See back cover for an English translation of this cover

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91526M

915265

NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

SUPERVISOR'S USE ONLY

Ahupūngao, Kaupae 3, 2014

91526M Te whakaatu māramatanga ki ngā pūnaha hiko

2.00 i te ahiahi Rātū 25 Whiringa-ā-rangi 2014
Whiwhinga: Ono

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā pūnaha hiko.	Te whakaatu māramatanga hōhonu ki ngā pūnaha hiko.	Te whakaatu māramatanga matawhānui ki ngā pūnaha hiko.

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 Rau Rauemi L3–PHYSMR.

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

Me hōmai te whakautu me tētahi waeine o te Pūnaha Waeine ā-Ao (SI) ki ngā tau tika o ngā tau tāpua.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia ngā whārangi kei muri i te pukapuka nei.

Tirohia mehemea kei roto nei ngā whārangi 2–16 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

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

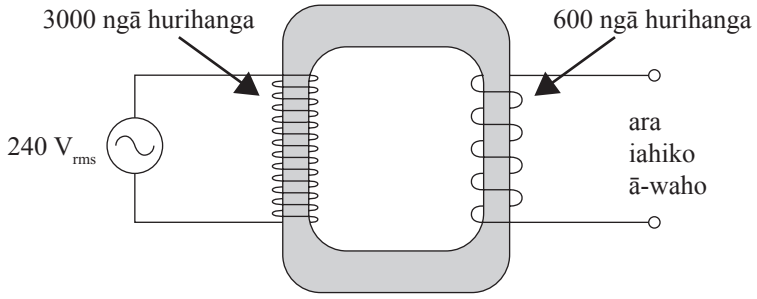
TAPEKE

MĀ TE KAIMĀKA ANAKE

PĀTAI TUATAHI: IAHIKO HOHOKO (AC)

MĀ TE KAIMĀKA ANAKE

Ko te whitihiko ā-ariā e whakaaturia ana i raro he 3000 ngā hurihanga o tana pōkai matua, ā, e 600 ngā hurihanga o te pōkai tuarua. E hono whakawhiti ana tētahi puna hiko 240 V_{rms} AC i te pōkai matua. E tūhono ana te pōkai tuarua ki tētahi ara iahiko ā-waho.



(a) (i) Tātaihia te ngaohiko rms i te ara iahiko ā-waho.

(ii) Tātaihia te ngaohiko teitei rawa i te ara iahiko ā-waho.

(b) Whakamāramahia he aha i whakamahia ai ngā uara rms hei whakaahua i ngā ngaohiko AC.

QUESTION ONE: AC

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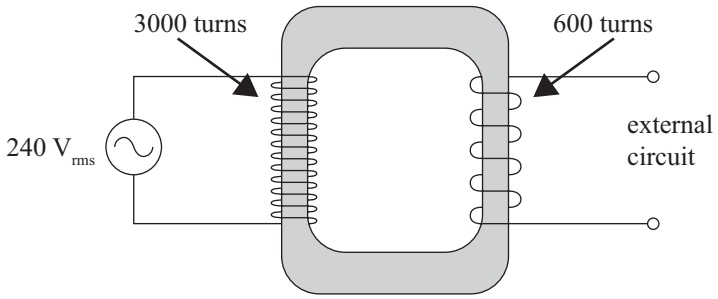
The ideal transformer shown below has 3000 turns in its primary coil, and 600 turns in the secondary coil. A 240 V_{rms} AC power supply is connected across the primary coil. The secondary coil is connected to an external circuit.



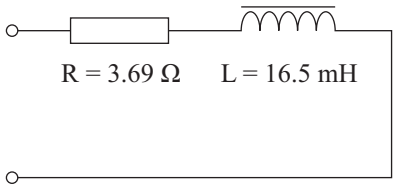
(a) (i) Calculate the rms voltage across the external circuit.

(ii) Calculate the peak voltage across the external circuit.

(b) Explain why rms values are often used to describe AC voltages.

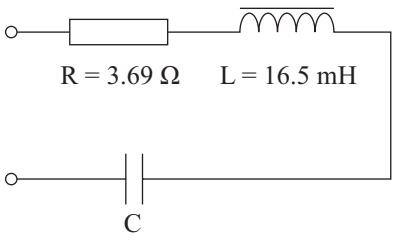
MĀ TE KAIMĀKA ANAKE

(c) Kei te ara iahiko ā-waho tētahi parenga iahiko me tētahi pūpoapoa e ai ki te hoahoa.
Ko te auautanga o te puna hiko he 50.0 Hz.



Mā te tuhi i tētahi hoahoa perehuri, whakaaturia he pēhea te tātai i te haukotinga (impedance) o te ara iahiko ā-waho.

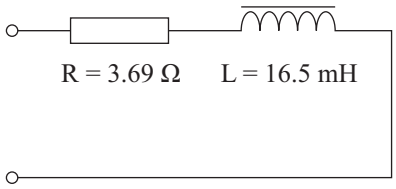
(d) Ka tāpirihia tētahi pūnga iahiko ki te ara iahiko ā-waho, kia kōwaro ai te ara iahiko.



Whakatauhia te ngaohiko rms i te pūnga iahiko.

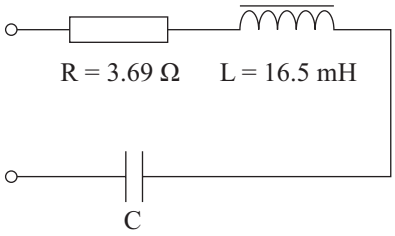
ASSESSOR'S USE ONLY

(c) The external circuit consists of a resistor and an inductor as shown.
The frequency of the power supply is 50.0 Hz.



By drawing a phasor diagram, show how the impedance of the external circuit can be calculated.

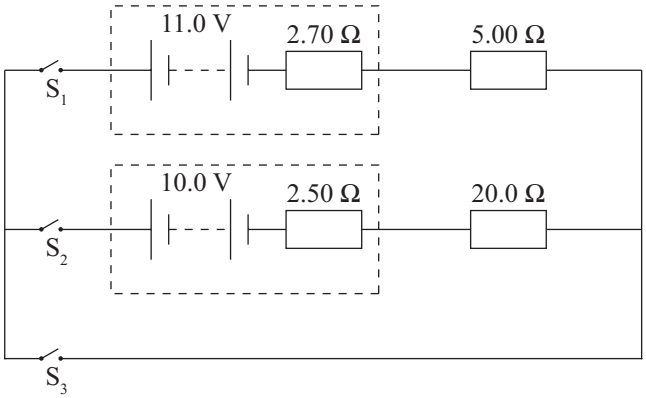
(d) A capacitor is added to the external circuit, causing the circuit to be at resonance.



Determine the rms voltage across the capacitor.

PĀTAI TUARUA: NGĀ PŪHIKO

MĀ TE KAIMĀKA ANAKE



E whakaatu ana te hoahoa i ngā pūhiko e rua e hono ana ki tētahi ara iahiko. Ko te parenga ā-roto, r_1, o te pūhiko 11.0 V he 2.70 Ω, me te parenga ā-roto, r_2, o te pūhiko 10.0 V he 2.50 Ω.

(a) Ka katia ngā pana S_1 me S_2, ā, ka waiho te pana S_3 kia tuwhera.

Whakaaturia ko te iahiko i roto i te ara iahiko he 0.0331 A.

(b) Kei te ahu pēhea te rere o te iahiko mā te pana S_1?

Whakamāramahia tō whakautu.

(c) Kua kati te pana S_3 ināianei, ā, kei te noho kati katoa ngā pana.

Me whakaatu, mā te whakamahi i ngā ture a Kirchhoff, ko te iahiko e haere ana mā te pana S_3 he 1.87 A.

MĀ TE KAIMĀKA ANAKE

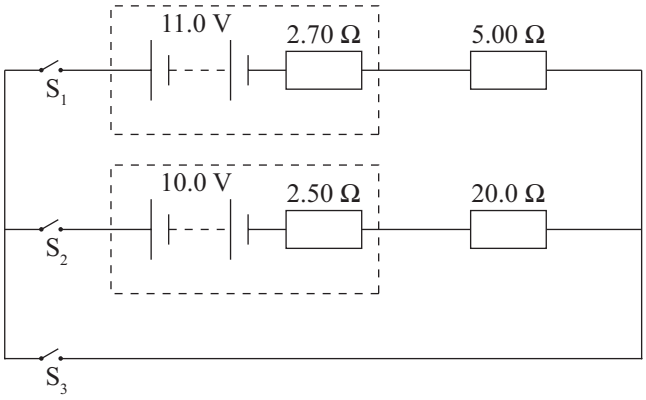
(d) Kua tuwhera te pana S_1 ināianei, ka noho kati ngā pana S_2 me te S_3. I muri i te whakahaerenga o tēnei ara iahiko mō tētahi wā, kātahi ka tīmata te hikokore haere o te pūhiko 10.0 V. Ko te whakapae a tētahi ākonga nā te pikitanga o te parenga ā-roto te pūtake.

Whakamāramahia he aha te pānga o te huringa o te parenga ā-roto ki te hiko e tukuna ana ki te parenga iahiko 20.0 Ω.

Ka whai wāhi ki tētahi whakautu whānui ko ētahi tātaitanga tauira.

QUESTION TWO: BATTERIES

ASSESSOR'S USE ONLY



The circuit diagram shows two batteries connected into a circuit. The internal resistance, r_1, of the 11.0 V battery is 2.70 Ω, and the internal resistance, r_2, of the 10.0 V battery is 2.50 Ω.

(a) Switches S_1 and S_2 are closed and switch S_3 is left open.

Show that the current in the circuit is 0.0331 A.

(b) In which direction will the current be flowing through switch S_1?

Explain your answer.

ASSESSOR'S USE ONLY

(c) Switch S_3 is now closed so all three switches are closed.

Show, using Kirchhoff's laws, that the current through switch S_3 is 1.87 A.

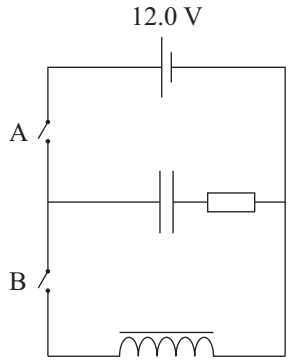
(d) Switch S_1 is now opened, leaving switches S_2 and S_3 closed. After this circuit has been operating for some time, the 10.0 V battery starts to go flat. A student suspects that this is caused by an increase in the internal resistance.

Explain what effect a changing internal resistance has on the power delivered to the 20.0 Ω resistor.

A full answer will include some sample calculations.

PĀTAI TUATORU: PŪNGAO

MĀ TE KAIMĀKA ANAKE



(a) I te hoahoa i runga ake, ka noho tuwhera tonu te pana B, ā, ka katia te pana A, e rere ai he whana ki ngā pāpana o te pūnga iahiko.

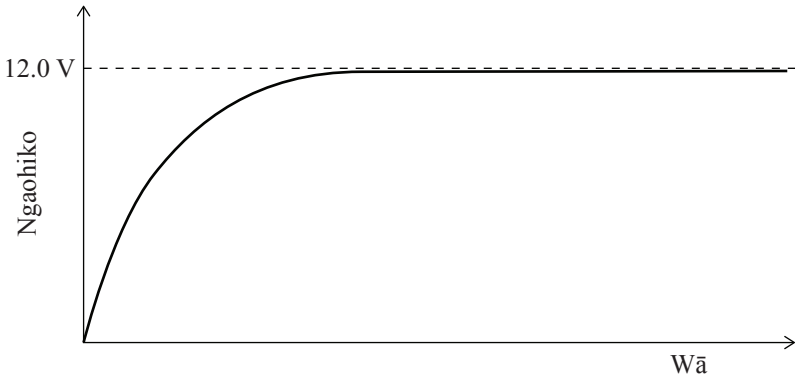
Whakamāramahia he aha i piki haere ai te ngaohiko o te pūnga iahiko ki te ngaohiko o te pūhiko.

(b) Ina hihiko katoa te pūnga iahiko i te ara iahiko o runga ake, ka kawea he whana o te 8.60×10^{-3} C.

Tātaihia te pūngao e noho ana i roto i te pūnga iahiko ina hihiko katoa.

(c) E whakaatu ana te kauwhata i raro i te pānga i waenga i te ngaohiko me te wā ina hihiko haere te pūnga iahiko.

MĀ TE KAIMĀKA ANAKE



Tātuhia tētahi atu ānau ki te kauwhata hei whakaatu i te pānga o te pikitanga o te parenga ki te whakawhana o te pūnga iahiko.

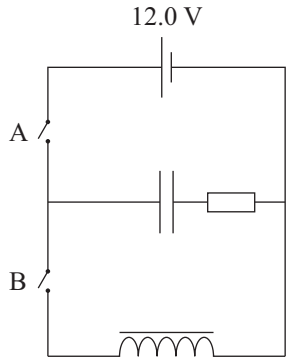
E huakina ana te pana A ināianei, ā, kua katia te pana B. Ka huri te iahiko i roto i te wā.

(d) Whakamāramahia te pānga o ngā pūpoapoa ki ngā iahiko ka huri i roto i te wā.

(e) Matapakihia he pēhea te rokiroki i te pūngao i roto i te pūnga iahiko me te pūpoapoa i te wā tonu e katia ana te pana B, ā, me te wā hoki e tuku hiko ana te pūnga iahiko.

QUESTION THREE: ENERGY

ASSESSOR'S USE ONLY



(a) In the circuit above, switch B is kept open and switch A is closed, allowing charge to flow onto the plates of the capacitor.

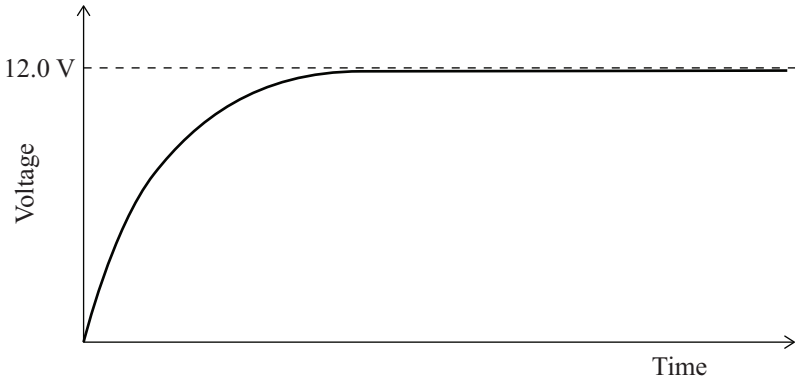
Explain why the voltage of the capacitor rises to the voltage of the battery.

(b) When the capacitor in the circuit above is fully charged, it carries a charge of 8.60×10^{-3} C.

Calculate the energy stored in the capacitor when it is fully charged.

ASSESSOR'S USE ONLY

(c) The graph below shows the relationship between voltage and time as the capacitor charges.



Sketch another curve on the graph to show the effect of an increased resistance on the charging of the capacitor.

Now switch A is opened and switch B is closed. The current changes with time.

(d) Explain the effect that inductors have on currents that change with time.

(e) Discuss how energy is stored in the capacitor and inductor at the instant switch B is closed, and then while the capacitor is discharging.

He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tāu 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 3 Physics, 2014

91526 Demonstrate understanding of electrical systems

2.00 pm Tuesday 25 November 2014
Credits: Six

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of electrical systems.	Demonstrate in-depth understanding of electrical systems.	Demonstrate comprehensive understanding of electrical systems.

91526M

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 Booklet L3–PHYSMR.

In your answers use clear numerical working, words and / or diagrams as required.

Numerical answers should be given with an SI unit, to an appropriate number of significant figures.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2 – 16 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.