91173M

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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, 2016

91173M Te whakaatu māramatanga ki te hiko me te autōhiko

9.30 i te ata Rātū 15 Whiringa-ā-rangi 2016
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 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 2–15 kei roto i tēnei pukapuka, ka mutu, 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.

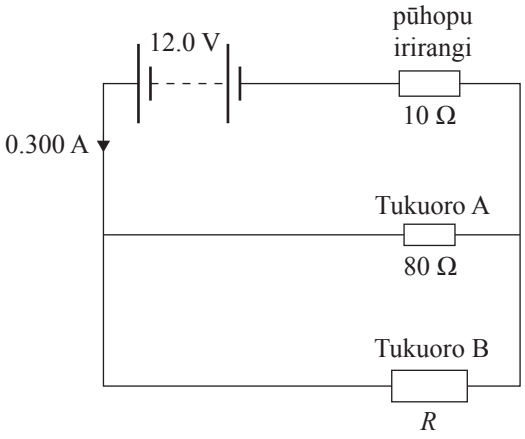
TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI: TE IAHIKO TOROTIKA (DC)

MĀ TE KAIMĀKA ANAKE

Ka tāea tētahi wairehe motukā te whakatauira mā te whakamahi parenga iahiko. Ka tāea tētahi parenga iahiko te whakamahi hei whakatauira i te pūhopu irirangi. E rua ngā parenga iahiko rahinga rerekē ka tāea te whakamahi hei whakatauira i ngā tukuoro rahinga rerekē e rua. E whakaaturia ana te ara iahiko i raro nei. Ko te parenga iahiko o te pūhopu irirangi he 10 Ω, ā, ko te parenga iahiko o te tukuoro iti he 80 Ω. Ko te iahiko mai i te pūhiko motukā he 0.300 A.



(a) Tātaihia te ngaohiko ka whakawhiti i te pūhopu irirangi.

(b) Tātaihia te iahiko e rere ana i te Tukuoro A.

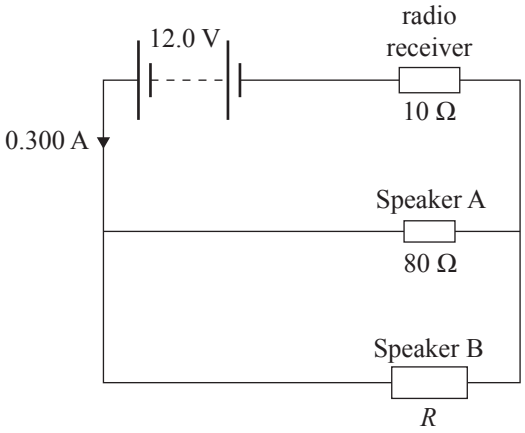
(c) He nui ake te hiko e whakamahia ana e te Tukuoro B i te Tukuoro A.

Whakatauritehia te parenga iahiko o te Tukuoro B me te parenga iahiko o te Tukuoro A. Kāore e hiahiatia ana he tātaitanga.

QUESTION ONE: DC

ASSESSOR'S USE ONLY

A car radio can be modelled by the use of resistors. One resistor can be used to model the radio receiver. Two different-sized resistors can be used to model two different-sized speakers. The circuit is shown below. The resistance of the radio receiver is 10 Ω, and the resistance of the small speaker is 80 Ω. The current from the car battery is 0.300 A.



(a) Calculate the voltage across the radio receiver.

(b) Calculate the current passing through Speaker A.

(c) Speaker B uses more power than Speaker A.

Compare the resistance of Speaker B with the resistance of Speaker A.

No calculations are required.

(d) Ka tāea te pūhiko motukā 12 V te tūhono atu ki tētahi ramamua motukā. Ko te whakatau mō tētahi o ngā pūrama o te ramamua o te motukā he 12 V, 60 W. Ko tētahi pūrama whare noa he 240 V, 60 W, ā, kei te tūhono atu ki te ratonga hiko 240 V o te whare.

MĀ TE KAIMĀKA ANAKE

(i) Mahia ngā tātaitanga hei whakamārama ko tēhea te pūrama (te pūrama o te motukā, te pūrama rānei o te whare) he nui ake te iahiko e rere ana i roto.

(ii) Matapakitia he pēhea te tīahoaho o te pūrama motukā e whakataurite ai ki tō te pūrama pūnoa o te whare.

Ko te whakapae he ōrite te momo o ngā pūrama e rua.

ASSESSOR'S USE ONLY

(d) The 12 V car battery can be connected to a car's headlight. One of the bulbs in the car's headlight is rated 12 V, 60 W. A normal household bulb is rated 240 V, 60 W, and is connected to the 240 V household supply.

(i) Carry out calculations to explain which bulb (the car's headlight bulb or a normal household bulb) has more current passing through it.

(ii) Discuss how the brightness of the car's headlight bulb compares with that of the normal household bulb.

Assume both bulbs are the same type.

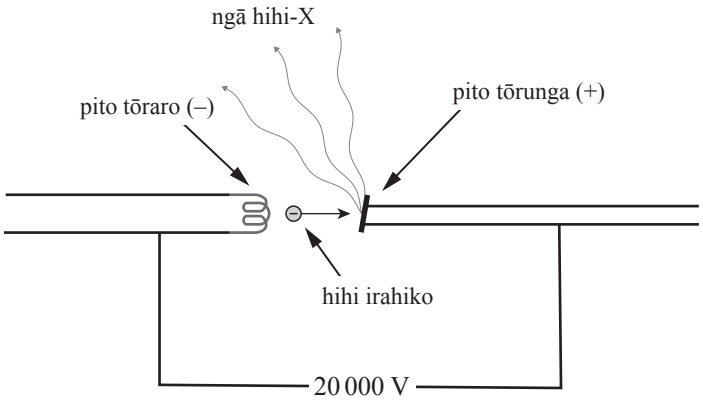
TŪMAHI TUARUA: HIKO PATEKO[1]

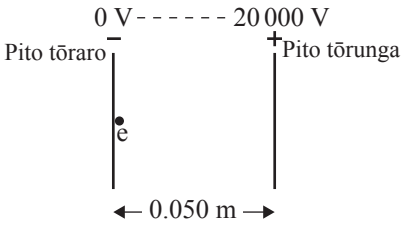
MĀ TE KAIMĀKA ANAKE

I roto i tētahi pūrere hihi-X, ka tukuna e tētahi tārahu whakamahana ngā irahiko mai i tētahi pereti e whakawhana tōrarotia ana e kīia ana he pito tōraro. Kātahi ka whakaterehia ngā irahiko e tētahi whaitua hiko kei waenga i te pito tōraro me tētahi pereti tangitene hihiko oho e kīia ana he pito tōrunga.

Kei te tūhono te pito tōraro me te pito tōrunga ki tētahi puna ngaohiko kaha o te 20 000 V. Ko te tawhiti i waenga i ngā pereti pito tōraro me te pito tōrunga he 0.050 m. Nā ngā hihi irahiko ka tukuna ngā hihi-X mai i te pito tōrunga.

Whana ki te irahiko $= 1.60 \times 10^{-19}$ C
Papatipu o te irahiko $= 9.11 \times 10^{-31}$ kg





E whakaatu ana te hoahoa i te taha matau i te whakanaha hei whakatere i ngā irahiko i te wā e wehe ana i te pito tōraro.

(a) Tātaihia te kaha o te whaitua hiko i waenga i ngā pereti, tuhia hoki tōna ahunga.

(b) Tuhia he aha te momo pūngao kei tētahi irahiko i te pito tōraro (pereti tōraro), ā, ka ahatia taua pūngao ina neke haere atu taua irahiko ki te pito tōrunga (pereti tōrunga).

[1] hikotū

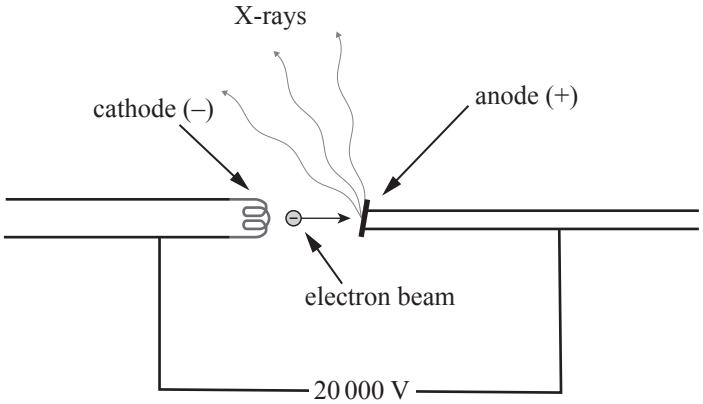
QUESTION TWO: STATIC ELECTRICITY

ASSESSOR'S USE ONLY

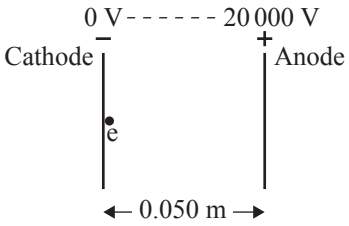
In an X-ray machine, a heating element releases electrons from a negatively charged plate called the cathode. The electrons are then accelerated by an electric field that exists between the cathode and a positively charged tungsten plate called the anode.

The cathode and the anode are connected to a high voltage source of 20 000 V. The distance between the cathode and anode plates is 0.050 m. The beam of electrons causes X-rays to be released from the anode.

Charge on an electron $= 1.60 \times 10^{-19}$ C
Mass of an electron $= 9.11 \times 10^{-31}$ kg



The diagram on the right shows the arrangement to accelerate the electrons as they leave the cathode.



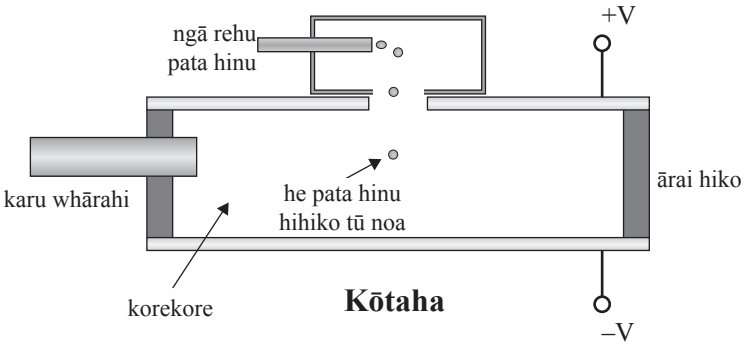
(a) Calculate the electric field strength between the plates, and state its direction.

(b) State what type of energy an electron would have at the cathode (negative plate), and what would happen to that energy as the electron moved towards the anode (positive plate).

(c) Tātaihia te tere o te irahiko i te wā ka tae atu ki te pito tōrunga (pereti tōrunga).

(d) I te tau 1909 i whakamahia e Millikan ngā pereti konganuku e rua i hihiko kōarotia kia mau tonu te tino tere o tētahi pata hinu hihiko i te wā e whakamātautau ana ki te kimi i te hihiko o tētahi irahiko. Mā tētahi rerekētanga o tana whakamātautau ka tū noa tētahi pata hinu.

Ka whakaatu te hoahoa i raro i tētahi wāhanga o te taputapu.



Matapakitia i pēhea te mahi kia tū noa te hinu pata i waenga i ngā pereti.

I tō tuhinga matawhānui me

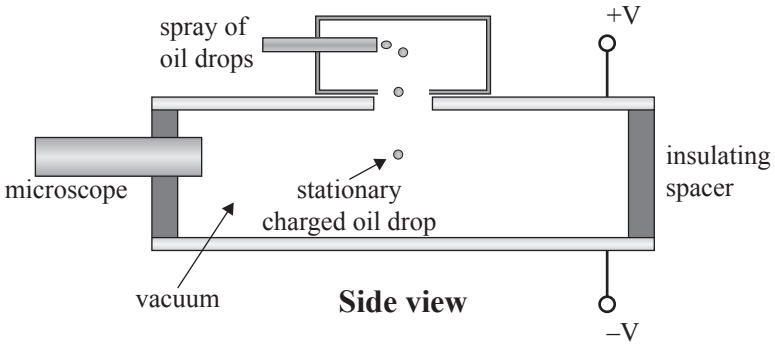
- matapaki i ngā tōpana e pā ana ki te pata hinu
- whakaahua he pēhea te paheko o ngā tōpana kia tū noa te pata hinu
- whakamārama mai i te **momo** hihiko me whai te pata hinu kia noho tū noa.

ASSESSOR'S USE ONLY

(c) Calculate the speed of the electron as it reaches the anode (positive plate).

(d) In 1909 Millikan used two oppositely charged metal plates to keep a charged oil drop falling at terminal velocity when he was experimenting to find the charge of an electron. A modified form of his experiment keeps an oil drop stationary.

The diagram below shows part of the equipment.



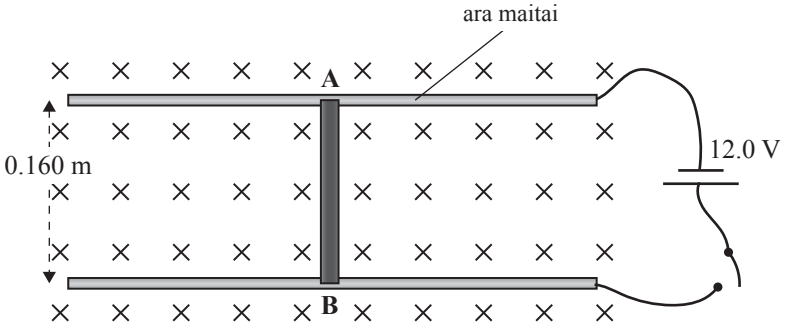
Discuss how it was possible to make the oil drop stationary between the plates.

In your comprehensive answer you should

- identify the forces acting on the oil drop
- describe how the forces can combine to cause the oil drop to be stationary
- explain what **type** of charge the oil drop must have in order to remain stationary.

TŪMAHI TUATORU: AUTŌHIKOTANGA

MĀ TE KAIMĀKA ANAKE



E wātea ana tētahi matira AB he 0.160 m te roa, ki te rēreti, me te kore waku, ki ngā ara maitai whakarara e rua. Kei te hono ngā ara e rua ki tētahi pūhiko 12.0 V kia mahia ai e te matira me ngā ara tētahi ara iahiko kati ina katia te pana. He 20.0 Ω te parenga o te matira AB, ā, he kore noa iho te parenga iahiko o ngā ara. Ka whakamaua he whaitua autō taimau, he 1.50×10^{-3} T te kaha, kia hāngai ki te papa o tēnei ara iahiko.

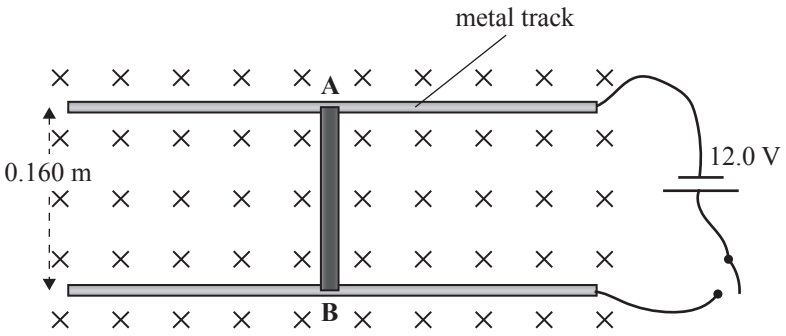
Ina katia te pana, ka neke te matira AB.

(a) He aha te ahunga ka neke te matira AB ina katia te pana?

(b) Tātaihia te rahi o te tōpana i pā ki te matira AB.

QUESTION THREE: ELECTROMAGNETISM

ASSESSOR'S USE ONLY



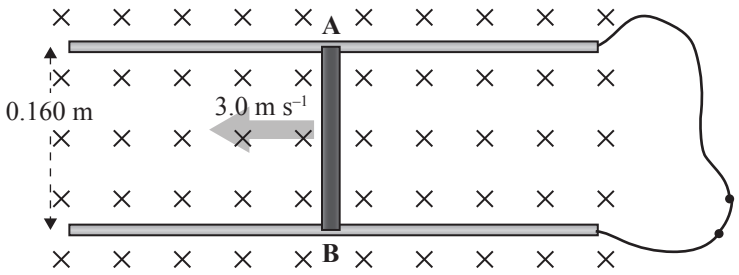
A metal rod AB of length 0.160 m is free to slide, without friction, on two parallel metal tracks. The two tracks are connected to a 12.0 V battery so that the rod and the tracks form a closed circuit when the switch is closed. The rod AB has a resistance of 20.0 Ω, and the tracks have negligible resistance. A uniform magnetic field, of strength 1.50×10^{-3} T, is applied perpendicular to the plane of this circuit.

When the switch is closed, the rod AB moves.

(a) In what direction does the rod AB move when the switch is closed?

(b) Calculate the size of the force experienced by the rod AB.

Ka tangohia te pūhiko ka whakakapihia ki tētahi waea kawenga hiko, e ai ki te whakaaturanga i raro. Ka peia te matira AB ki te taha mauī ki te tere pūmau o te 3.0 m s^{-1}.

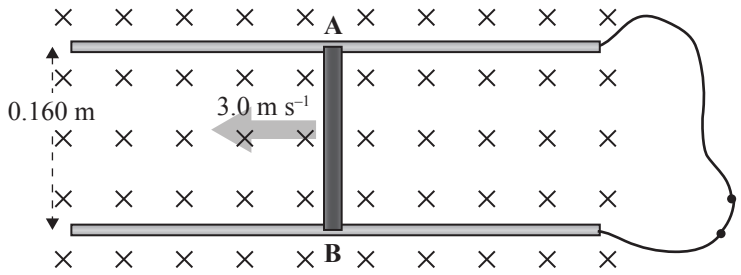


(c) Whakamāramahia mai te take e puta mai ai te ngaohiko.

(d) Tātaihia te rahi me te ahunga o te iahiko whakaputa (iahiko ā-tikanga) e rere ana i te matira maitai ina nekehia ki te taha mauī me te tere pūmau o te 3.0 m s^{-1}.

ASSESSOR'S USE ONLY

The battery is removed and replaced by a conducting wire, as shown below. The rod AB is pushed to the left at a constant speed of 3.0 m s^{-1}.



(c) Explain why a voltage is induced.

(d) Calculate the size and direction of the induced current (conventional current) flowing through the metal rod when it is moved to the left with a constant speed of 3.0 m s^{-1}.

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, 2016

91173 Demonstrate understanding of electricity and electromagnetism

9.30 a.m. Tuesday 15 November 2016
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 2–15 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.