See back cover for an English translation of this cover

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91173M

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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

SUPERVISOR'S USE ONLY

Ahupūngao, Kaupae 2, 2012

91173M Te whakaatu māramatanga ki te hiko me te autōhiko

2.00 i te ahiahi Rāapa 14 Whiringa-ā-rangi 2012
Whiwhinga: Ono

Paetae	Paetae Kaiaka	Paetae 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 mehemea e ōrite ana te Tau Ākonga ā-Motu (NSN) kei tō pepa whakauru ki te tau kei runga ake nei.

Me whakautu e koe ngā pātai KATOA kei roto i te pukapuka nei.

Tirohia mēnā kei a koe te Puka Rauemi L2–PHYSMR.

I ō whakautu, whakamahia ngā whiriwhiringa tohutau mārama, ngā kupu, ngā hoahoa hoki/rānei ki hea hiahiatia ai.

Me hoatu te wae tika o te Pūnaha o te Ao (SI) ki ngā whakautu tohutau.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te (ngā) whārangi kei muri i te pukapuka nei, ka āta tohu ai i ngā tau pātai.

Tirohia mehemea kei roto nei ngā whārangi 2–19 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

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

TAPEKE

MĀ TE KAIMĀKA ANAKE

Kia 60 meneti hei whakautu i ngā pātai o tēnei pukapuka.

MĀ TE KAIMĀKA ANAKE

PĀTAI TUATAHI: NGĀ RAMA 12 V

He whakaahua tēnei o ngā rama e rua.

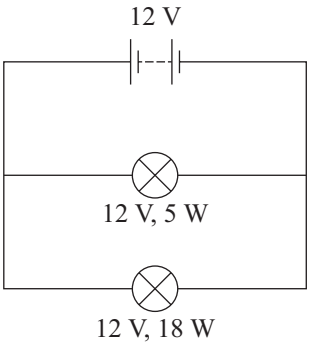
E kī ana te tapanga i tētahi rama ko te 12 V 5 W.

(a) Tuhia he aha te tikanga o te 12 V 5 W.

E kī ana te tapanga o te rama tuarua ko te 12 V 18 W. E tūhonotia ā-whakarara ana ngā rama e rua ki tētahi puna hiko 12 V, pēnei i raro nei.

(b) Tuhia ko tēhea o ngā rama e rua te mea kanapa ake.

Homai ngā pūtake mō tō whakautu.



(c) Tātaihia te parenga hohoko (effective resistance) o te ara iahiko.

You are advised to spend 60 minutes answering the questions in this booklet.

ASSESSOR'S USE ONLY

QUESTION ONE: 12 V LAMPS

The photograph alongside is of two lamps.

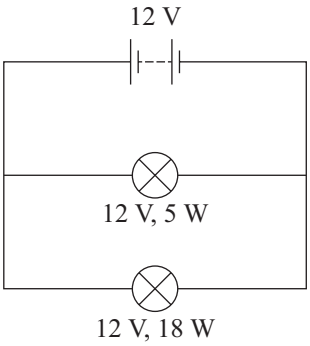
The label on one of the lamps reads 12 V 5 W.

(a) State what 12 V 5 W means.

The label on the second lamp reads 12 V 18 W. The two lamps are connected in parallel to a 12 V power supply, as shown below.

(b) State which of the two lamps will be brighter.

Give reasons for your answer.



(c) Calculate the effective resistance of the circuit.

(d) Mā te titiro ki te hoahoa ara iahiko kei te whārangi 2, tātaihia te ngao ka whakawhitihia e te rama 18 W mēnā e kā ana mō te 3 meneti.

MĀ TE KAIMĀKA ANAKE

(d) With reference to the circuit diagram on page 3, calculate the energy transferred by the 18 W lamp if it is left on for 3 minutes.

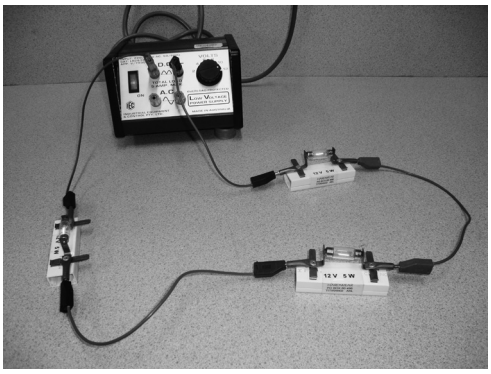
ASSESSOR'S USE ONLY

PĀTAI TUARUA: ĒTAHI ATU RAMA 12 V

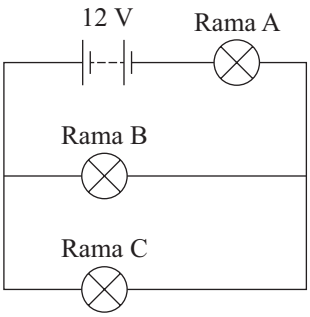
MĀ TE KAIMĀKA ANAKE

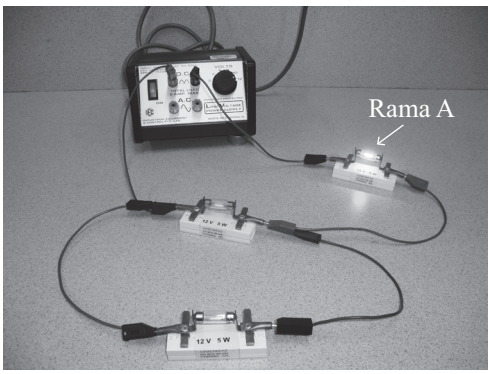
Ka tūhono a Jason i ngā rama ōrite (12 V, 5 W) e toru hei ara hātepe ki tētahi puna hiko 12 V. Ka kite ia kei te ōrite te mārama o te kā mai o ngā rama e toru.

(a) Whakamāramatia he aha i ōrite ai te mārama o te kā mai o ia rama.



Kātahi ka tūhono anō a Jason i te ara iahiko, pēnei i te hoahoa me te whakaahua kei raro.





(b) Tātaihia te **iahiko ka tōia** mai i te puna hiko ina tūhonotia te ara iahiko pēnei i te hoahoa kei te whārangi 6 (Rama A hei ara hātepe ki te puna hiko, Rama B me Rama C e whakarara ana tētahi ki tētahi).

Tīmataria tō whakautu mā te tātai i te parenga o ia rama.

MĀ TE KAIMĀKA ANAKE

(c) Ka kite a Jason kāore i te ōrite te mārama o ngā rama e toru. He mārama ake a Rama A i te Rama B me te Rama C.

Matapakitia he aha i **mārama ake ai** te Rama A i te Rama B me te Rama C, ahakoa he ōrite tonu ēnei rama (12 V, 5 W).

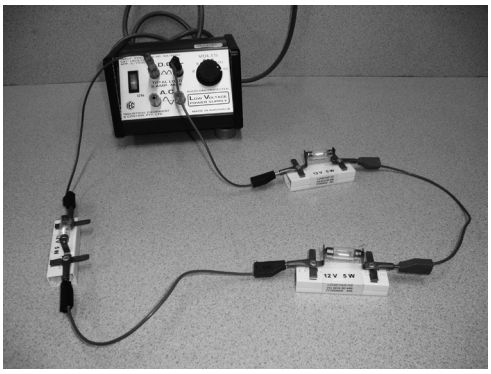
Ka taea te whakamahi tātaitanga hei tautoko i tō whakautu.

QUESTION TWO: MORE 12 V LAMPS

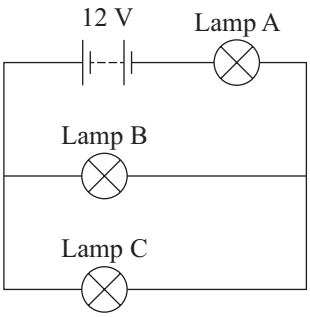
ASSESSOR'S USE ONLY

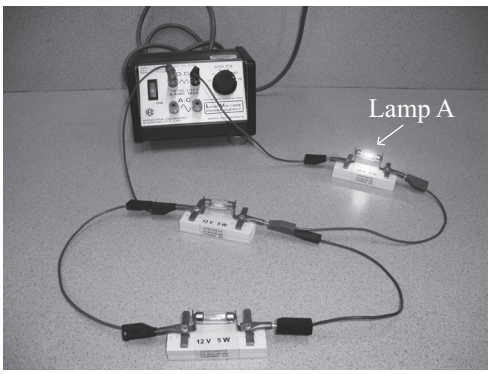
Jason connects three identical (12 V, 5 W) lamps in series to a 12 V power supply. He notices that all three of them glow with the same brightness.

(a) Explain why the lamps all glow with the same brightness.



Jason then reconnects the circuit, as shown in the diagram and photograph below.





ASSESSOR'S USE ONLY

(b) Calculate the **current drawn** from the power source when the circuit is connected as shown in the diagram on page 8 (Lamp A in series with the source, Lamp B and Lamp C parallel to each other).

Begin your answer by calculating the resistance of each lamp.

(c) Jason notices that the three lamps no longer all glow with the same brightness. Lamp A is brighter than Lamp B and Lamp C.

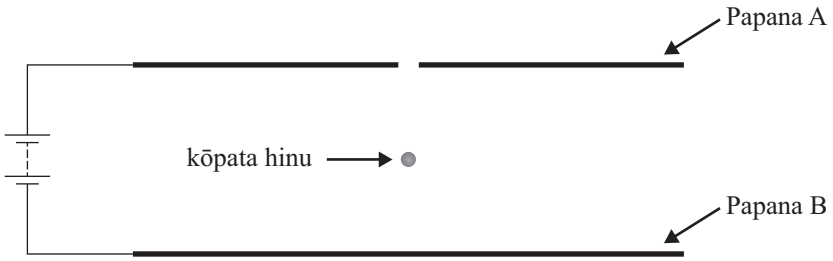
Discuss why Lamp A is **brighter** than Lamps B and C, even though they are all identical lamps (12 V, 5 W).

You may use calculations to justify your answer.

PĀTAI TUATORU: TE HIKO TŪ

MĀ TE KAIMĀKA ANAKE

Nā te whakamātauranga a Robert Millikan i te tau 1909 ka whakatauhia te rahi o te whana ki tētahi irahiko. Ka whakarite a Millikan i tētahi whana ki runga i tētahi kōpata hinu meroiti, ā, ka ine me pēhea te kaha o te papahiko ka hoatu kia āraitia ai te takanga o te kōpata hinu. Ka whakaatu te hoahoa i raro i tētahi tauira rūnā o te taputapu i whakamahia e ia:



Ka whakamahi a Millikan i ngā whakaahua roto hei whakangao i te whana tōraro ki runga i ngā kōpata hinu.

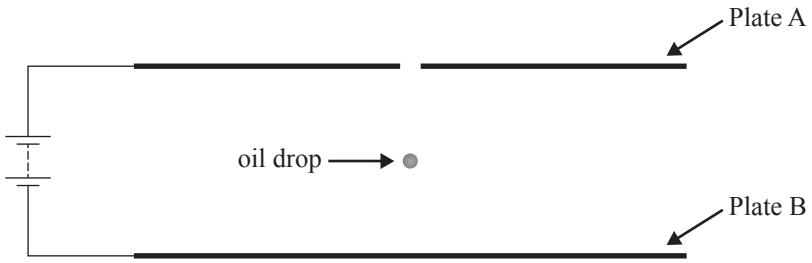
(a) Whakamāramatia he aha i tūhonotia ai te pūhiko pēnei i te hoahoa nei.

(b) Hei kīanga o ngā tōpana, kōrerotia ngā āhuatanga e hiahiatia ana kia puri whakapahohotia te kōpata hinu i waenganui i ngā papana huapae.

QUESTION THREE: STATIC ELECTRICITY

ASSESSOR'S USE ONLY

An experiment performed by Robert Millikan in 1909 determined the size of the charge on an electron. Millikan put a charge on a tiny drop of oil, and measured how strong an applied electric field had to be in order to stop the oil drop from falling. The diagram below shows a simplified version of the apparatus he used:



Millikan used x-rays to produce a negative charge on the oil drops.

(a) Explain why the battery is connected as shown in the diagram.

(b) In terms of forces, state the conditions necessary for the oil drop to be held stationary between the horizontal plates.

(c) I tētahi wā, ka whakamahi a Millikan i tētahi kōpata hinu o te papatipu e 2.54×10^{-5} kg me te whana e 3.6×10^{-9} C. E 4.8×10^{-4} mita te tawhiti o ngā papana tētahi i tētahi.

MĀ TE KAIMĀKA ANAKE

Tātaihia te ngaohiko e hiahiatia ana kia puritia te kōpata hinu i waenganui i ngā papana e rua.

Me tīmata mā te whiriwhiri i te tōpana taumaha o te kōpata hinu mā te $F_g = mg$ me te $g = 9.8$ N kg^{-1}.

(d) Whakapuakina tō whakautu ki te Wāhanga (c) ki te tau tika o ngā mati tāpua.

Homai he pūtake mō tō kōwhiringa mati tāpua.

ASSESSOR'S USE ONLY

(c) On one occasion, Millikan used an oil drop of mass 2.54×10^{-5} kg with a charge of 3.6×10^{-9} C. The plates were 4.8×10^{-4} m apart.

Calculate the voltage needed to hold the oil drop stationary between the two plates.

Start by working out the weight force of the oil drop using $F_g = mg$ and $g = 9.8$ N kg^{-1}.

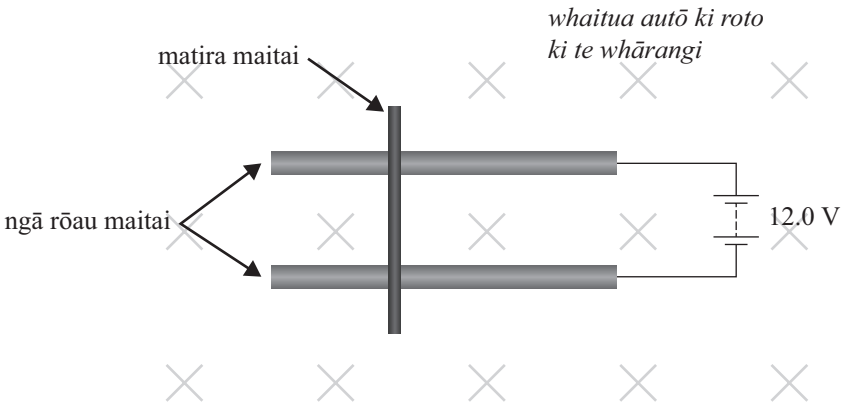
(d) Express your answer to Part (c) to the correct number of significant figures.

Give a reason for your choice of significant figures.

PĀTAI WHĀ: TE AUTŌHIKO

MĀ TE KAIMĀKA ANAKE

E whakaatu ana te hoahoa o raro i tētahi matira maitai e wātea ana kia pīrori haere whakawhiti i ētahi rōau[1] maitai whakarara e rua. Kei roto ngā rōau me te matira i te whaitua autō e ārahina ana ki roto i te whārangi. E tūhonotia ana ngā pito o ngā rōau ki tētahi puna hiko 12.0 V.



(a) **Kōrerotia, ka whakamārama** ka ahatia te matira maitai ina whakakāhia te puna hiko.

(b) Tātaihia te tōpana autōhiko ka pā ki te matira maitai ina whakakāhia te puna hiko.

Ko hoatu ki a koe ngā mōhiohio e whai nei:

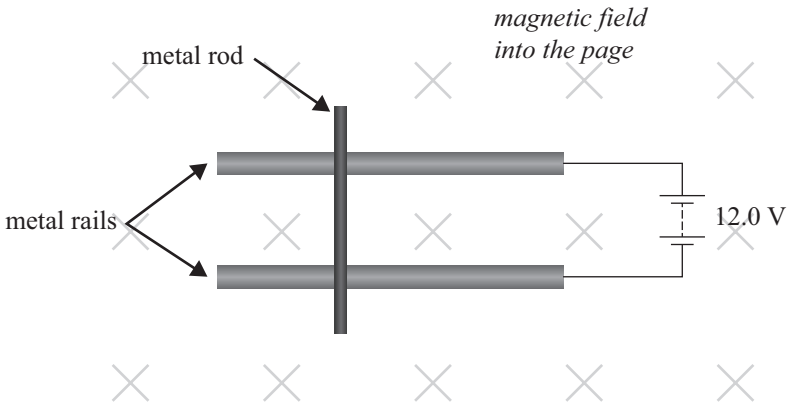
Te kaha o te whaitua autō	$= 0.85 \times 10^{-3}$ T
Te roa o te matira maitai	$= 25.0 \times 10^{-2}$ m
Te tawhiti kei waenganui i ngā rōau maitai whakarara	$= 18.5 \times 10^{-2}$ m
Te parenga o ngā waea, ngā rōau me te matira	$= 35.4\ \Omega$
Te ngaohiko o te puna hiko	= 12.0 V

[1] tangotango

QUESTION FOUR: ELECTROMAGNETISM

ASSESSOR'S USE ONLY

The diagram below shows a metal rod that is free to roll along, across two parallel metal rails. The rails and the rod are in a magnetic field that is directed into the page. The ends of the rails are connected to a 12.0 V power supply.



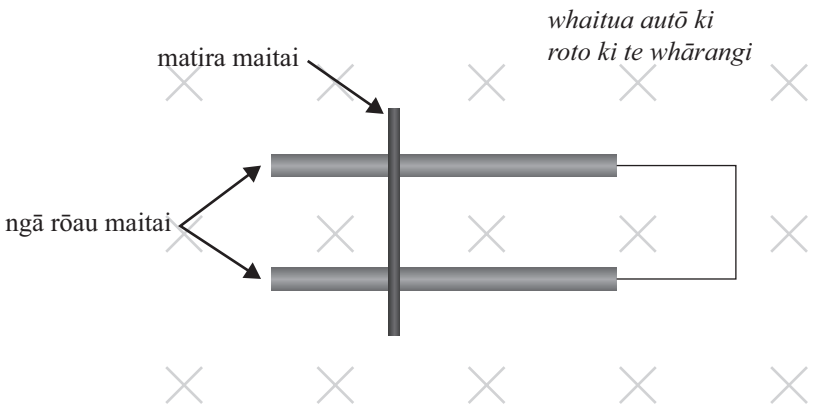
(a) **State and explain** what happens to the metal rod when the power supply is switched on.

(b) Calculate the electromagnetic force experienced by the metal rod when the power supply is switched on.

You are given the following information:

Strength of magnetic field	$= 0.85 \times 10^{-3}$ T
Length of metal rod	$= 25.0 \times 10^{-2}$ m
Distance between parallel metal rails	$= 18.5 \times 10^{-2}$ m
Resistance of wires, rails and rod	$= 35.4\ \Omega$
Voltage of power supply	= 12.0 V

(c) Ka tangohia te puna hiko, ā, ka tūhonotia tētahi waea ki ngā rōau maitai. Ka āta panaia te matira maitai kia pīrori noa ki te taha matau, pēnei i te hoahoa nei. E ārahi tonutia ana te whaitua autō ki roto i te whārangi.



Tātaihia te ngaohiko ka kawea whakawhiti i te rōau maitai ina nuku haere i te whaitua autō.

Ko hoatu ki a koe ngā mōhiohio e whai nei:

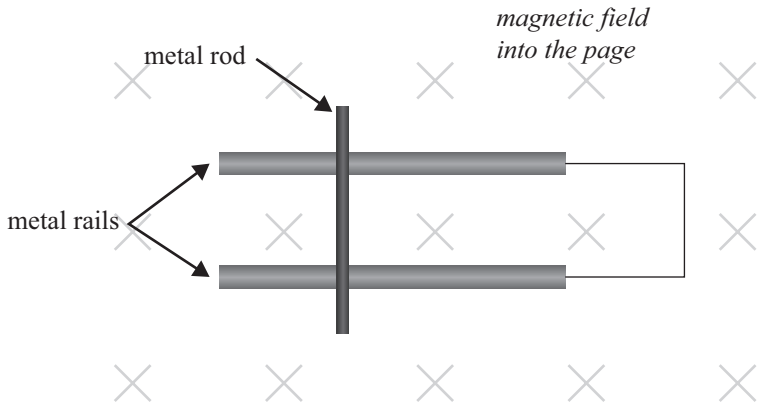
Te kaha o te whaitua autō $= 0.85 \times 10–^{3}$ T
Te roa o te matira maitai $= 25.0 \times 10^{-2}$ m
Te tawhiti i waenganui i ngā rōau maitai whakarara $= 18.5 \times 10^{-2}$ m
Te tere o te matira maitai $= 2.5$ m s^{-1}

(d) Whakaahua ka ahatia ngā nekenga o te matira maitai i te haerenga tonutanga mā te whaitua autō.

Whakamāramatia tō whakautu.

ASSESSOR'S USE ONLY

(c) The power supply is removed and a wire is connected to the metal rails. The metal rod is given a gentle push so that it rolls freely to the right, as shown in the diagram. The magnetic field is still directed into the page.



Calculate the voltage induced across the metal rod as it moves through the magnetic field.

You are given the following information:

Strength of magnetic field = 0.85×10^{-3} T
Length of metal rod = 25.0×10^{-2} m
Distance between parallel metal rails = 18.5×10^{-2} m
Speed of metal rod = 2.5 m s^{-1}

(d) Describe what happens to the movement of the metal rod as it continues to move through the magnetic field.

Explain your answer.

He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tau pātai mēnā e hāngai ana.

TAU PĀTAI

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, 2012

91173 Demonstrate understanding of electricity and electromagnetism

2.00 pm Wednesday 14 November 2012
Credits: Six

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.

91173M

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.