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NZQA

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Ahupūngao, Kaupae 2, 2018

91173M Te whakaatu māramatanga ki te hiko me te autōhiko

9.30 i te ata Rāmere 9 Whiringa-ā-rangi 2018
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 Waeine ā-Ao (SI) ki ngā tuhinga tohutau.

Mēnā ka hiahia whārangi atu anō koe mō ō tuhinga, whakamahia te (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 2–19 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.

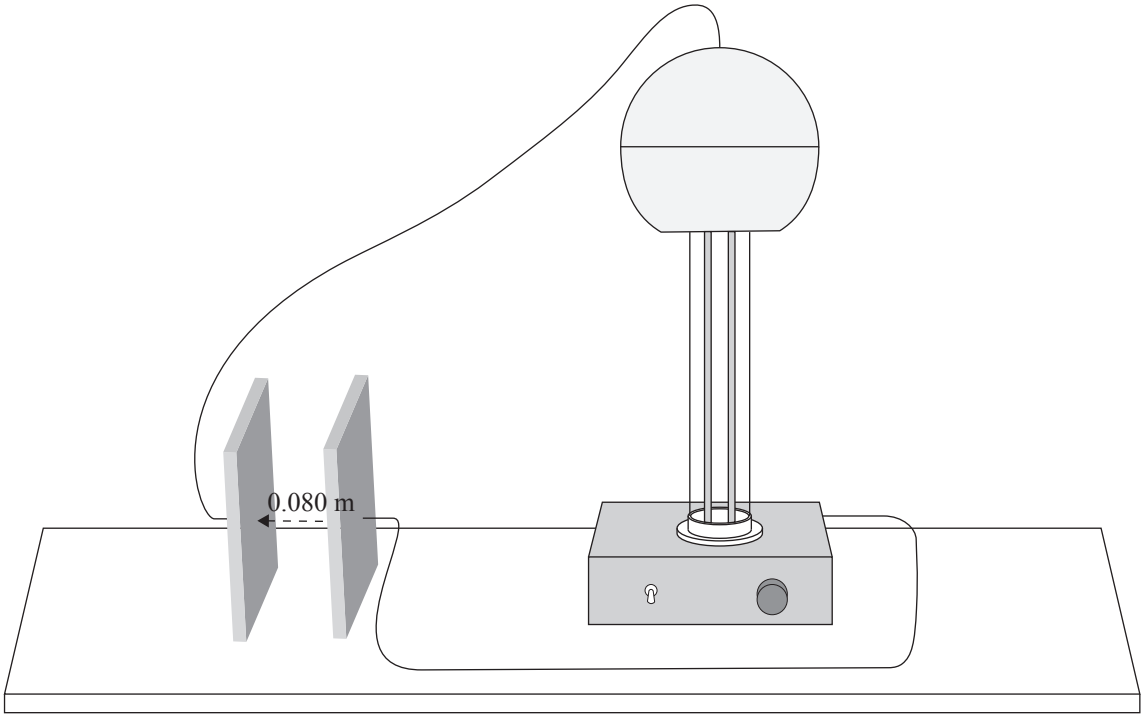
TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI: TE KĀNARA ME TE WHAKAHIKO VAN DE GRAAFF

MĀ TE KAIMĀKA ANAKE

Kua tūhonoa e Sam te whakahiko Van de Graaff (puna hiko DC me te ngaohiko tino kaha) ki ngā papana konganuku whakarara e rua, ā, e 0.080 m te tawhiti tētahi i tētahi.



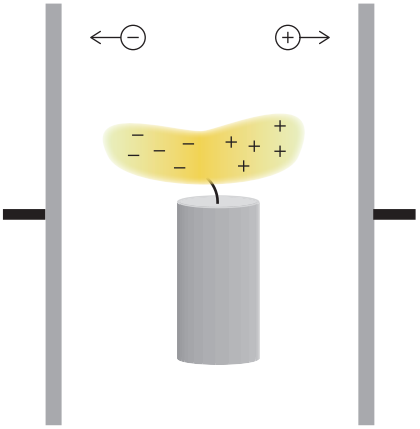
(a) Ka whakatūhia he whaitua hiko me te kaha o te 2.50×10^6 V m^{-1} ki waenga i ngā papana i te wā e kā ana te whakahiko Van de Graaff.

Tātaihia te ngaohiko i waenganui i ngā papana.

Kei roto i te mura o tētahi kānara ngā korakora whana tōrunga me te tōraro.

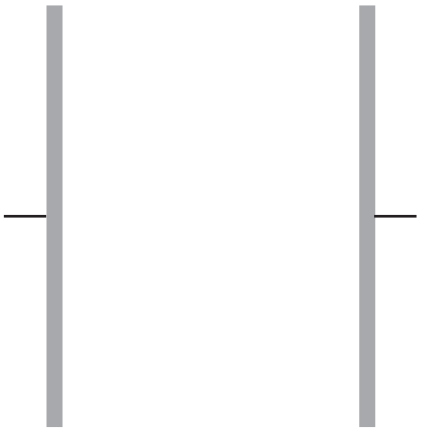
I te rautanga a Sam i te kānara mura i waenga i ngā papana konganuku whakarara e rua e tūhono ana ki te whakahiko Van de Graaff, ka hora te mura e ai ki te hoahoa.

Ka neke ngā korakora whana tōraro i roto i te mura ki te taha mauī, ā, ka neke ngā korakora whana tōrunga ki te taha matau.



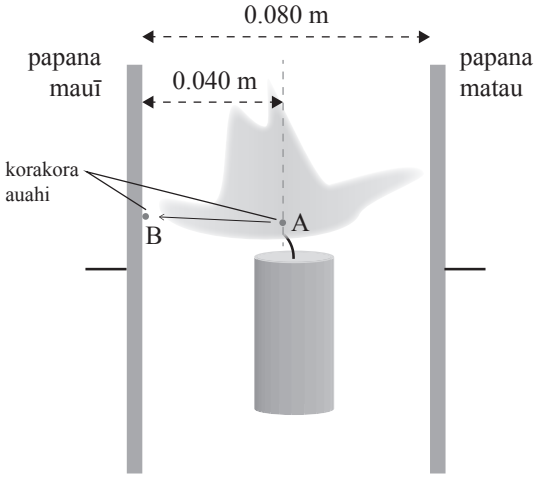
MĀ TE KAIMĀKA ANAKE

(b) Tātuhia te whaitua hiko i puta i waenga i ēnei papana konganuku whakarara e rua, e āta tohu ana ko tēhea te papana tōrunga.



(c) Kātahi ka tineia e Sam te kānara, ā, ka puta te makenu neke o te auahi. Ka neke ngā korakora auahi whana tōraro ki te taha mauī, ā, ka neke ngā korakora auahi whana tōrunga ki te taha matau.

Kei waenga pū tētahi korakora auahi whana tōraro, he mea whakapahoho i te tuatahi, me te whana o te 6.52×10^{-13} i te pūwāhi A. Ka whakaterea ake te korakora auahi ki te taha mauī, nā te whaitua hiko 2.50×10^{6} V m^{-1}.

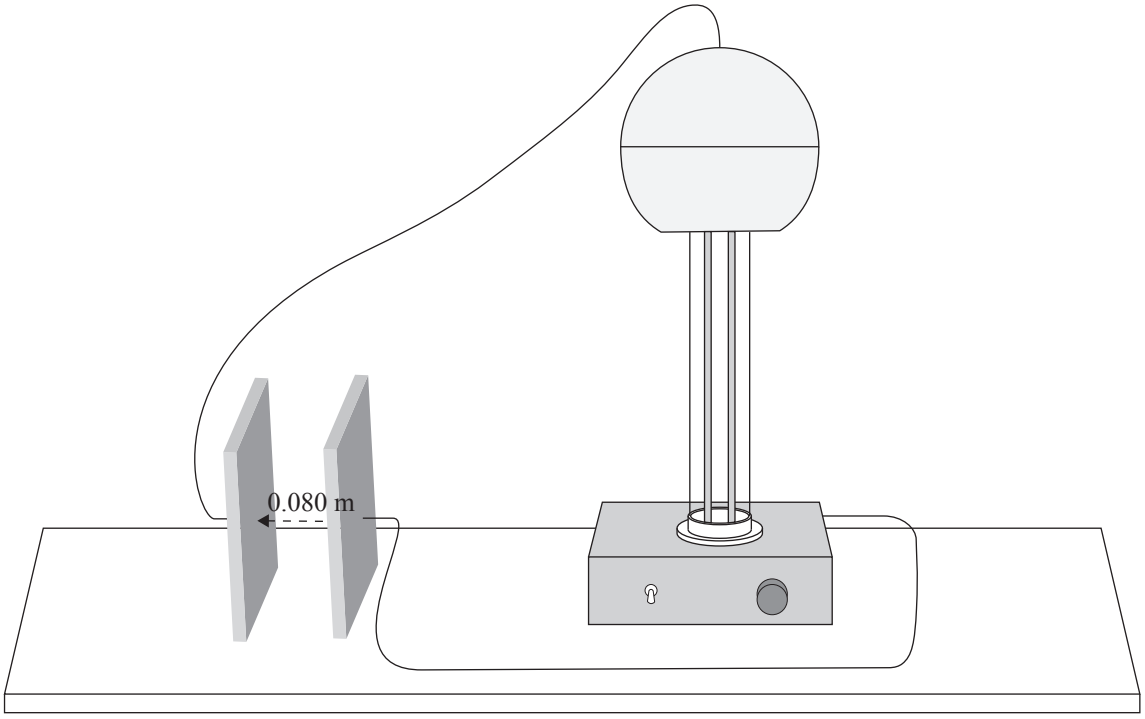


Mā te whakamahi i te pūmau o te pūngao, tātaihia te tere o te korakora auahi he 4.5×10^{-6} kg i mua tonu i te tukinga ki te papana mauī (pūwāhi B) e 0.040 m te tawhiti mai i te pūwāhi A.

QUESTION ONE: THE CANDLE AND THE VAN DE GRAAFF GENERATOR

ASSESSOR'S USE ONLY

Sam has connected his school's Van de Graaff generator (high voltage DC power source) to two parallel metal plates that are 0.080 m apart.



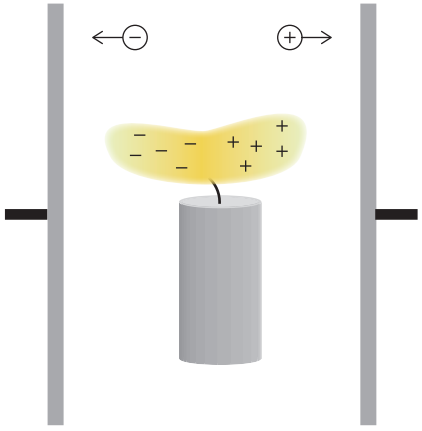
(a) An electric field strength of 2.50×10^6 V m^{-1} is established between the plates when the Van de Graaff generator is turned on.

Calculate the voltage between the plates.

The flame of a candle contains both positively and negatively charged particles.

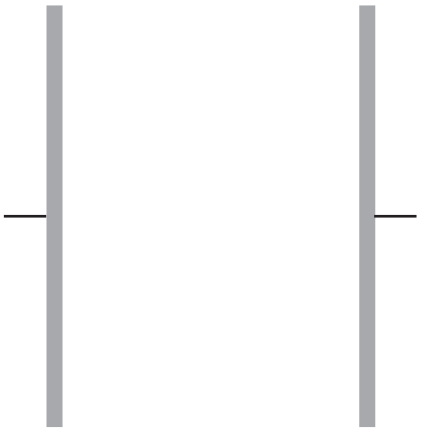
When Sam places a burning candle between the two parallel metal plates connected to the Van de Graaff generator, the flame spreads out as shown in the diagram.

The negatively charged particles within the flame move to the left and the positively charged particles move to the right.



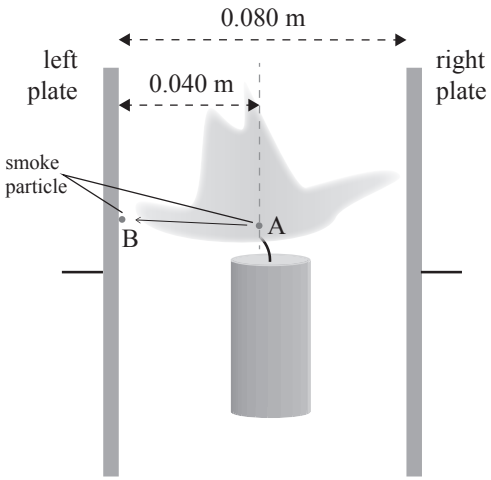
ASSESSOR'S USE ONLY

(b) Draw the electric field formed between these two parallel metal plates, clearly indicating which plate is positive.



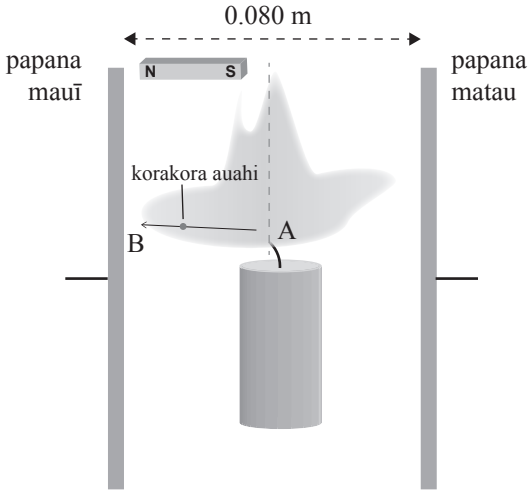
(c) Sam then extinguishes the candle, causing a moving trail of smoke to appear. The negatively charged smoke particles travel to the left and the positively charged smoke particles travel to the right.

An initially stationary negatively charged smoke particle with a charge of 6.52×10^{-13} C is positioned centrally at point A. The smoke particle is accelerated to the left, due to the 2.50×10^{6} V m^{-1} electric field.



Using conservation of energy, calculate the speed of the 4.5×10^{-6} kg smoke particle the instant before it collides with the left hand plate (point B) that is 0.040 m away from point A.

(d) Ka raua he poro autō pūmau kaha ki runga rawa ake i te makenu auahi, kia anga atu ai te pito raki ki te taha mauī. E haere ana ngā korakora auahi whana tōraro mai i te kānara ki te papana mauī (pūwāhi A ki te pūwāhi B).



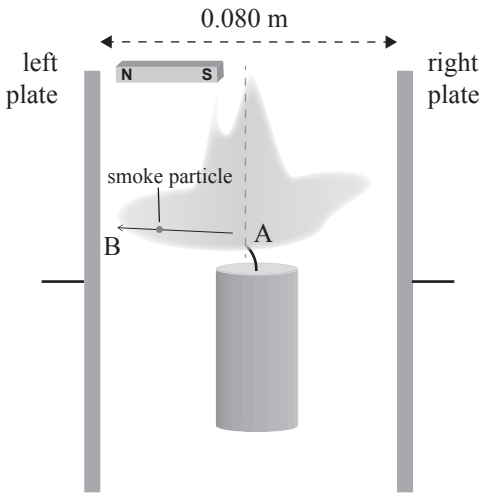
(i) Tuhia kia rua ngā huringa, me waiho te autō, ka taea hei whakapiki ake i te tere o te korakora auahi whana tōraro.

(ii) Mō tētahi o aua huringa, me āta whakamārama ngā ahupūngao tōtika e tere ake ai te korakora auahi whana tōraro nā te huringa.

(iii) Matapakitia me aha te autō hei whakaawe i te nekehanga o te korakora auahi whana tōraro.

ASSESSOR'S USE ONLY

(d) A strong permanent bar magnet is then placed high above the smoke trail, so the north pole is pointing towards the left. The negatively charged smoke particles are travelling from the candle to the left hand plate (point A to point B).



(i) State two changes, not involving the magnet, that could be made to increase the velocity of the negatively charged smoke particle.

(ii) For one of the changes, clearly explain the relevant physics of how the change increases the velocity of the negatively charged smoke particle.

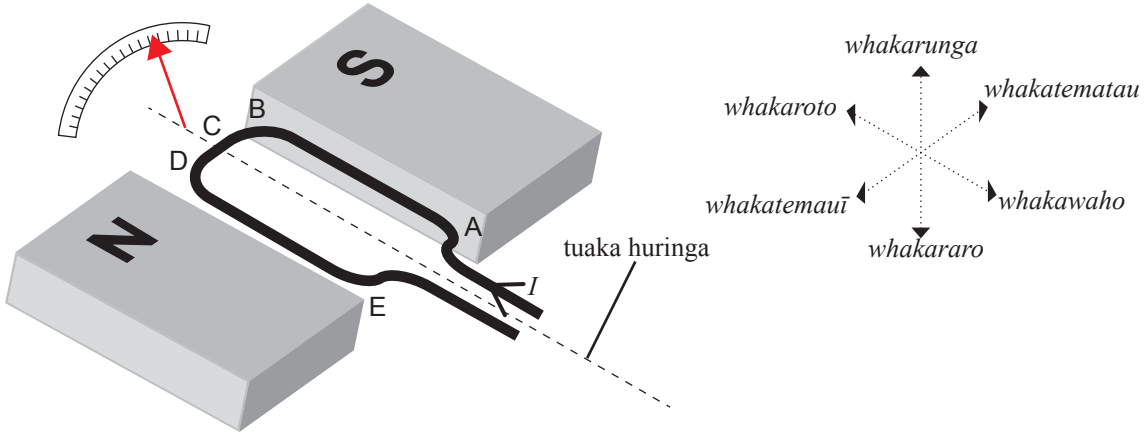
(iii) Discuss what could be done with the magnet to affect the motion of the negatively charged smoke particle.

TŪMAHI TUARUA: TE INE-IAHIKO

MĀ TE KAIMĀKA ANAKE

E whakaatu ana te hoahoa i raro i te whakaaturanga māmā o tētahi ine-iahiko ā-ngira.

Ka rere te iahiko mā te pōkai (ABCDE) i roto i tētahi whaitua autō, kia puta mai he tōpana autō e nekeneke ana i te ngira, hei tohu i te rahinga o te iahiko e puta ana i te ine-iahiko.



(a) Ka rere kōaro he iahiko o te 2.5 A mā te ine-iahiko (ABCDE).

Tuhia te ahunga o te tōpana (mēnā kei reira) kei ia wāhanga o te waea.

Kāore he tātaihanga e hiahiatia.

(i) AB _____

(ii) BC _____

(iii) DE _____

(b) Ka puta he tōpana **tapeke** o te 0.60 N ki te waea i roto i te ine-iahiko ina puta ana te 2.5 A mā te pōkai.

Tātaihia te roa tūturu o te waea **pōkai** i waenga i ngā pūwāhi A me te B.

Ko te torokaha o te whaitua autō i roto i te ine-iahiko he 0.20 T.

_____

_____

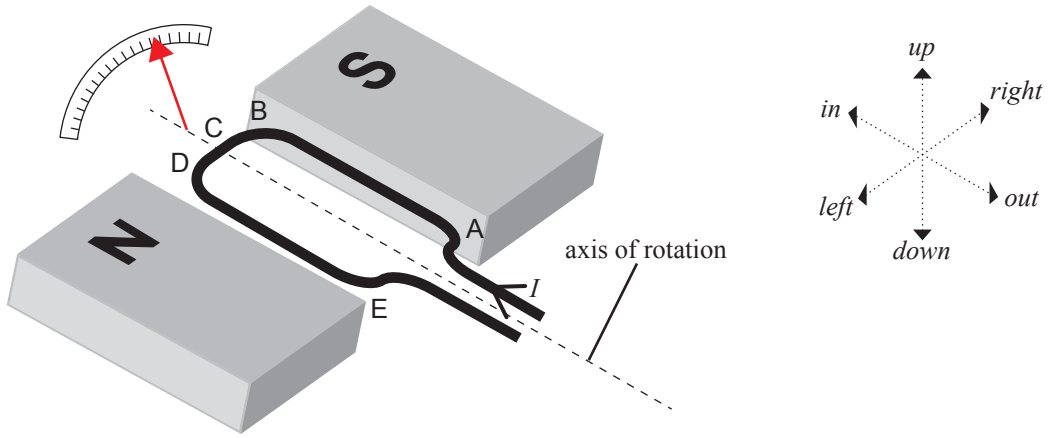
_____

QUESTION TWO: THE AMMETER

ASSESSOR'S USE ONLY

The diagram below shows a simplified version of the inside of an analogue ammeter.

Current passes through the coil (ABCDE) within a magnetic field, causing a magnetic force that moves the needle, indicating the amount of current passing through the meter.



(a) A current of 2.5 A passes anticlockwise through the ammeter (ABCDE).

State the direction of the force (if any) on each section of wire.

No calculations are necessary.

(i) AB _____

(ii) BC _____

(iii) DE _____

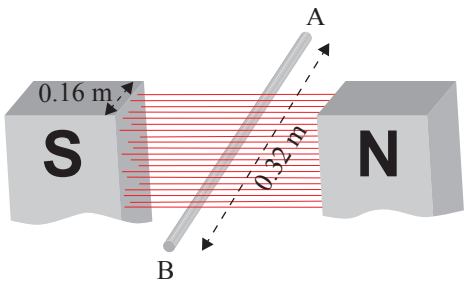
(b) A **total** force of 0.60 N is produced on the wire within the ammeter when 2.5 A is passed through its coil.

Calculate the effective length of the **coiled** wire between points A and B.

The magnetic field strength within the ammeter is 0.20 T.

(c) I tētahi wā i muri mai, ka neke whakararohia he matira maitai ki waenga i ngā pito o tētahi autō tāwhana i te tere pūmau o te 7.5 m s^{-1} puta noa i tētahi whaitua autō 3.5 T te kaha.

He 0.32 m te roa o te matira AB, ā, he 0.16 m te whānui o ngā taha o te autō tāwhana.



Tātaihia te ngaohiko ka whakaputaina i te matira AB, ā, ka tuhi ko tēhea te pito tōrunga.

He tōrunga te pito _____.

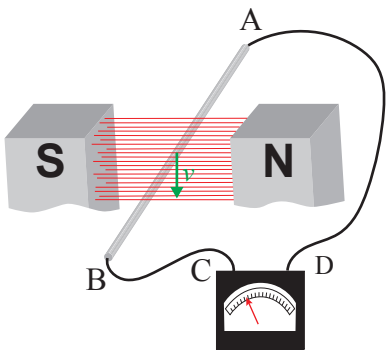
(d) E toru anō ngā wā i mahia e Sam te whakamātau, ā, me te mau tonu ki te tere me te autō ōrite. Ki ngā whakamātau i raro, i whakamaua e ia he waea pūkawe hiko me te parenga ehara i te kore mā tētahi ine-iahiko tairongo, me te rapu ko tēhea te whakamātau ka whakaputa i tētahi iahiko.

Whakamātau 1: Ka neke whakararo te matira AB ki roto i te whaitua autō, ka kopi ngā waea AD me BC i te ara iahiko i waho o te whaitua autō.

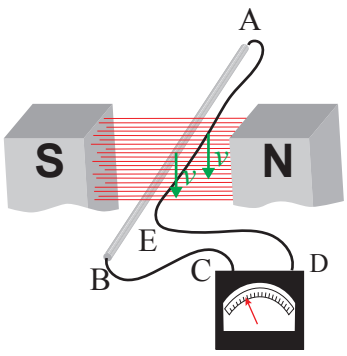
Whakamātau 2: Ka neke whakararo te matira AB me te waea AE ki roto i te whaitua autō. Ka kopi ngā waea BC me te ED i te ara iahiko i waho o te whaitua autō.

Whakamātau 3: Ka neke whakararo te matira AB ki roto i te whaitua autō. Ka noho tū noa te waea EF i roto i te whaitua autō. Ka kopi ngā waea BC, AF, me te ED i te ara iahiko i waho o te whaitua autō.

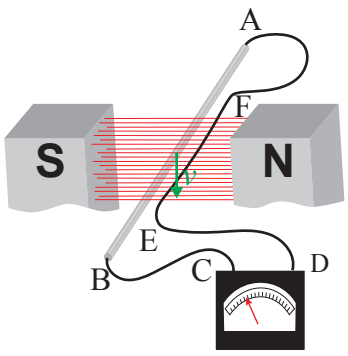
Whakamātau 1



Whakamātau 2



Whakamātau 3



(i) Mō ngā whakamātau 2 me te 3, me tuhi mēnā ka whakaputaina he ngaohiko i te waea AB.

MĀ TE KAIMĀKA ANAKE

(ii) Mō ia whakamātau, parahautia mēnā ka rere ngā iahiko mā te pōkai kopi, ka whakamārama i ngā mātāpono ahupūngao taketake kei roto.

MĀ TE KAIMĀKA ANAKE

Whakamātau 1: _____

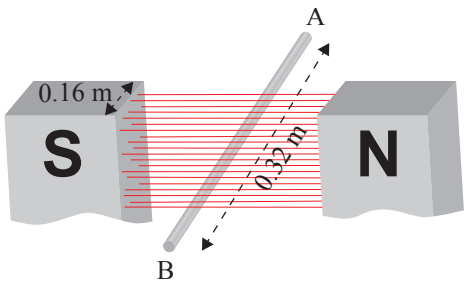
Whakamātau 2: _____

Whakamātau 3: _____

ASSESSOR'S USE ONLY

(c) At a later time, a metal rod is moved downwards between the poles of a horse-shoe magnet at a constant speed of 7.5 m s^{-1} across a strong 3.5 T magnetic field.

The rod AB is 0.32 m and the sides of the horseshoe magnet are 0.16 m wide.



Calculate the voltage induced in the rod AB, and state which end is positive.

End _____ is positive.

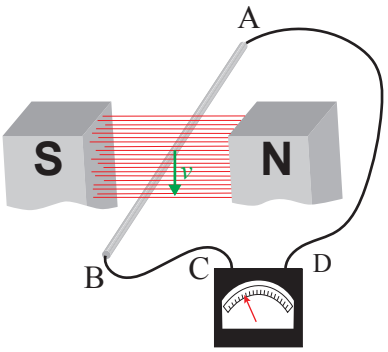
(d) Sam completed the experiment three more times, maintaining the same speed and magnet. In the experiments below, he attached a conducting wire with non-zero resistance through a sensitive ammeter, wanting to determine which experiment would induce a current.

Experiment 1: Rod AB moves downwards inside the magnetic field, wires AD and BC complete the circuit outside the magnetic field

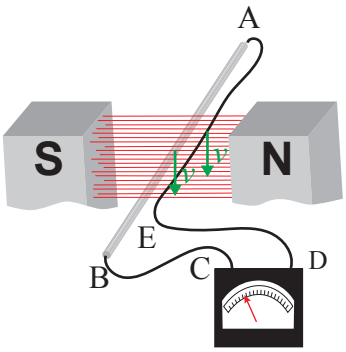
Experiment 2: Rod AB and wire AE both move downwards inside the magnetic field. Wires BC and ED complete the circuit outside the magnetic field

Experiment 3: Rod AB moves downwards inside the magnetic field. Wire EF remains stationary inside the magnetic field. Wires BC, AF, and ED complete the circuit outside the magnetic field.

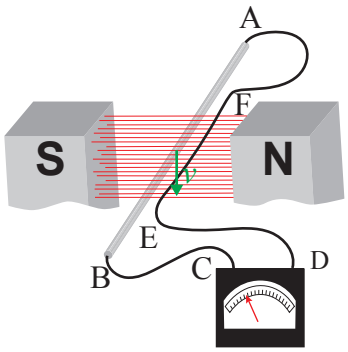
Experiment 1



Experiment 2



Experiment 3



(i) For experiments 2 and 3, state whether a voltage is induced in the wire AB.

(ii) For each of the experiments, justify whether current flows through the closed loop, explaining the underlying physics principles involved.

ASSESSOR'S USE ONLY

Experiment 1:

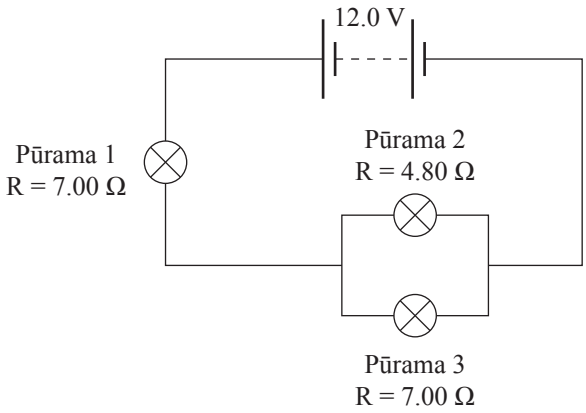
Experiment 2:

Experiment 3:

TŪMAHI TUATORU: NGĀ ARA IAHIKO

MĀ TE KAIMĀKA ANAKE

Whakamahia te hoahoa ara iahiko hei whakatutuki i ngā tūmahi i raro.



(a) Whakaaturia mai ko te tapeke parenga iahiko o te ara iahiko i runga nei he tata ki te 10 Ω.

(b) Tātaihia ngā ngaohiko puta noa i te pūrama 1 me te pūrama 2.

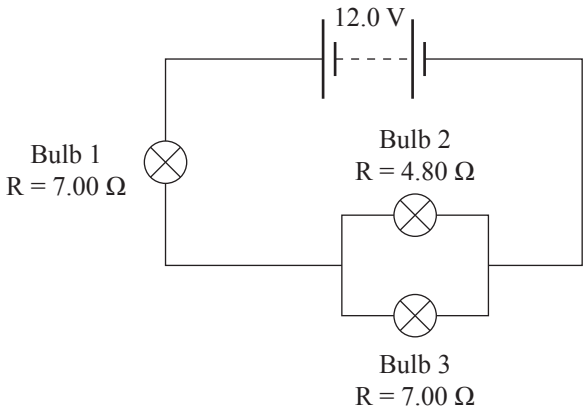
(c) He rerekē te tīahoaho o ngā pūrama 2 me te 3.

Matapakitia ko tēhea te pūrama he tīahoaho ake, ā, he aha ai hoki.

QUESTION THREE: CIRCUITS

ASSESSOR'S USE ONLY

Use the following circuit diagram to answer the questions below.



(a) Show that the total resistance of the above circuit is approximately 10 Ω.

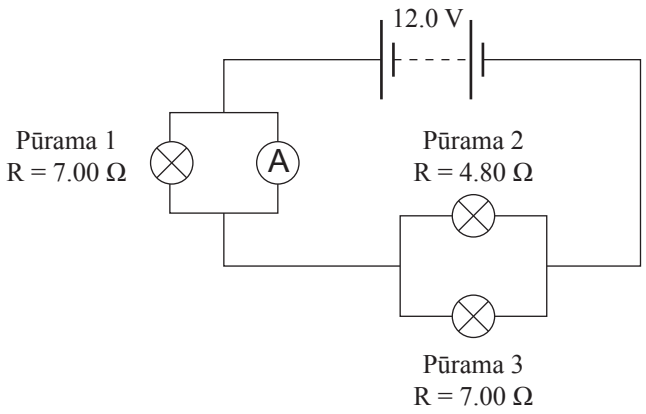
(b) Calculate the voltages across bulb 1 and bulb 2.

(c) Bulbs 2 and 3 are not the same brightness.

Discuss which bulb is brighter, and why.

(d) Ka tāpirihia tētahi ine-iahiko (me te parenga tino iti) ki te ara iahiko o mua, e whakaaturia ana i raro.

MĀ TE KAIMĀKA ANAKE



Matapakitia te pānga o te tāpiri i te ine-iahiko ki te iahiko, te ngaohiko, ā, koinā i pērā ai te tīahonga o ia pūrama.

(d) An ideal ammeter (with negligible resistance) is added to the previous circuit as shown below.

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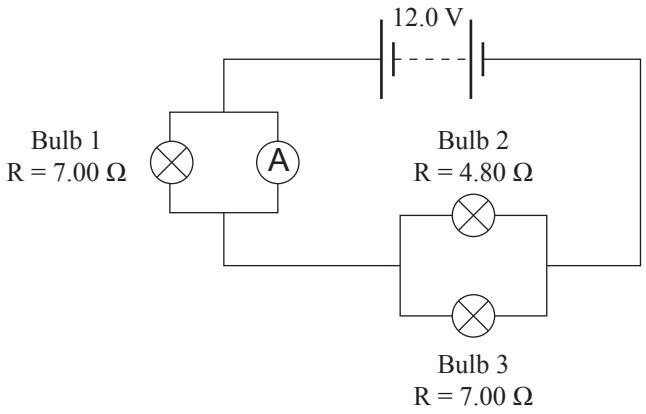

Discuss the effect adding the ammeter has on the current, the voltage, and hence the brightness of each bulb.

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

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English translation of the wording on the front cover

Level 2 Physics, 2018

91173 Demonstrate understanding of electricity and electromagnetism

9.30 a.m. Friday 9 November 2018
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–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 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.