91173M

911735

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

Tohua tēnei pouaka mēnā kāore he tuhituhi i roto i tēnei pukapuka

Ahupūngao, Kaupae 2, 2020

91173M Te whakaatu māramatanga ki te hiko me te autōhiko

9.30 i te ata Rāhina 16 Whiringa-ā-rangi 2020
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 2–19 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.

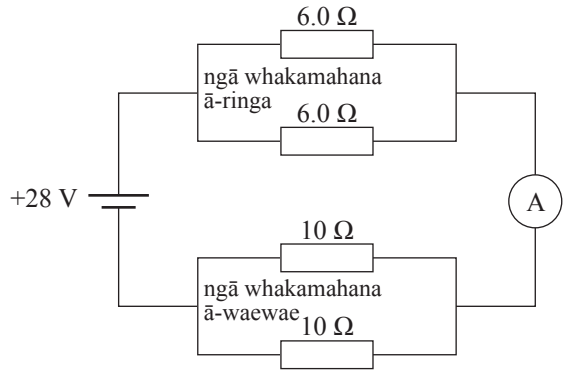
TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI: NGĀ WĀHI NOHO RANGATIRA

MĀ TE KAIMĀKA ANAKE

I tētahi wāhi noho rangatira, kei roto i ngā tūru ko ngā whakamahana e whā; e rua mō ngā ringa, e rua mō ngā waewae. He 6.0 Ω, te parenga hiko o ngā whakamahana ā-ringa, ā, he 10 Ω mō ngā whakamahana ā-waewae. E hono ana te ara iahiko pōkākā ki te putunga hiko 28 V.



https://media.istockphoto.com/vectors/first-class-passenger-illustration-vector-id478216695?k=6&m=478216695&s=612x612&w=0&h=S3hV6e_YVJY5H8bbPAbKn-rigMz8flv2zGZesV2Wh80=

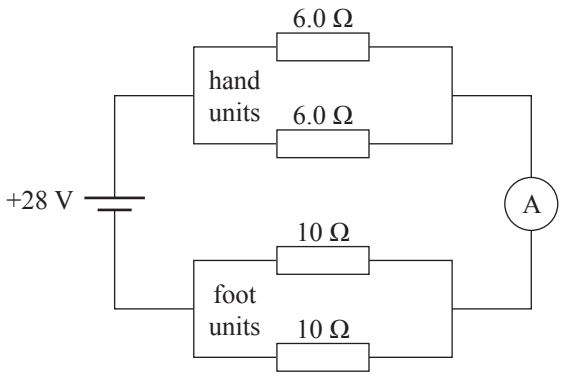
(a) Whakaaturia mai ko te tapeke parenga iahiko o ngā whakamahana ā-ringa he 3.0 Ω.

(b) Tātaihia te iahiko e rere ana mā te ine-iahiko.

QUESTION ONE: FIRST CLASS CABINS

ASSESSOR'S USE ONLY

In a first class cabin, the seats are fitted with four heating units; two for the hands, and two for the feet. The hand units have a resistance of 6.0 Ω, and the foot units 10 Ω. The heating circuit is connected to the 28 V supply.



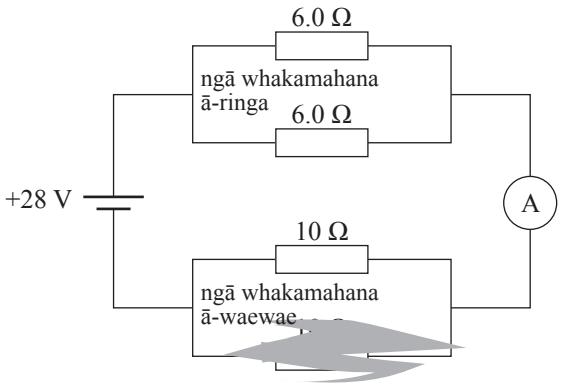
https://media.istockphoto.com/vectors/first-class-passenger-illustration-vector-id478216695?k=6&m=478216695&s=612x612&w=0&h=S3hV6e_YVJY5H8bbPAbKn-rigMz8flv2zGZesV2Wh80=

(a) Show the combined resistance of the hand units is 3.0 Ω.

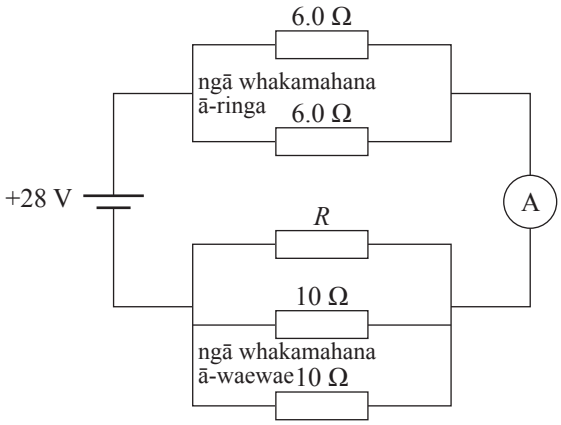
(b) Calculate the current flowing through the ammeter.

(c) Kua kore tētahi o ngā whakamahana ā-waewae e mahi.

Whakamāramahia mai he aha te pānga o tēnei ki te iahiko kei tētahi whakamahana ā-ringa kotahi.



(d) Hei whakapiki ake, ka tāpirihia e te kamupene rerangi tētahi whakamahana tāpiri (ko *R*) ki te tūru. Ina tāpiritia te whakamahana hou, ko te whakaputanga hiko mai i te putunga hiko he 120 W.



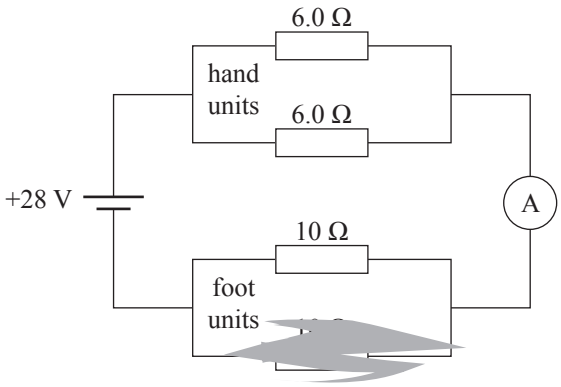
He aha te uara o te parenga iahiko, *R*, o te whakamahana hou?

MĀ TE KAIMĀKA ANAKE

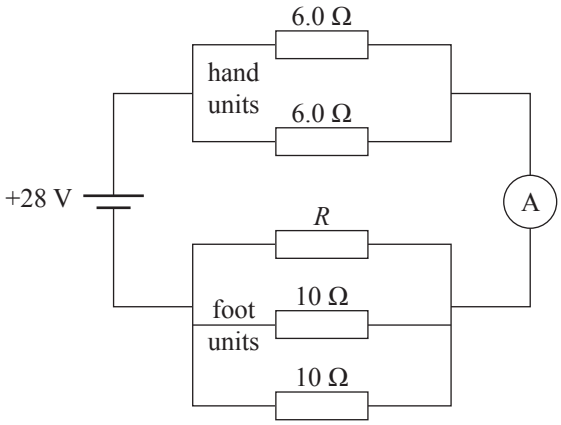
ASSESSOR'S USE ONLY

(c) One of the foot units stops working.

Explain what effect this would have on the current through a single hand unit.



(d) As an upgrade, the airline adds an additional heating unit (labelled *R*) to the seat. When the new heating unit is added, the power output from the supply is 120 W.



What is the value of the resistance, *R*, of the new heating unit?

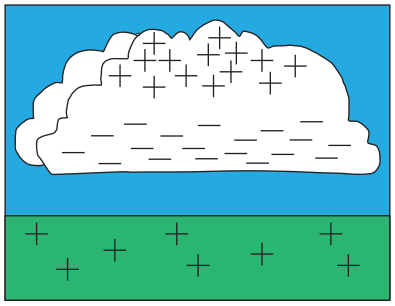
TŪMAHI TUARUA: UIRA

MĀ TE KAIMĀKA ANAKE

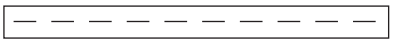
Papatipu o te irahiko = 9.11×10^{-31} kg

Whana kei te irahiko = -1.60×10^{-19} C

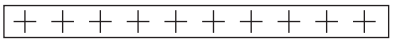
Me kī ko te pūtakenga mai o te uira ko te tukutanga o ngā irahiko i whakatōpū atu ki rō kapua. He whana tōraro kei te pūtake o te kapua, ā, ko te papa i raro o te kapua he whana tōrunga.



Ka taea te whakatauira te kapua me te papa mā te whakarite mai i ngā papa whakarara e rua.



pūtake o te kapua



papa

Ko te rerekētanga o te ngaohiko i waenga i tētahi kapua ake me te papa he 1.75×10^{8} V, ā, ko te kaha o te whaitua hiko he 8.57×10^{4} V m^{-1}.

(a) Whiriwhiria te teitei o te kapua i runga ake o te whenua.

(b) Ka tukua ake he pūangi huarere i te whenua.

Ko te whana o te pūangi he 3.70 μC (3.70×10^{-6} C).

Tātaitia te rahi me te ahunga o te tōpana hikotū ka pā ki te pūangi ina eke ki te haurua o te tawhiti i waenga i te kapua me te papa.

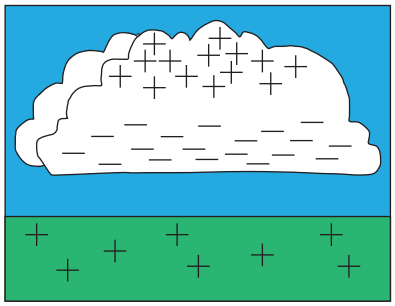
QUESTION TWO: LIGHTNING

ASSESSOR'S USE ONLY

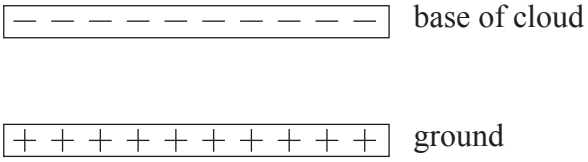
Mass of electron = 9.11×10^{-31} kg

Charge on electron = -1.60×10^{-19} C

Lightning is typically caused by a build-up of electrons in clouds being released to Earth. The bottom of the cloud is negatively charged, and the ground under the cloud becomes positively charged.



The cloud and the ground can be modelled by a pair of parallel plates.



The voltage difference between a particular cloud and the ground is 1.75×10^{8} V, and the electric field strength is 8.57×10^{4} V m^{-1}.

(a) Find the height of the cloud above the ground.

(b) A weather balloon is released from the ground.

The balloon has a charge of 3.70 μC (3.70×10^{-6} C).

Calculate the size and direction of the electrostatic force exerted on the balloon when it is halfway between the cloud and the ground.

(c) He pēhea te huri o te tōpana hikotū ki pā ki tētahi irahiko i te hekenga mai i te kapua ki te papa?

Whakamahia ngā mātāpono o te ahupūngao hei whakamārama i tō tuhinga.

MĀ TE KAIMĀKA ANAKE

(d) Ka tukuna whakararotia tētahi irahiko mai i te pūtake o te kapua me tētahi tere o te 1.20×10^5 m s^{-1}.

Ka eke tōna tere ki te 4.20×10^5 m s^{-1}.

Tātaihia te tawhiti i haerehia mai i te kapua kia taea ai tēnei tere.

ASSESSOR'S USE ONLY

(c) How does the electrostatic force on an electron change as it travels from the cloud to the ground?

Use physics principles to explain your answer.

(d) An electron is discharged downwards from the base of the cloud with a speed of 1.20×10^5 m s^{-1}.

It reaches a speed of 4.20×10^5 m s^{-1}.

Calculate the distance it could have travelled from the cloud to have reached this speed.

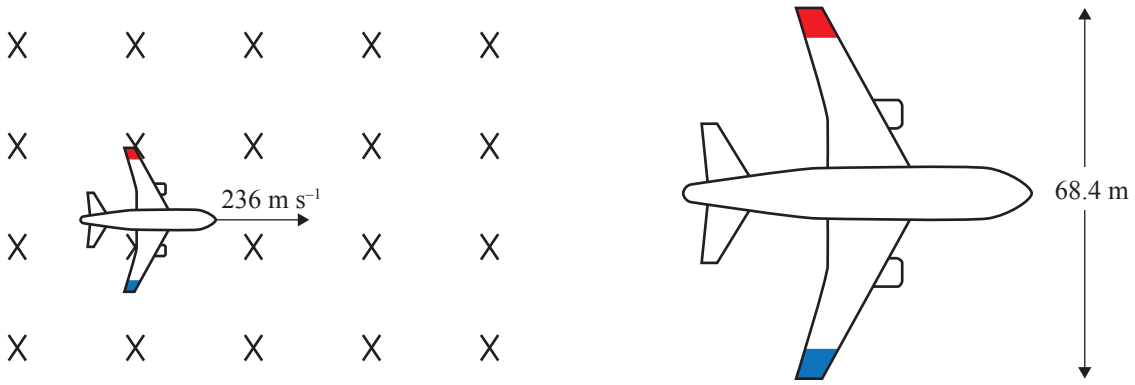
TŪMAHI TUATORU: TE WAKARERERANGI

MĀ TE KAIMĀKA ANAKE

Kua peitatia tetahi moka o tētahi wakarererangi me ngā parihau rino he kikorangi me tētahi moka he whero.

He 68.4 m te awhe o te parihau.

Kei te rere huapae te wakarererangi i te 850 km h^{-1} (236 m s^{-1}) i tētahi rohe ko te whaitua autō o Papatūānuku he poutū, ā, ko tōna kaha he 40.0 μT (40.0×10^{-6} T).



(a) Whakaaturia ko te ngaohiko ka poapoatia i waenga i ngā pito o ngā parihau he 0.646 V.

(b) Whakaotihia te tūtohi e whai ake nei.

Me kī ka mahia motuhaketia ia huringa ki te wakarererangi taketake.

Huringa	**Pānga ki te rahi o te ngaohiko i poapoatia**	**Ko tēhea te tae o te moka parihau he tōrunga**
Ka tere ake te haere o te wakarererangi		
Ka rere anō te wakarererangi ki te ahunga kōaro me taua tere anō		
Ka piki whakapoutū te wakarererangi mai i te papa		

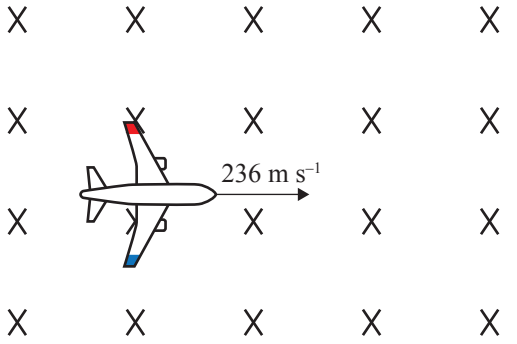
QUESTION THREE: THE PLANE

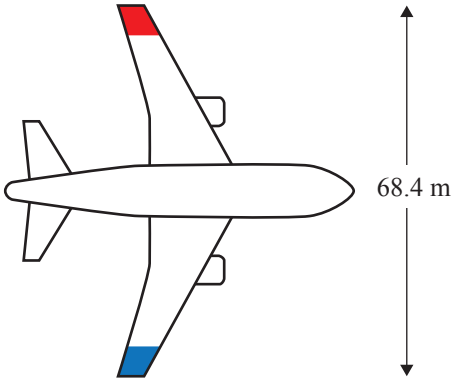
ASSESSOR'S USE ONLY

A plane with metal wings has one wing tip painted blue and the other wing tip red.

The wingspan is 68.4 m.

The plane is flying horizontally at 850 km h^{-1} (236 m s^{-1}) in a region where the Earth's magnetic field is vertical and has a strength of 40.0 μT (40.0×10^{-6} T).





(a) Show the voltage induced between the ends of the wings is 0.646 V.

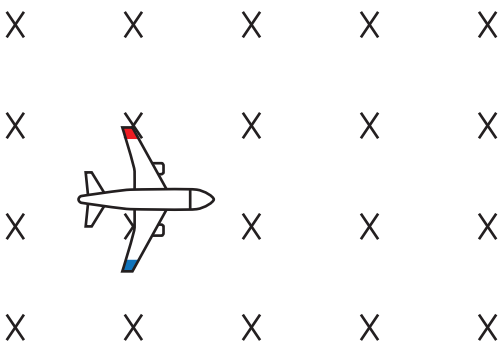
(b) Complete the following table.

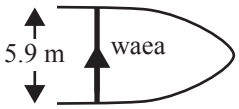
Assume each change is made to the original plane separately.

Change	Effect on size of induced voltage	Which colour wing tip is positive
Speed of plane increases		
Plane is flown in opposite direction at the same speed		
Plane climbs vertically upwards from the earth		

(c) I rō wakarererangi, ka rere tētahi waea hiko i raro i te papa o te wāhi noho.

MĀ TE KAIMĀKA ANAKE





E hono ana te waea ki te putunga hiko 28 V, ā, ko te parenga iahiko o te ara iahiko he 5.0 Ω.

Mēnā kei te rere te iahiko ki te ahunga e whakaaturia ana i roto i te waea, tātaihia te whānuitanga, me te whakatau i te ahunga, o te tōpana ka pā ki te waea nā te whaitua autō o Papatūānuku.

Ko te ahunga (porohitatia tētahi):

ki rō whārangi **ki waho o te whārangi** **ki runga (↑)** **ki raro (↓)**

ki mauī (←) **ki matau (→)**

Ka haere tonu te Tūmahi Tuatoru i te whārangi 14.

(c) Inside the plane, an electrical feeder wire runs under the floor of the cabin.

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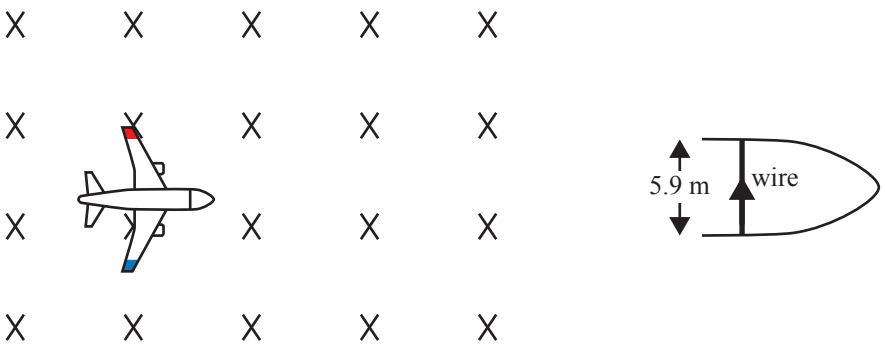


The wire is connected to a 28 V supply, and the circuit has 5.0 Ω resistance.

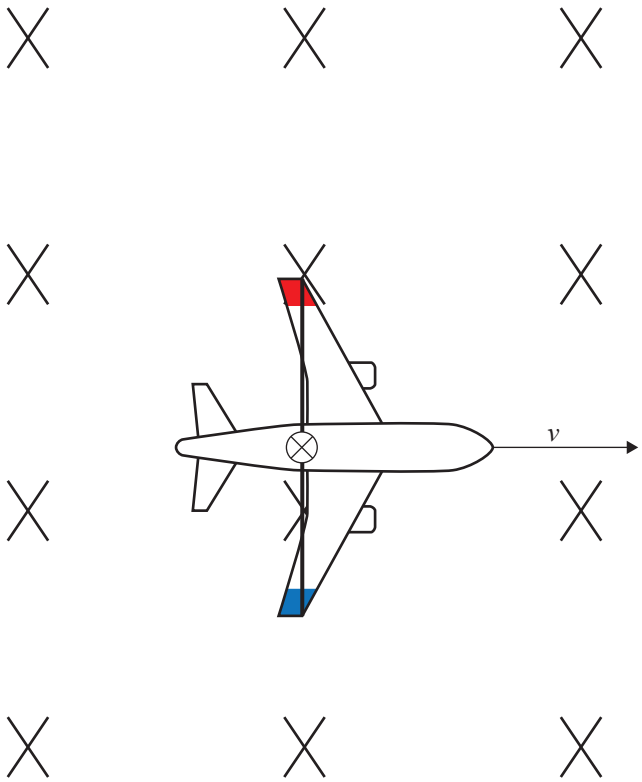
If the current is flowing in the direction shown in the wire, calculate the magnitude, and state the direction, of the force on the wire due to the Earth's magnetic field.

Direction is (circle one):

into page **out of page** **up (↑)** **down (↓)** **left (←)** **right (→)**

Question Three continues on page 15.

(d) Ka hoahoatia e tētahi kaipūkaha he pūrere whakatūpato-tere kua whai waea e hono ana ki ngā moka parihau me tētahi rama 0.5 V. E kī ana te kaipūkaha ko te terenga atu o te wakarererangi, ka mārama ake te tiaho o te rama.

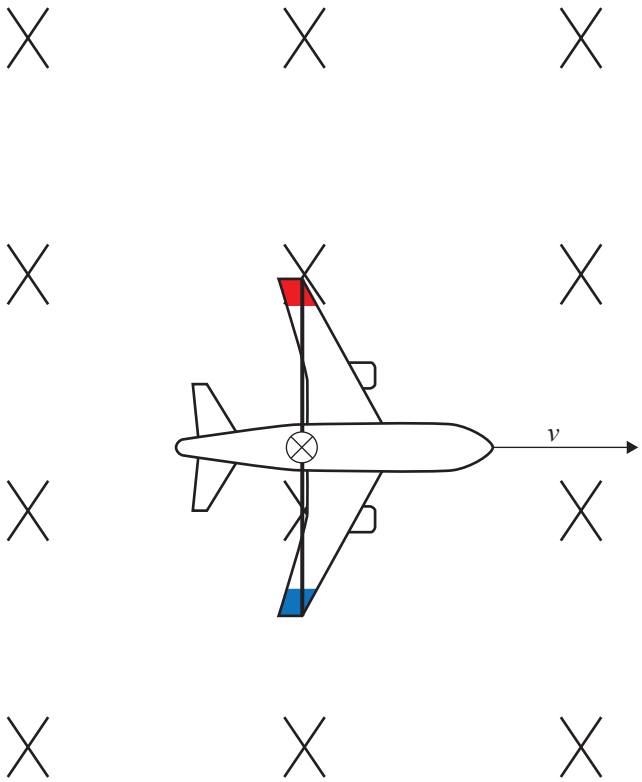


Whakamahia ngā mātāpono ahupūngao ki te whakamārama me te parahau mēnā ka mahi tēnei, ā, ka pēhea te mahi a tēnei takotoranga hei pūrere whakatūpato-tere.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(d) An engineer designs a speed-warning device that consists of a wire connecting the wing tips and a 0.5 V lamp. The engineer states that the faster the plane goes, the brighter the lamp will glow.



Use physics principles to explain and justify if and how this arrangement would work as a speed-warning device.

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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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 2020

91173 Demonstrate understanding of electricity and electromagnetism

9.30 a.m. Monday 16 November 2020
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.