātahi ka whakapā ia i te poi e hono ana ki te papa ki te taha runga o te ipu. Kātahi ka tīmata ngā pōro ki te tāwhanawhana i waenga i ngā kōpae konganuku o runga me raro. E kīia ana he Volta Hailstorm tēnei.

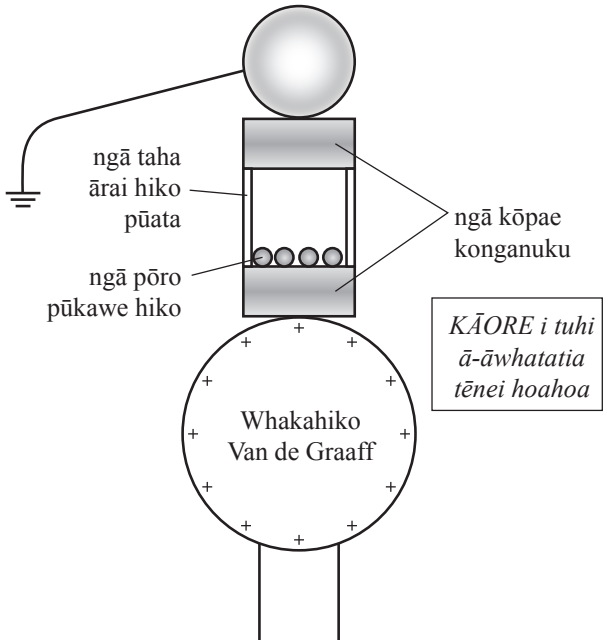
MĀ TE KAIMĀKA ANAKE

Me whakamārama mai he aha i tāwhanawhana ai ngā pōro i waenga i ngā kōpae.

I tō tuhinga me:

- whakamārama he aha i neke ai ngā pōro ki te kōpae o runga i te tuatahi
- whakamārama he aha ngā pōro i taka ai ki raro i muri mai.





He wāhi anō mō tō tuhinga mō tēnei tūmahi kei te whārangi 8.

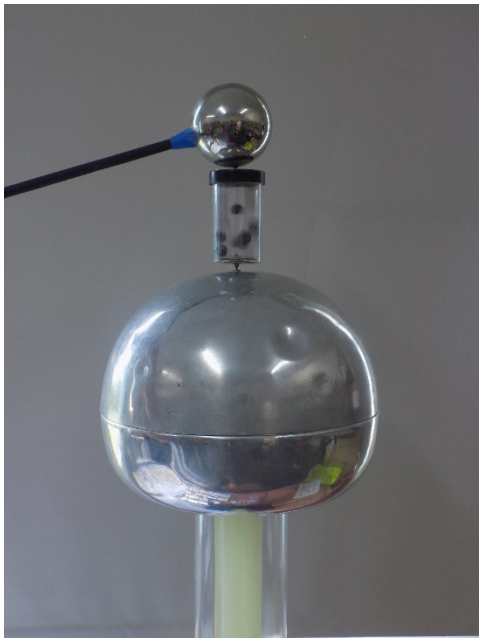
ASSESSOR'S USE ONLY

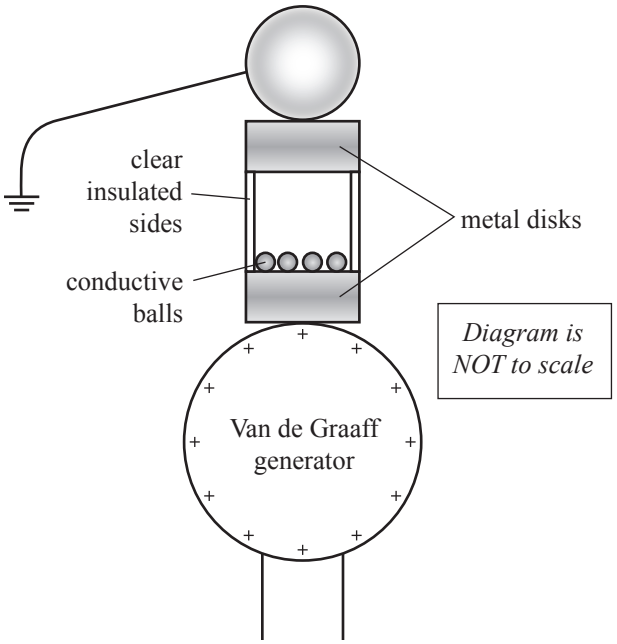
(d) A smaller Van de Graaff generator is used for a class activity. The teacher places a container of conductive balls onto the top of the Van de Graaff generator, as shown in the picture. The top and bottom of the container contain metal discs. They then touch the ground sphere against the top of the container. The conductive balls start to bounce back and forth between the top and bottom metal discs. This is called a Volta Hailstorm.

Explain why the balls bounce back and forth between the plates.

As part of your answer you should:

- explain why the balls initially move towards the top plate
- explain why the balls then fall back down.





There is more space for your answer to this question on page 9.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

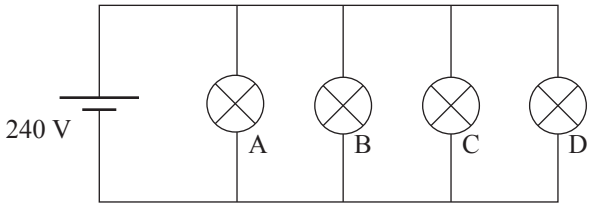
TŪMAHI TUARUA: PAEKŌHAO HIKO

MĀ TE KAIMĀKA ANAKE

He DJ a Andrew, ā, i te nuinga o te wā me whai kōhao hiko maha ia hei whakakā i ana utauta me ngā rama. Ka hono mai a Andrew i te paekōhao, e whakaaturia ana i te taha matau, ki tētahi kōhao hiko pātū e tuku ana i te 240 V. Kātahi ka hono mai ia i ngā rama ritepū e whā, ā, e 60 W te kaha hiko o ia rama. E tūhono whakararatia ana te paekōhao hiko i ngā wā katoa.

(a) Me whakamārama he aha te take me tūhono whakarara te paekōhao hiko.

(b) Ka tūhono a Andrew i ngā rama 60 W ritepū e whā kia whakarara me tētahi puna hiko 240 V DC hei whakamātautau, e ai ki te hoahoa i raro.



he ritepū ngā rama katoa

Whakaaturia mā te tātai ko te iahiko e rere ana i tētahi o ngā rama he 0.25 A.

(c) Ka whakakapia te pūrama C ki tētahi pūrama penapena-hiko e iti ake te whakatauranga hiko i tō te rama tuatahi, engari he ōrite te tīaho.

Me whakamārama mēnā he teitei ake, paku ake rānei te parenga iahiko o te pūrama penapena-hiko i te rama tuatahi.

MĀ TE KAIMĀKA ANAKE

(d) I whakarite a Andrew ki te whakakapi i ngā rama katoa e whā ki ngā pūrama penapena-hiko. I te tutukitanga o tēnei, he 0.20 A te iahiko tapeke mō ngā rama katoa e whā.

Tātaihia te pūngao hiko e whakapetoa ana e tētahi pūrama penapena-hiko KOTAHI i roto i te rua haora te roa, Ā, ka whakataurite i tēnei ki te pūngao ka whakapetoa e tētahi pūrama 60 V KOTAHI i roto i te rua haora.

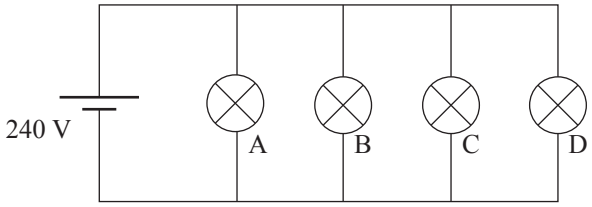
QUESTION TWO: POWER STRIP

ASSESSOR'S USE ONLY

Andrew is a DJ, and often needs multiple plugs to power his equipment and lights. Andrew plugs the power strip, as seen at right, into a wall outlet that provides 240 V. He then plugs in four identical lights each with a power of 60 W. A power strip is always wired in parallel.

(a) Describe why a power strip must be wired in parallel.

(b) Andrew connects four identical 60 W lights in parallel with a 240 V DC power supply to test them, as shown in the diagram below.



all lights are identical

Show by calculation that the current through one of the lights is 0.25 A.

(c) Bulb C is replaced by an energy-efficient light that has a lower power rating than the original light, but has the same brightness.

Explain whether the energy-efficient light bulb has a higher or lower resistance than the original light.

ASSESSOR'S USE ONLY

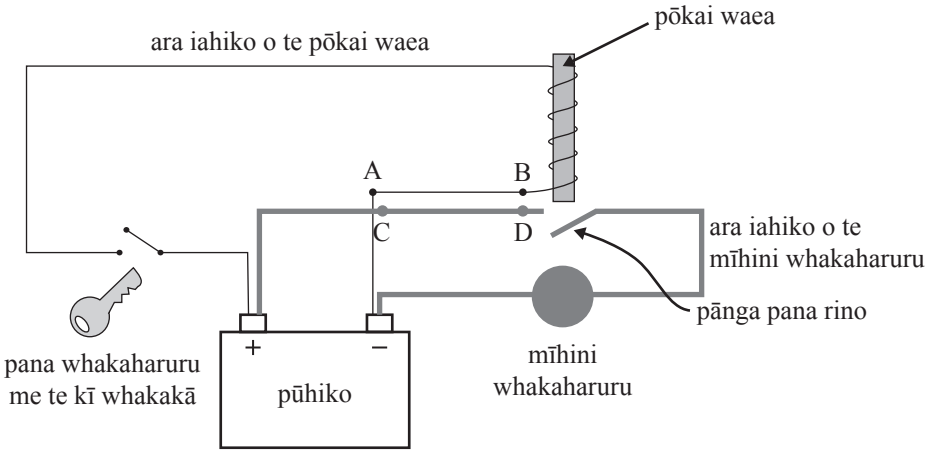
(d) Andrew decided to replace all four lights with energy-efficient light bulbs. When this happened, the total current for all four lights was 0.20 A.

Calculate the electrical energy used by ONE energy-efficient bulb over a period of two hours, AND compare this with the energy used by ONE 60 W light bulb over two hours.

TŪMAHI TUATORU: NGĀ PANAHIKO TĀNGA

MĀ TE KAIMĀKA ANAKE

E whakahaerehia ana tētahi mīhini[1] whakaharuru waka e ngā ara iahiko motuhake e rua; te ara iahiko pōkai waea, he iti te iahiko e rere ana i roto; me te ara iahiko whakaharuru waka, he nui te iahiko e rere ana i roto. Kei roto i tētahi pana tānga ko tētahi pōkai waea ka raua ki te taha o tētahi pānga pana rino. Ka whakamahia te pānga pana rino hei whakahaere i te mīhini whakaharuru.
E whakaatu ana te hoahoa i raro nei i ngā ara iahiko e rua.



(a) (i) Ki te hoahoa i runga ake, me tapa te pito tonga autō kei te pōkai waea ina kati ana te pana whakakā.

(ii) Tuhia te ingoa o te ture i whakamahia e koe hei whiriwhiri ki hea te pito tonga.

(b) Me whakamārama ka pēhea te kati i te pana whakakā e whakakā ai i te mīhini whakaharuru.

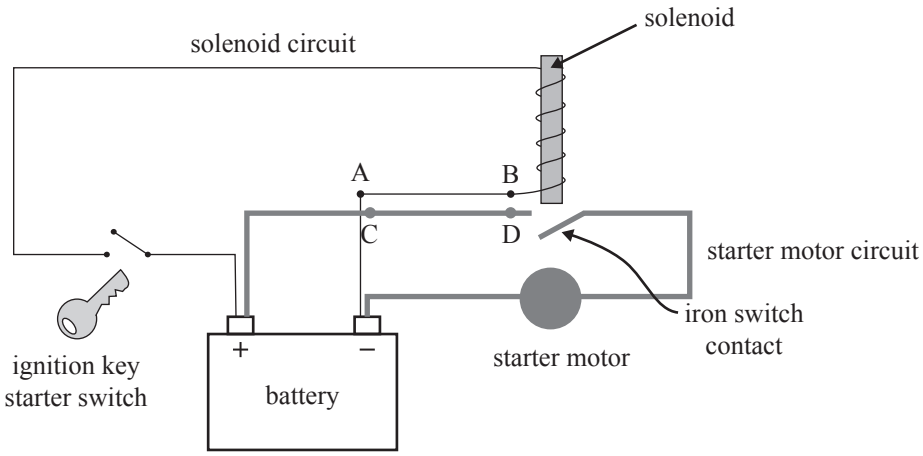
I tō whakautu me whakamārama e koe ka aha i roto i te pōkai waea, ā, i roto hoki i te pānga pana rino, i te katinga o te pana whakakā.

[1] pūkaha

QUESTION THREE: RELAY SWITCHES

ASSESSOR'S USE ONLY

A car starter motor is operated by two separate circuits; the solenoid circuit which has a small current flowing through it; and the starter motor circuit which has a large current flowing through it. A relay switch consists of a solenoid placed near an iron switch contact. The iron switch contact is used to operate the starter motor. The diagram below shows the two circuits.



(a) (i) On the diagram above, label the magnetic south pole on the solenoid when the ignition switch is closed.

(ii) State the name of the rule you used to determine where the south pole is located.

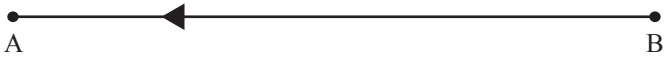
(b) Explain how closing the ignition switch turns the starter motor on.

As part of your answer you should explain what occurs in the solenoid, and in the iron switch contact, when the ignition switch is closed.

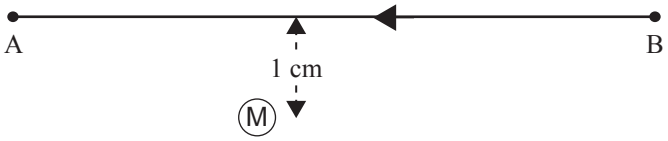
(c) Kei raro ko te wāhanga AB o te ara iahiko pōkai waea.

Tātuhia te ahunga o te whaitua autō e whakaputaina ana e te wāhanga AB, i runga ake me raro i te waea, i te wā e rere ana te iahiko i roto i te ara iahiko pōkai waea.

Ki te hiahia koe ki te tuhi anō i tēnei hoahoa, whakamahia te hoahoa i te whārangi 20.



(d) Ka raua he pūine whaitua autō kia 1 cm mai i te waea hei ine i te kaha o te whaitua autō, e ai ki te whakaaturanga.



Pūine whaitua autō

(i) I inea e te pūine whaitua autō te torokaha o te whaitua autō e whakaputaina ana e te wāhanga AB kia 40 μT (4.0×10^{-5} T) i te tawhiti o te 1.0 cm mai i te waea.

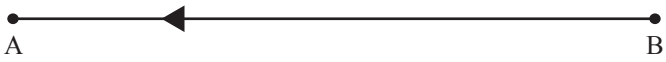
Tātaihia te iahiko i roto i te wāhanga AB o te ara iahiko pōkai waea.

ASSESSOR'S USE ONLY

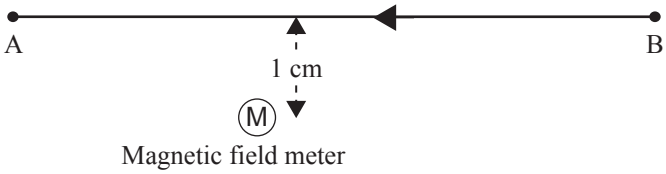
(c) Below is section AB of the solenoid circuit.

Draw the direction of the magnetic field produced by section AB, both above and below the wire, when the current is flowing in the solenoid circuit.

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



(d) A magnetic field meter is placed 1 cm away from the wire to measure the strength of the magnetic field, as shown.



(i) The magnetic field meter measured the strength of the magnetic field produced by section AB to be 40 μT (4.0×10^{-5} T) at a distance of 1.0 cm from the wire.

Calculate the current in section AB of solenoid circuit.

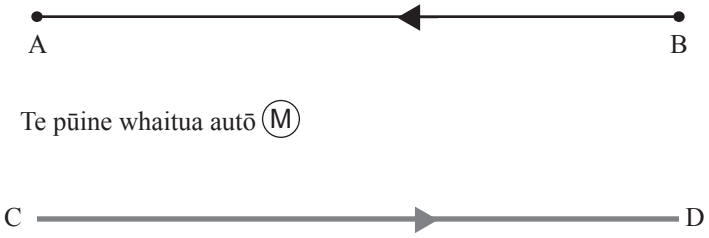
MĀ TE KAIMĀKA ANAKE

(ii) Ina mahi ana te mīhini whakaharuru, ka rere anō he iahiko mā te waea CD kei te ara iahiko o te mīhini whakaharuru. Kei raro te waea CD i te pūine whaitua autō, e ai ki te whakaaturanga. E rere ana te iahiko i CD ki te ahunga kōaro i tō te iahiko i AB, e ai ki te whakaaturanga i raro.

Me whakamārama he pēhea te whakaawe a te iahiko e rere ana i te waea CD ki te torokaha whaitua autō kei te wāhi i waenga i ngā waea e rua.

Me tīmata mā te tātuhi i te ahunga o ngā whaitua autō i runga ake me raro iho o ia waea.

Ki te hiahia koe ki te tuhi anō i tēnei hoahoa, whakamahia te hoahoa i te whārangi 20.



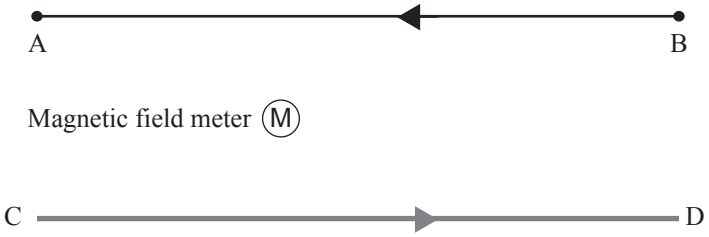
ASSESSOR'S USE ONLY

(ii) When the starter motor is operating, current also flows through the wire CD in the starter motor circuit. The wire CD is below the magnetic field meter, as shown. The current in CD flows in the opposite direction to the current in AB, as shown below.

Explain how the current through the wire CD affects the magnetic field strength in the region between the two wires.

Start by drawing the direction of the magnetic fields above and below each wire.

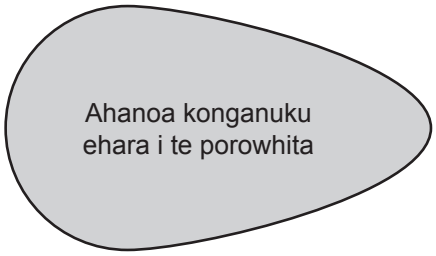
If you need to redraw this, use the diagram on page 21.



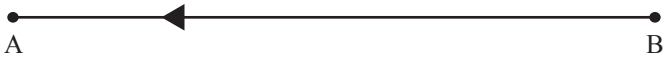
HE HOAHOA TĀPIRI

MĀ TE KAIMĀKA ANAKE

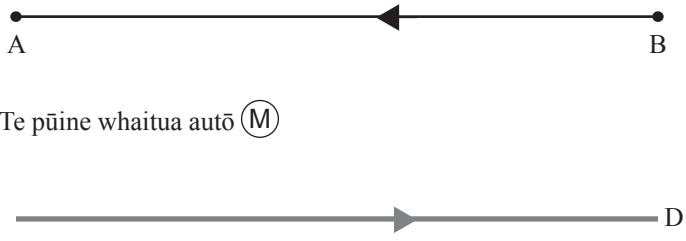
Ki te hiahia koe kia tuhia anō i tō hoahoa mai i te Tūmahi Tuatahi (a), tuhia ki raro nei. Kia mārama te tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.



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



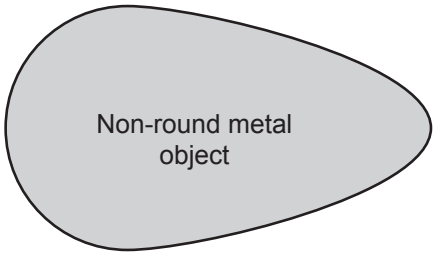
Ki te hiahia koe kia tuhia anō i tō hoahoa mai i te Tūmahi Tuatoru (d)(ii), tuhia ki raro nei. Kia mārama te tohu ko tēhea te tuhinga ka hiahia koe kia mākahia.



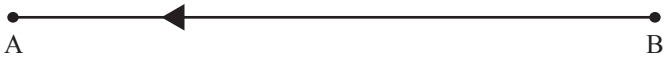
SPARE DIAGRAMS

ASSESSOR'S USE ONLY

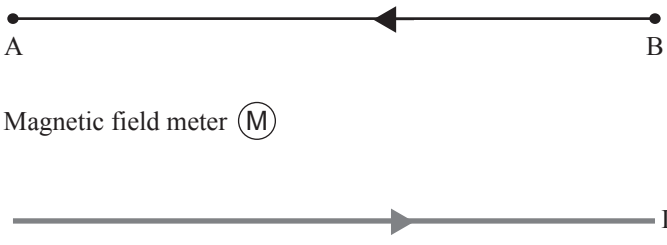
If you need to redraw your diagram from Question One (a), draw it below. Make sure it is clear which answer you want marked.



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



If you need to redraw your diagram from Question Three (d)(ii), draw it 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

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 1 Physics, 2018

90937 Demonstrate understanding of aspects of electricity and magnetism

2.00 p.m. Friday 23 November 2018
Credits: Four

90937M

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

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 L1–PHYSR.

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 and clearly number the question.

Check that this booklet has pages 2–23 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.