91173M

911735

NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

2

SUPERVISOR'S USE ONLY

Ahupūngao, Kaupae 2, 2017

91173M Te whakaatu māramatanga ki te hiko me te autōhiko

2.00 i te ahiahi Rāmere 10 Whiringa-ā-rangi 2017
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 Rau 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 mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i ngā 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.

HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

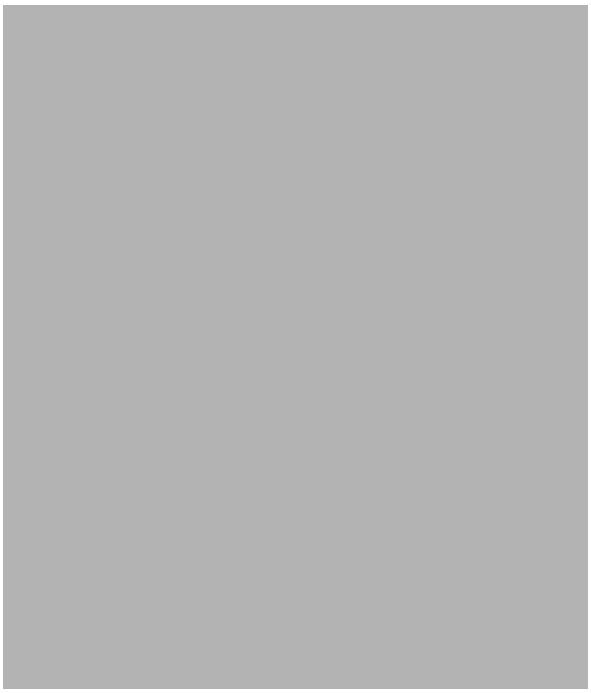
© Mana Tohu Mātauranga o Aotearoa, 2017. Pūmau te mana.
Kia kaua rawa he wāhi o tēnei tuhinga e whakahuatia ki te kore te whakaaetanga tuatahi a te Mana Tohu Mātauranga o Aotearoa.

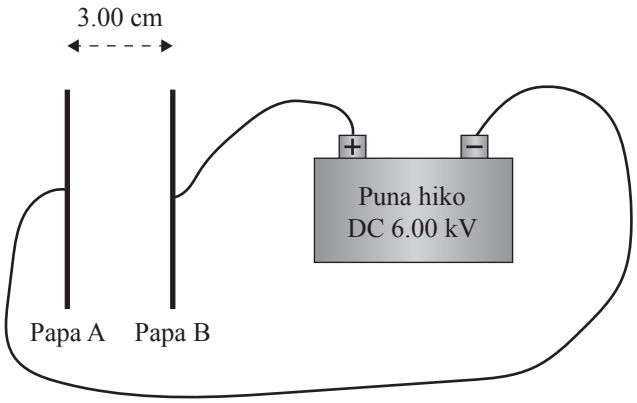
TŪMAHI TUATAHI: NGĀ TUKUORO HIKOTŪ

MĀ TE KAIMĀKA ANAKE

Ina tata nei i hokona mai e Sam he tukuoro hikotū e whakaputa ana i te oro mā te neke i tētahi kiri tōiri (he rau pareaku rahirahi) i waenga i ngā papa pūkawe hiko e rua he 3.00 cm te wehe tētahi i tētahi.

E whakaaturia ana i te hoahoa māmā i raro ko tētahi tukuoro hikotū. E tūhono ana ngā papa ki tētahi puna hiko DC ngaohiko teitei o te 6.00 kV.

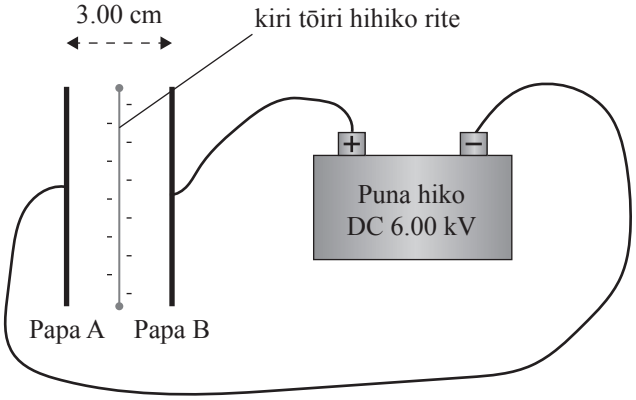




http://electronics.howstuffworks.com/question713.htm

(a) Whakaaturia mai ko te kaha o te whaitua hiko i waenga i ngā papa A me te B he $2.00 \times 10^5\ \text{Vm}^{-1}$.

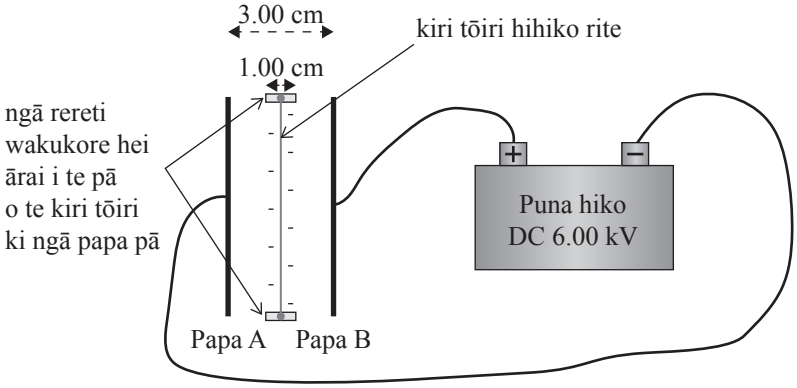
(b) He ngū te kiri tōiri i te tuatahi, ā, kei waenga i ngā papa, ka whaihiko mā te tāpiri atu i te 3.70×10^{12} irahiko ki runga.



Tātaihia te whana tapeke me te rahi o te tōpana tapeke (tae atu ki te ahunga) ka pā ki te kiri tōiri hihiko.

MĀ TE KAIMĀKA ANAKE

(c) Kei te mau te kiri tōiri hihiko rite i runga me raro ki ngā rereti maene (wakukore), e taea ai te nekeneke ki te taha mauī me te matau mā te tawhiti tapeke o te 1.00 cm.



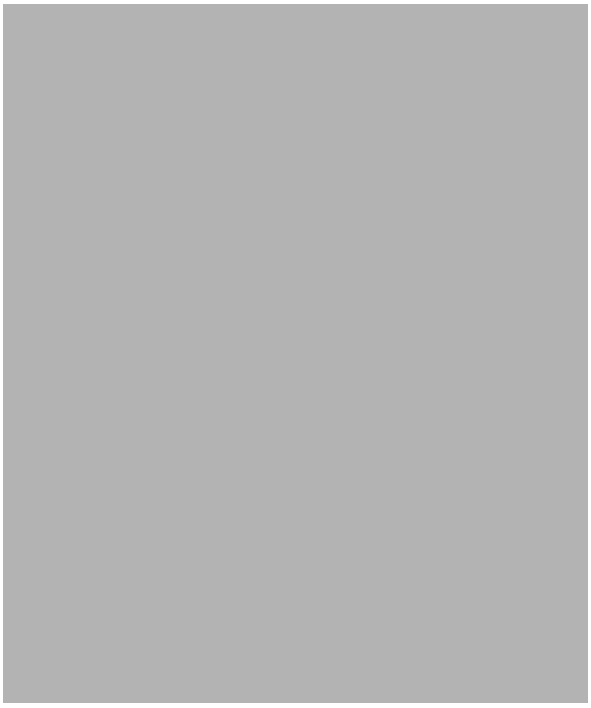
Whakamāramahia mai he aha i noho pūmau ai te tōpana ka pā ki te kiri tōiri, ā, kāore i te piko, i te wā ka neke te kiri tōiri i roto i ngā rereti.

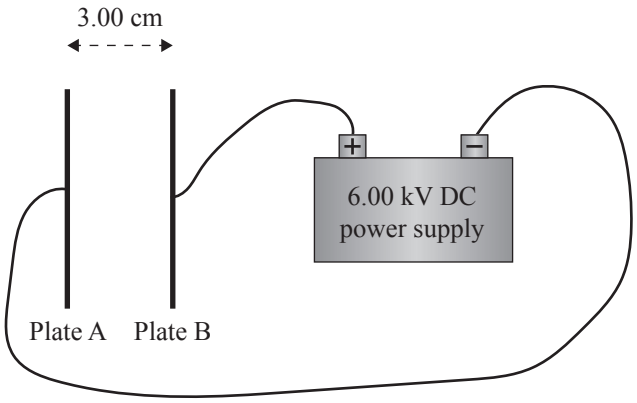
QUESTION ONE: ELECTROSTATIC SPEAKERS

ASSESSOR'S USE ONLY

Sam has recently purchased an electrostatic speaker that produces sound by moving a diaphragm (thin sheet of polyester film) between two conducting plates that are 3.00 cm apart.

A simplified diagram of an electrostatic speaker is shown below. The plates are connected to a 6.00 kV high-voltage DC power supply.

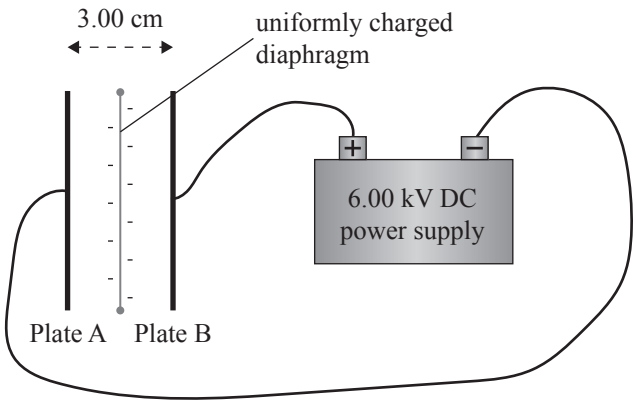




http://electronics.howstuffworks.com/question713.htm

(a) Show the strength of the electric field between plates A and B is $2.00 \times 10^5\ \text{Vm}^{-1}$.

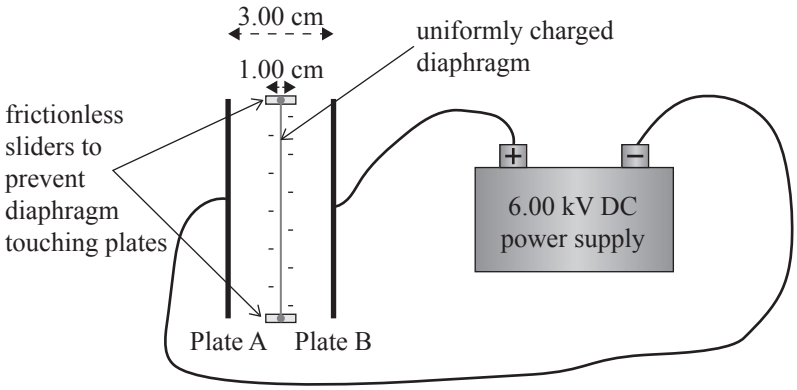
(b) The initially neutral diaphragm, centrally placed between the plates, is charged by adding 3.70×10^{12} electrons onto it.



ASSESSOR'S USE ONLY

Calculate the total charge and the size of the total force (including direction) experienced by the charged diaphragm.

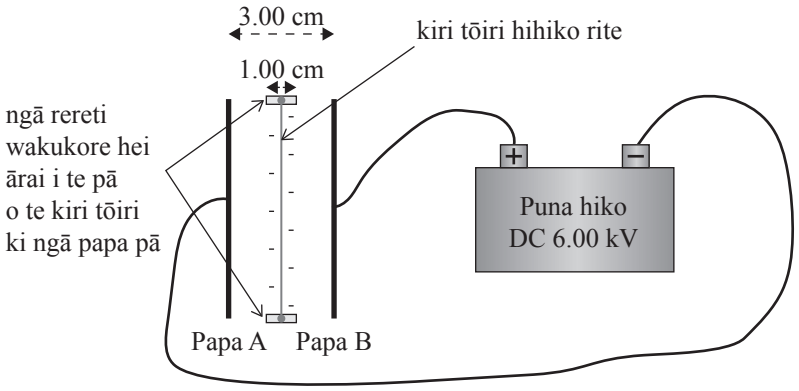
(c) The uniformly charged diaphragm is fixed at the top and bottom to smooth (frictionless) sliders, which allows it to move to the left or right by a total distance of 1.00 cm.



Explain why the size of the force on the diaphragm remains constant, and no bending occurs, as the diaphragm moves within the sliders.

(d) Ka tāruatia te hoahoa mai i te whārangi o mua.

MĀ TE KAIMĀKA ANAKE



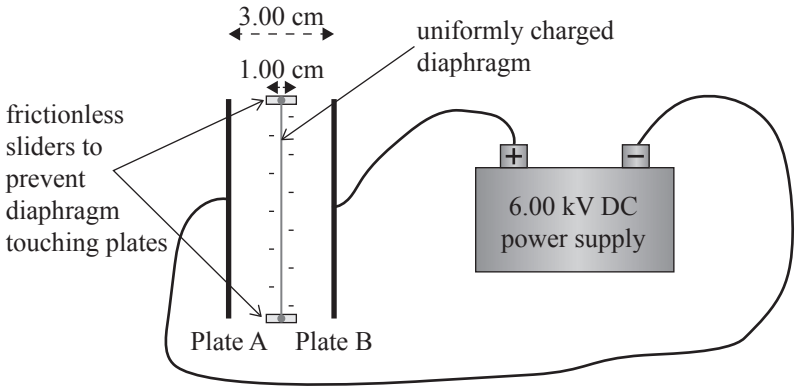
I tētahi wāhi he whana tōraro rite tō te kiri tōiri tū noa o te -4.20×10^{-5} C, ā, kei waenganui i te rereti i te tuatahi. Ko te papatipu o te kiri tōiri he 5.80×10^{-5} kg, ā, ko te mātotoru o te rereti he 1.00 cm. E tū wehe ana ngā papa pūkawe hiko mā te 3.00 cm.

Kimihia te tere mōrahi o te kiri tōiri ka riro mai i mua i te whakatūnga e te tapa o te rereti.

Tuhia ngā whakapae ka mahia e koe.

ASSESSOR'S USE ONLY

(d) The diagram below is repeated from the previous page.



At one point the stationary diaphragm has a uniform negative charge of -4.20×10^{-5} C, and is initially located in the middle of the slider. The mass of the diaphragm is 5.80×10^{-5} kg, and the width of the slider is 1.00 cm. The conducting plates are 3.00 cm apart.

Find the maximum speed the diaphragm will have before it is stopped by the edge of the slider.

State any assumptions you make.

TŪMAHI TUARUA: NGĀ PŪRAMA

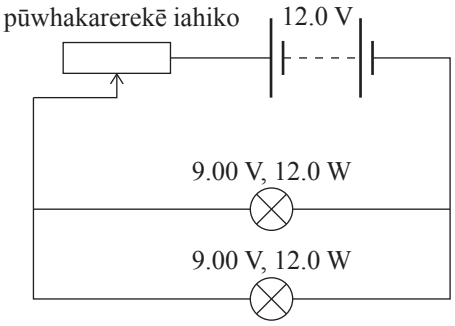
MĀ TE KAIMĀKA ANAKE

E whakamahia ana e Sam tētahi pūrama he 9.00 V, 12.0 W te whakatauranga.

(a) Tātaihia te iahiko e rere ana i te pūrama i te wā e mahi ana ki te ngaohiko i whakatauhia o te 9.00 V.

Kātahi ka tūhono a Sam i ngā pūrama 9.00 V, 12.0 W ritepū e rua, he pūhiko 12.0 V, me tētahi pūwhakarerekē iahiko (parehiko taurangi) pēnei e whakaaturia ana i raro.

www.electronics-tutorials.ws/resistor/slider-rheostat.jpg?x98918



(b) Whakamārahia mai he pēhea te pānga ki te ngaohiko i ia pūrama mai i te whakapiki i te parehiko o te pūwhakarerekē iahiko.

QUESTION TWO: LIGHT BULBS

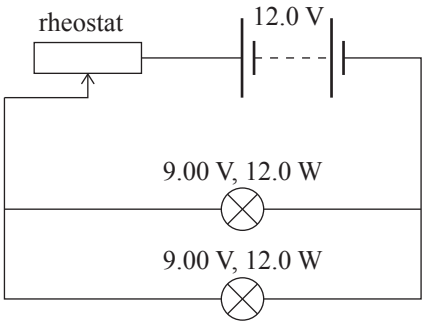
ASSESSOR'S USE ONLY

Sam is using a light bulb rated as 9.00 V, 12.0 W.

(a) Calculate the current flowing through the bulb when it is working at the stated voltage of 9.00 V.

Sam then connects two identical 9.00 V, 12.0 W bulbs, a 12.0 V battery, and a rheostat (variable resistor) as shown below:

www.electronics-tutorials.ws/resistor/slider-rheostat.jpg?x98918

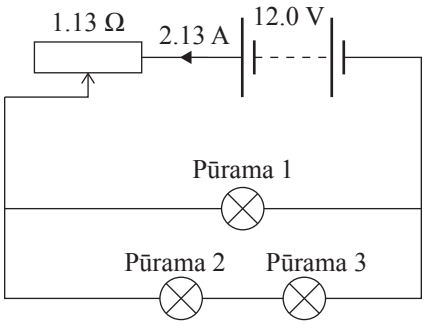


(b) Explain how increasing the resistance of the rheostat affects the voltage across each bulb.

(c) Me whakaatu ko te parehiko o te pūwhakarerekē iahiko me mātua 1.13 Ω, kia taea ia pūrama te mahi ki te 9.00 V.

MĀ TE KAIMĀKA ANAKE

(d) I muri noa mai ka whakarerekēhia e Sam te ara iahiko i te wāhanga (a) mā te tāpiri i tētahi atu pūrama ritepū. Ka tangohia he iahiko o te 2.13 A mai i te pūhiko ina tūhonotia te ara iahiko.

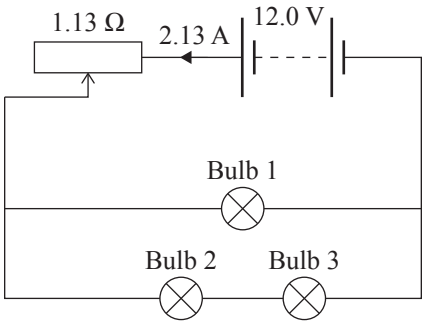


Whakamāramahia he pēhea te pānga o te pūrama 3 tāpiri ki te kaha tīaho o te Pūrama 1. I tō tuhinga, whakamāramahia mai mēnā ka nui ake te tūpono ka 'pahū' tētahi o ngā pūrama.

ASSESSOR'S USE ONLY

(c) Show that the resistance of the rheostat must be 1.13 Ω, in order for each bulb to be operating at 9.00 V.

(d) Some time later Sam modifies the circuit in part (a) by adding one more identical bulb. A current of 2.13 A is drawn from the battery when the circuit is connected.

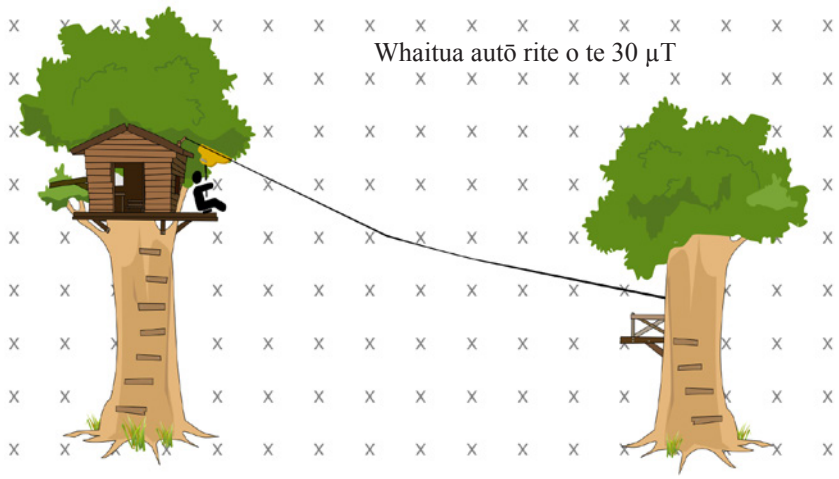


Explain how the addition of Bulb 3 affects the brightness of Bulb 1. In your answer, explain if any of the bulbs are now more likely to 'blow'.

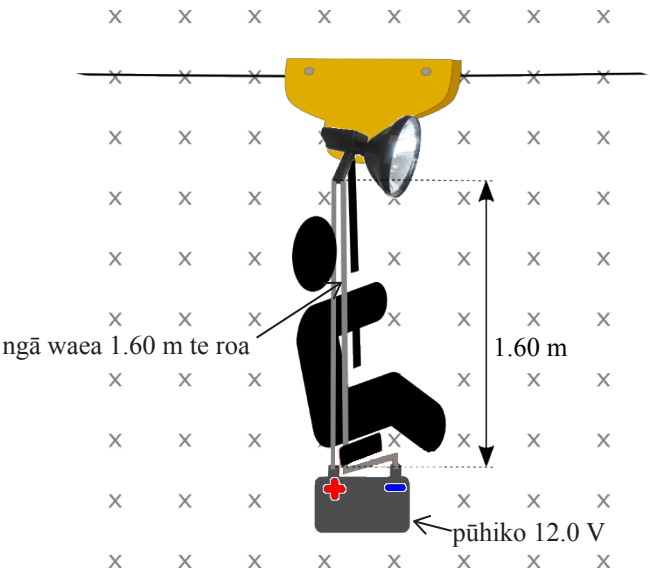
TŪMAHI TUATORU: TE TAURA RERE

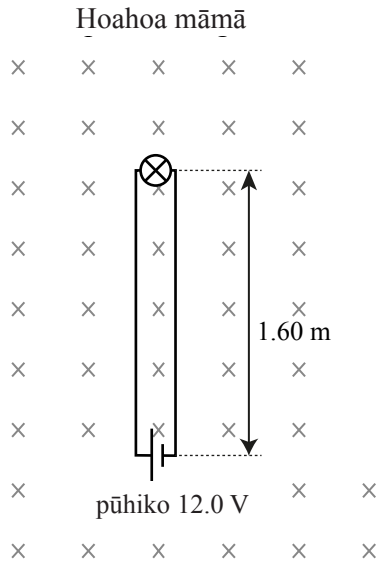
MĀ TE KAIMĀKA ANAKE

He taura rere (raina reti) tā Sam e hiahia ana ia ki te whakamahi i roto i te pōuri.



Ka tūhono a Sam i te pūhiko 12.0 V ki tētahi rama, mā ngā waea e rua he 1.60 mita te roa. He 2.40 Ω te parehiko tōpū o te tūrama me ngā waea. Ka noho noa a Sam i te taha runga o te taura rere i roto i te whaitua autō o Papatūānuku, he huapae, ā, ko te kaha o te whaitua autō he 30.0×10^{-6} T.



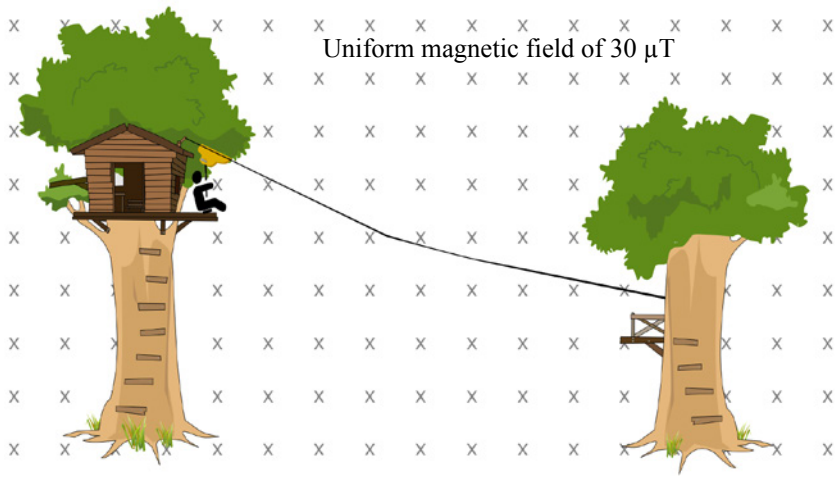


(a) Tātaihia te tōpana (tae atu ki te ahunga), nā te whaitua autō o Papatūānuku, kei te waea 1.60 m te roa e tūhono ana ki te pito tōrunga o te pūhiko. E tūhono ana te pito whakararo o te waea mauī ki te pito tōrunga o te pūhiko.

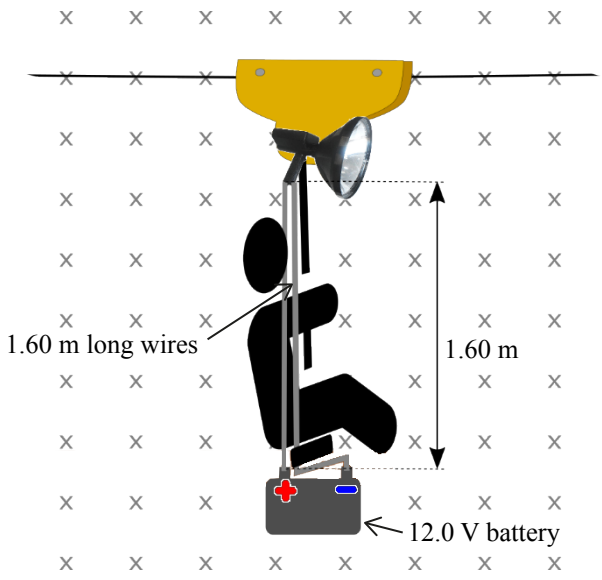
QUESTION THREE: THE FLYING FOX

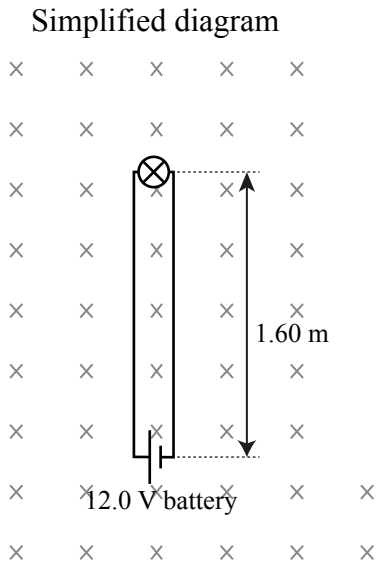
ASSESSOR'S USE ONLY

Sam has a flying fox (zip line) that he wants to use in the dark.



Sam connects a 12.0 V battery to a spotlight, using two 1.60-metre-long wires. The light and wires have a combined resistance of 2.40 Ω. Sam sits stationary at the top of the flying fox inside the earth's magnetic field, which is horizontal and has a magnetic field strength of 30.0×10^{-6} T.



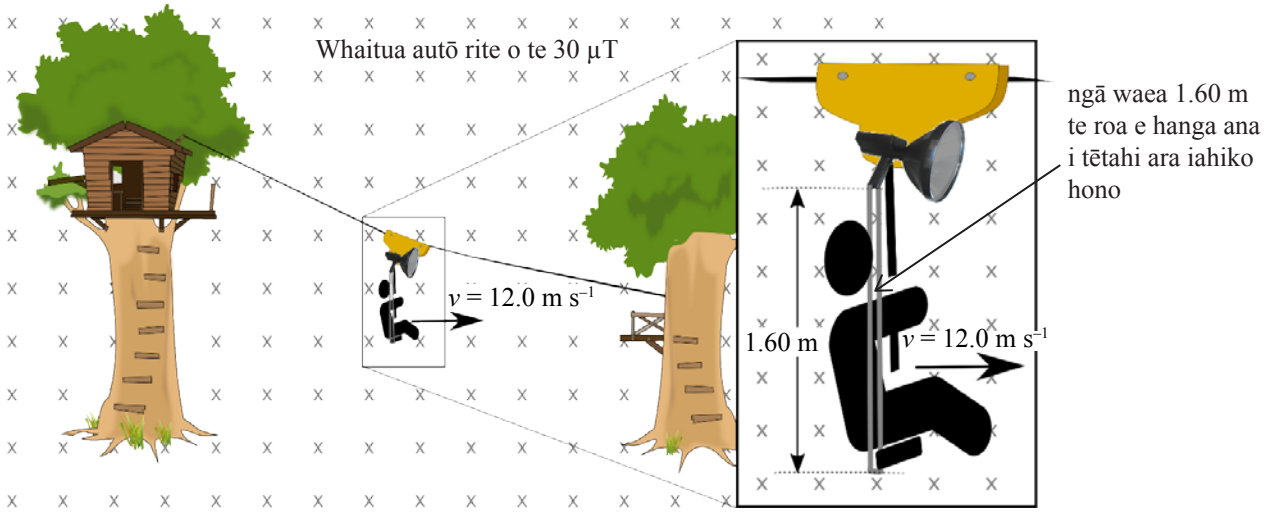


(a) Calculate the force (including direction), due to the earth's magnetic field, on the 1.60-metre-long wire connected to the positive terminal of the battery. The lower end of the left-hand wire is connected to the positive end of the battery.

(b) Whakaahuahia te pānga o te tōpana autō mai i ngā waea e rua ki te wā e oti ai i a Sam te haere i runga i te taura rere.

MĀ TE KAIMĀKA ANAKE

I muri ake i taua ahiahi ka tangohia e Sam te pūhiko. Kātahi ka tūhonohia e ia ngā waea ki te wāhi i reira te pūhiko. I tētahi pūwāhi kei te tino huapae tana rere i te 12.0 m s^{-1} i te whaitua autō o Papatūānuku.



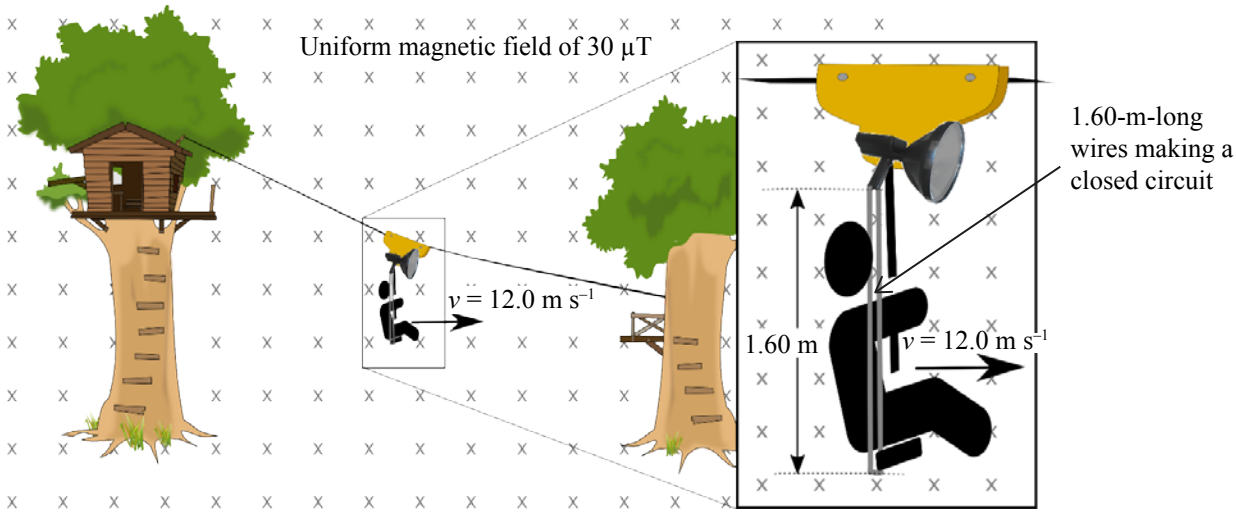
(c) Tātaihia te ngaohiko ka puta i te waea mauī.

(d) (i) Āta whakamāramahia he aha i puta ai he ngaohiko i te waea mauī i a Sam e neke ana.

ASSESSOR'S USE ONLY

(b) Describe the effect the magnetic force from both wires has on the time it takes Sam to complete the run down the flying fox.

Later in the evening Sam removes the battery. He then connects the wires where the battery was. At one point he is travelling purely horizontally at 12.0 m s^{-1} across the earth's magnetic field.



(c) Calculate the voltage induced in the left-hand wire.

(d) (i) Explain in detail why there is a voltage induced in the left-hand wire as Sam moves.

(ii) Whakamāramahia he aha i kore ai e rere he iahiko i te ara iahiko hono o ngā waea me tētahi pūrama.

MĀ TE KAIMĀKA ANAKE

(ii) Explain why no current flows in the closed circuit of wires and a bulb.

ASSESSOR'S USE ONLY

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 2 Physics, 2017

91173 Demonstrate understanding of electricity and electromagnetism

2.00 p.m. Friday 10 November 2017
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 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.