2

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91173M

911735

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

Ahupūngao, Kaupae 2, 2015

91173M Te whakaatu māramatanga ki te hiko me te autō ā-hiko

9.30 i te ata Rātū 17 Whiringa-ā-rangi 2015
Whiwhinga: Ono

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki te hiko me te autō ā-hiko.	Te whakaatu māramatanga hōhonu ki te hiko me te autō ā-hiko.	Te whakaatu māramatanga matawhānui ki te hiko me te autō ā-hiko.

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.

Mēna 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, 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

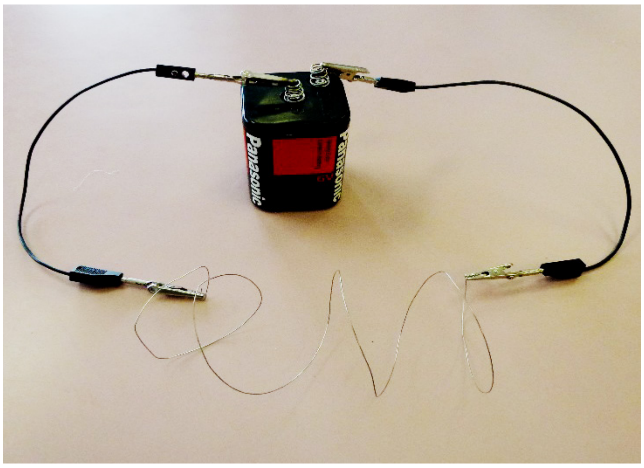
MĀ TE KAIMĀKA ANAKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI: WHAITUA HIKO I ROTO I TĒTAHI WAEA

Te whana ki te irahiko = -1.6×10^{-19} C

Ka tūhono a Hamish i tētahi ara iahiko, e ai ki te pikitia i raro. Ko ngā mea kei te ara iahiko ko tētahi pūhiko 6.0 V, he 1.0 m o te waea parenga Nichrome me ngā waea whakahono e rua. Ka whakaputaina e te pūhiko he whaitua hiko rite i roto i te waea parenga Nichrome.



Ko te whakapae kāore he parenga o ngā waea whakahono.

(a) Tātaihia te kaha o te whaitua hiko i roto i te waea parenga Nichrome.

(b) Whakamāramahia mai ka ahatia te rahi o te tōpana hiko ki tētahi irahiko i te wā e rere ana i te waea parenga Nichrome.

(c) Tātaihia te tawhiti ka nekehia e tētahi irahiko ina ngaro te 9.6×10^{-20} J o te pūngao moe hiko.

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(d) Kātahi ka tāpirihia mai e Hamish he pūhiko 6.0 V atu anō hei ara hātepe ME te whakapoto i te waea ki te 0.50 m.

Tuhia he whakamāramatanga matawhānui mō ngā mea ka pā ki te rahi o te tōpanga ki te irahiko.

Kāore e hiahiatia ngā tātaitai.

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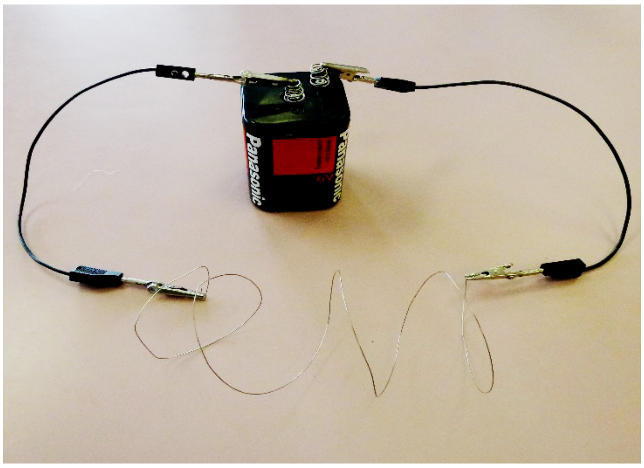
QUESTION ONE: ELECTRIC FIELD IN A WIRE

Charge on an electron = -1.6×10^{-19} C

Hamish connects a circuit as shown in the picture below. The circuit comprises a 6.0 V battery, 1.0 m of Nichrome resistance wire and two connecting wires. The battery produces a uniform electric field in the Nichrome resistance wire.



Assume that the connecting wires have no resistance.

(a) Calculate the strength of the electric field in the Nichrome resistance wire.

(b) Explain what happens to the size of the electric force on an electron as it travels through the Nichrome resistance wire.

(c) Calculate the distance moved by an electron as it loses 9.6×10^{-20} J of electrical potential energy.

(d) Hamish then adds another 6.0 V battery in series AND shortens the wire to 0.50 m.

Write a comprehensive explanation on what will happen to the size of the force on the electron.

Calculations are not needed.

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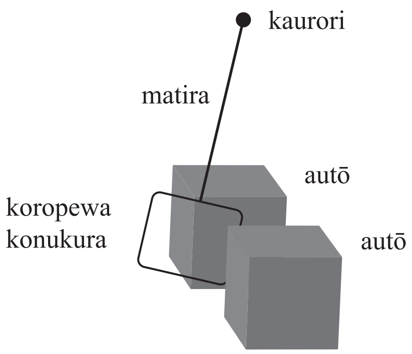
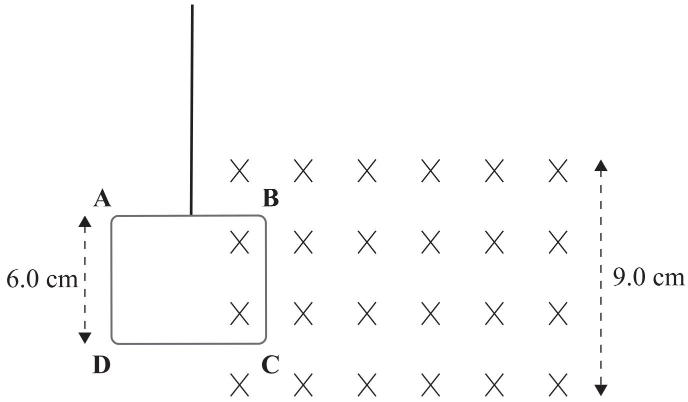
TŪMAHI TUARUA: TE TĀRERE AUTŌHIKO

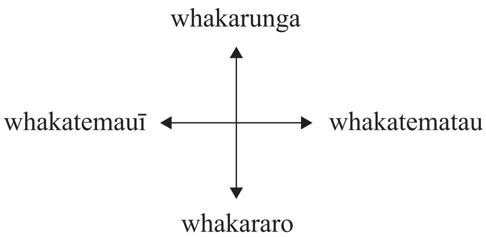
Ka hangaia e Monique he tārere hei whakaatu i te kōpana autōhiko. E mau ana ko tētahi matira māmā, e kaurori ana i runga kia tārere ai, me tētahi waea konukura koropewa i raro. Ka raua e ia ngā autō kaha e rua ki te pūwāhi o raro rawa o te nekehanga me ngā pito e hāngai ana tētahi ki tētahi.

E whakaatu ana te hoahoa i raro i te koropewa e uru ana ki te whaitua autō.





(a) Whakaritea te ahunga o te tōpana e pā ana ki ngā **irahiko** i roto i te waea BC, nā te nekenga i roto i te whaitua autō.



Ahunga: ____________________

(b) I te wā tonu e whakaaturia ana ki te hoahoa, ko te ngaohiko i roto i te waea BC he 0.15 mV.

Tātaihia te tere o te koropewa.

Ko te torokaha o te whaitua autō ko 3.0×10^{-3} T.

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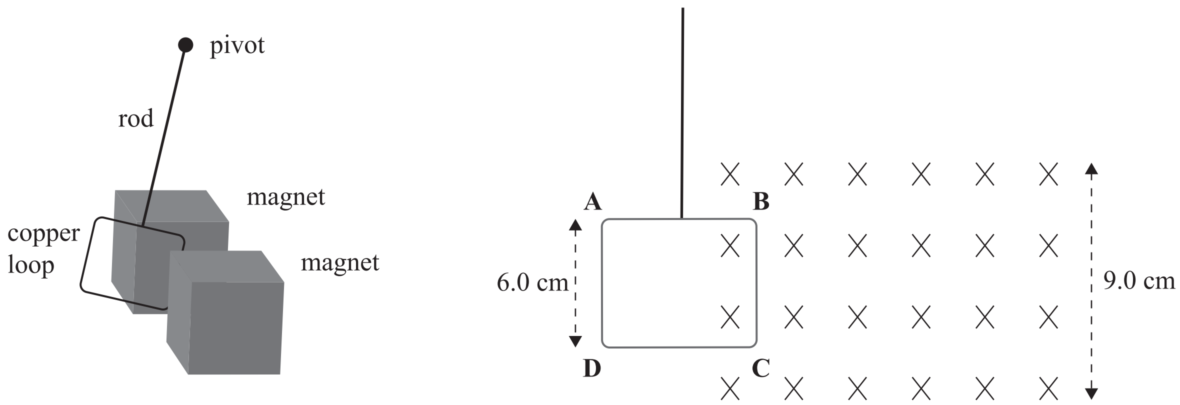
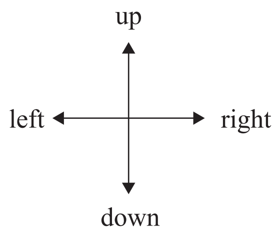
QUESTION TWO: THE ELECTROMAGNETIC SWING

Monique builds a swing to show electromagnetic induction. It comprises a light rod, pivoted at the top so it can swing, and a loop of copper wire at the bottom. She places two strong magnets at the lowest point of the motion with opposite poles facing each other.

The diagrams below show the loop entering the magnetic field.



(a) Determine the direction of the force acting on **electrons** in the wire BC, due to their motion in the magnetic field.



Direction: ______________________

(b) At the instant shown in the diagram, the voltage across the wire BC is 0.15 mV.

Calculate the speed of the wire loop.

The magnetic field strength is 3.0×10^{-3} T.

MĀ TE KAIMĀKA ANAKE

(c) Ka mahia anō e Monique te whakamātautau, engari ka tīmataria e ia te tārere mai i tētahi teitei i runga ake. Ko te tere o te koropewa i te pūwāhi e whakaaturia ana i te hoahoa ka rearuatia.

Whakamāramahia mai ka ahatia te rahi o te iahiko i roto i te koropewa.

(d) Kāore i roa, kua uru katoa te koropewa ki te whaitua autō.

Tuhia he whakamāramatanga matawhānui mō te iahiko i roto i te koropewa i te wā kei roto katoa te koropewa i te whaitua autō.

(c) Monique repeats the experiment, but starts the swing from a greater height. The speed of the loop at the point shown in the diagram is doubled.

Explain what happens to the size of the current in the loop.

(d) A short time later the whole loop is inside the magnetic field.

Write a comprehensive explanation about the current in the loop when the whole loop is in the magnetic field.

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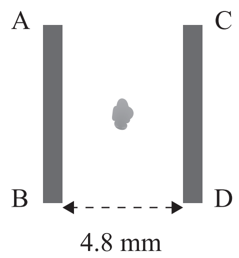
MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATORU: TE PŪOKO AUAHI

Te whana ki te irahiko = -1.6×10^{-19} C

Kei roto i tētahi momo pūoko auahi ko ngā papana maitai e rua 4.8 mm tētahi i tētahi, e hono ana ki tētahi pūhiko. Ka whakakatote ngā korakora ārepa mai i tētahi puna iraruke i ngā korakora auahi i waenga i ngā papana. Nā tēnei ka ngaro tētahi, ētahi rānei o ngā iahiko mai i ngā korakora auahi, ā, ka hihiko[1].

E whakaatu ana te hoahoa i raro i tētahi korakora auahi hihiko oho. Ko te tōpana e pā ana ki te korakora e anga ana ki AB.



(a) Tātuhia ngā raina hei whakaatu i te whaitua hiko i waenganui i ngā papana.

Me whakauru ko ngā ahunga o ngā raina whaitua.

Ko te papatipu o te korakora auahi he 1.7×10^{-7} kg

(b) Ka ngaro i tētahi korakora auahi ngā iahiko e rua. Kātahi ka pā mai te tōpana 5.88×10^{-16} N nā te whaitua hiko.

Tātaihia te torokaha o te whaitua hiko.

(c) Ka whakatatahia atu e Maria tētahi autō ki tētahi pūoko auahi. Ka puta i te autō tētahi torokaha whaitua autō o te 3.0×10^{-2} T, e ai ki te hoahoa i runga, kei te ahu atu ki te whārangi.

Tuhia te rahi o te tōpana nā te autō kei te korakora auahi tū noa.

Whakamāramahia tō tuhinga.

[1] whawhana

(d) Ka whakakatotetia te korakora auahi mā te rironga o ngā iahiko e rua ina 2.4 mm mai i te papana AB.

Tātaihia te tere o te korakora auahi i tana taenga atu ki te papana AB.

Me kī, ka pā anake te tōpana hiko ki te korakora auahi.

MĀ TE KAIMĀKA ANAKE

QUESTION THREE: THE SMOKE DETECTOR

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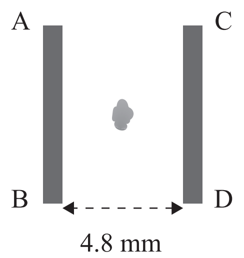
Charge on an electron = -1.6×10^{-19} C

One type of smoke detector comprises a pair of metal plates 4.8 mm apart, connected to a battery. Alpha particles from a radioactive source ionise particles of smoke between the plates. This causes the smoke particles to lose one or more electrons and become charged.

The diagram below shows a positively charged smoke particle. The force on the particle is towards AB.



(a) Draw lines showing the electric field between the plates.

Include the direction of the field lines.

The mass of the smoke particle is 1.7×10^{-7} kg

(b) A particular smoke particle loses two electrons. It then experiences a force of 5.88×10^{-16} N due to the electric field.

Calculate the strength of the electric field.

(c) Maria brings a magnet close to the smoke detector. The magnet produces a magnetic field of strength 3.0×10^{-2} T, which, with reference to the diagram above, is directed into the page.

State the size of the force due to the magnet on the stationary smoke particle.

Explain your answer.

(d) The smoke particle becomes ionised by losing two electrons when it is 2.4 mm from plate AB.

Calculate the speed of the smoke particle when it reaches the plate AB.

Assume that only the electric force acts on the smoke particle.

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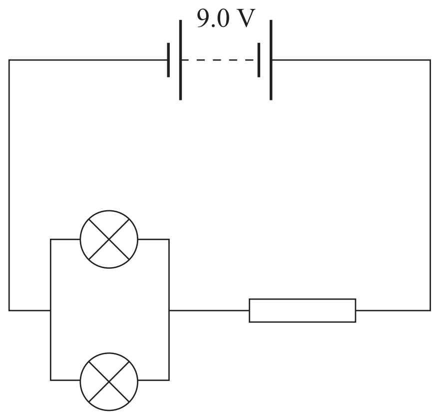
TŪMAHI TUAWHĀ: NGĀ ARA IAHIKO

E rua ngā tūrama ritepū a Kahu kua tohua ko 6.0 V, 2.0 W. Kei te hiahia ia ki te tūhono atu ki tētahi pūhiko 9.0 V. Ka kite ia me tūhono atu e ia tētahi parenga iahiko hei whakaiti i te ngaohiko e rere ana i ngā tūrama.

Ka tūhono ia i te ara iahiko e ai ki raro nei.



(a) Tātaihia te iahiko kei ia tūrama i te wā e mahi ana ki tōna pīataata tonu.

(b) Tātaihia te parenga o te parenga iahiko me whakamahi e ia kia mahi ai ngā tūrama ki te pīataata tonu.

(c) Ka ahatia te iahiko i roto i te parenga iahiko ki te "pahū" tētahi tūrama?

Whakamāramahia tō tuhinga.

QUESTION FOUR: CIRCUITS

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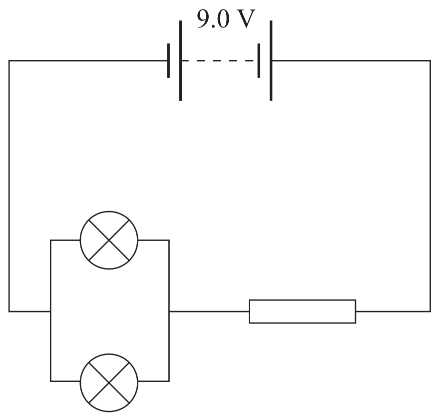
Kahu has two identical lamps marked 6.0 V, 2.0 W. He wants to connect them to a 9.0 V battery. He realises that he will have to connect a resistor to reduce the voltage across the lamps.

He connects the circuit shown below.



(a) Calculate the current in each lamp when it is operating at its normal brightness.

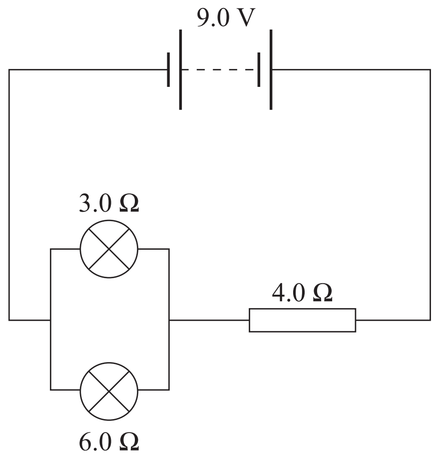
(b) Calculate the resistance of the resistor that he should use so that the lamps are at their normal brightness.

(c) What will happen to the current in the resistor if one lamp "blows"?

Explain your answer.

Ka whakatūhia e Kahu tētahi ara iahiko hou me ngā tūrama rerekē me tētahi parenga iahiko, e ai ki te hoahoa i raro.

MĀ TE KAIMĀKA ANAKE



(d) Tātaihia te ngaohiko e whakawhiti ana i te parenga iahiko 4.0 Ω.

Kahu sets up a new circuit with different lamps and resistor, as shown in the diagram below.

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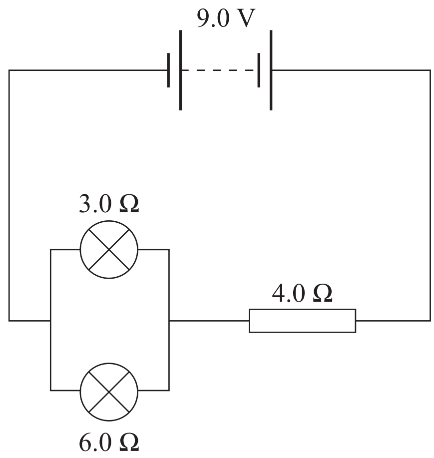

(d) Calculate the voltage across the 4.0 Ω resistor.

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, 2015

91173 Demonstrate understanding of electricity and electromagnetism

9.30 a.m. Tuesday 17 November 2015
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.