

# 1

90937



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## Level 1 Physics, 2019

### 90937 Demonstrate understanding of aspects of electricity and magnetism

2.00 p.m. Tuesday 19 November 2019  
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of electricity and magnetism.	Demonstrate in-depth understanding of aspects of electricity and magnetism.	Demonstrate comprehensive understanding of aspects of electricity and magnetism.

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 L1–PHYSR.

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

Numerical answers should be given with an appropriate SI unit.

Useful information for calculation questions is available on the Resource Sheet.

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

Check that this booklet has pages 2–12 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.**

**TOTAL**

ASSESSOR'S USE ONLY

**QUESTION ONE: TRAMPOLINE**

- (a) What is meant by the term “static electricity”?

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- (b) Ewan enjoys jumping on trampolines. He notices that sometimes he can build up a static charge when jumping on a trampoline. The trampoline mat is made of polypropylene.

- (i) Explain how Ewan can become negatively charged while jumping on a trampoline.

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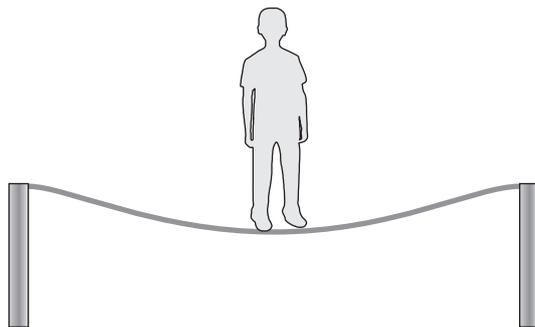


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- (ii) Show the distribution of the charges on Ewan and the trampoline in the diagram below when Ewan is negatively charged.



*If you need to redraw this, use the diagram on page 9.*

- (c) When Ewan touched the metal frame of the trampoline, he felt an electric shock, even though he did not feel a shock when he was touching only the polypropylene trampoline mat.

- (i) Explain why Ewan did not get a shock when he was only touching the polypropylene mat, but did when he touched the metal frame.

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- (ii) Ewan decides that one way to prevent getting a shock when he touched the metal frame would be to make the trampoline mat from a material that conducts electricity.

Explain why this change would prevent Ewan from experiencing a shock when he touches the metal frame.

- (d) When Ewan touched the metal frame of the trampoline, there was a small spark. The spark lasted for  $2.5 \times 10^{-4}$  s, had a voltage of 3500 V, and released a total energy of  $1.25 \times 10^{-5}$  J.

Calculate the average current that flowed during the spark.

**QUESTION TWO: CHRISTMAS LIGHTS**

- (a) Nick buys a set of battery-powered lights for Christmas. He finds that when he removes one of the light bulbs from its socket, all of the other light bulbs in the set stop working.

Nick realises that this means all the light bulbs are connected in series.

Explain why removing one of the light bulbs causes all the others to stop working.

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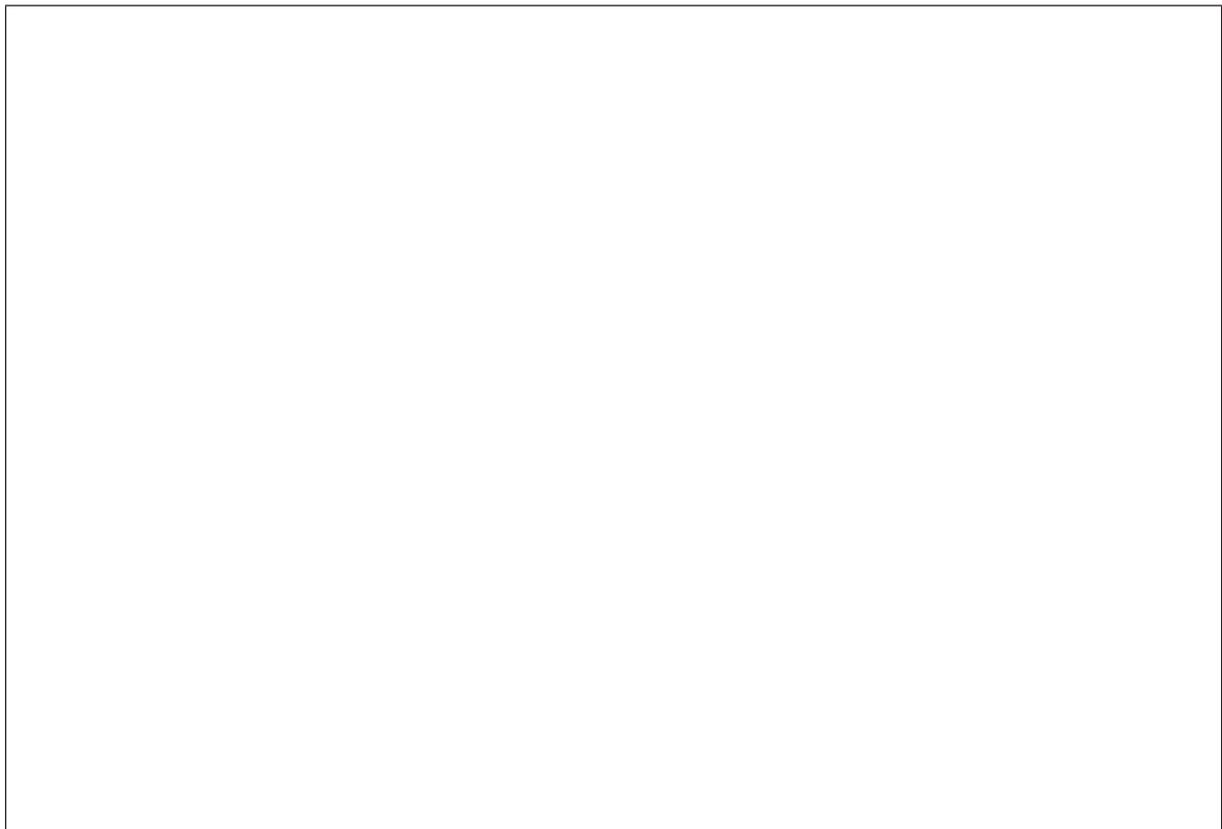
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- (b) Nick connects the light bulb he removed from the set to a circuit to measure its resistance. The circuit Nick made used the following circuit components:

- a 1.5 V cell
- a switch
- a light bulb
- an ammeter to measure the current through the light bulb
- a voltmeter to measure the voltage of the light bulb.

In the space below, draw a circuit diagram of the circuit Nick made.

*If you need to  
redraw this, use the  
box on page 9.*



- (c) Nick's set of lights has a total of 20 light bulbs connected in series, and is powered by a 9.0 V battery.

Calculate the **total current** in the set of lights if the resistance of **each** bulb is 0.40 ohms.

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- (d) One of the light bulbs in the set breaks, so Nick replaces it with another light bulb. The new light bulb has a **lower resistance** than the rest of the light bulbs in the set.

Explain how replacing one of the light bulbs with one with a lower resistance will affect the total power output of the circuit and the life of the battery.

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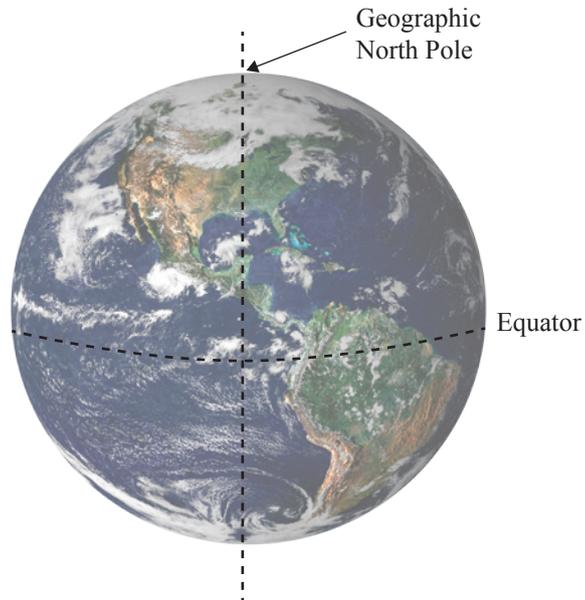
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**QUESTION THREE: EARTH'S MAGNETIC FIELD**

- (a) Use the diagram below to draw the shape of the Earth's magnetic field, including arrows to show the direction of the magnetic field.



- (b) Describe TWO differences between the Earth's magnetic field near the Geographic North Pole and the Earth's magnetic field near the Equator.

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- (c) A current-carrying wire, wire A, is shown below. The diagram below shows a cross-section of wire A, with current flowing “into the page”.



*If you need to redraw this, use the diagram on page 10.*

- (i) Complete the diagram to show the **shape** and **direction** of the magnetic field near wire A, due to the current in the wire.
- (ii) Wire A has a constant current of 0.20 A flowing through it. At point P, the magnetic field due to the current in the wire is  $8.0 \times 10^{-7}$  T.

Calculate the distance,  $d$ , between point P and wire A.




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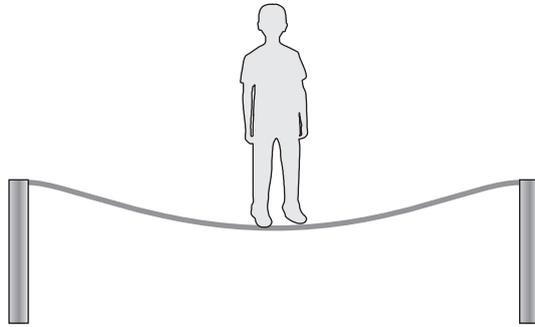
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**Question Three continues on the following page.**



**SPARE DIAGRAMS**ASSESSOR'S  
USE ONLY

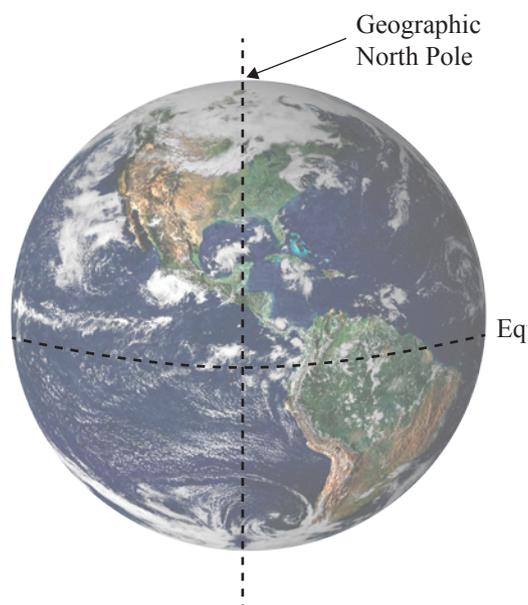
If you need to redraw your diagram from Question One (b)(ii), draw it below. Make sure it is clear which answer you want marked.



If you need to redraw your diagram from Question Two (b), draw it below. Make sure it is clear which answer you want marked.



If you need to redraw your diagram from Question Three (a), draw it below. Make sure it is clear which answer you want marked.



If you need to redraw your diagram from Question Three (c)(i), draw it below. Make sure it is clear which answer you want marked.

wire A



If you need to redraw your diagram from Question Three (d), draw it below. Make sure it is clear which answer you want marked.

