

# 1

90937



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## Level 1 Physics, 2015

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

9.30 a.m. Thursday 19 November 2015  
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.

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.

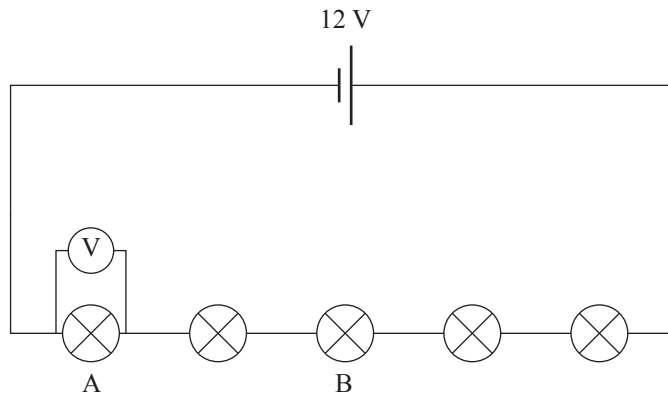
**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

**TOTAL**

ASSESSOR'S USE ONLY

**QUESTION ONE: DC ELECTRICITY**

A road-side stall in a street fair is lit with five **identical** 6.0 V bulbs. The bulbs are connected in series to a 12 V battery, and in this circuit the resistance of each bulb is  $2.5 \Omega$ . A voltmeter is connected across the bulb A, as shown in the diagram below.

**Circuit 1**

- (a) (i) What is the reading on the voltmeter?

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- (ii) Give an explanation for part (i).

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- (b) Calculate the current through the circuit.

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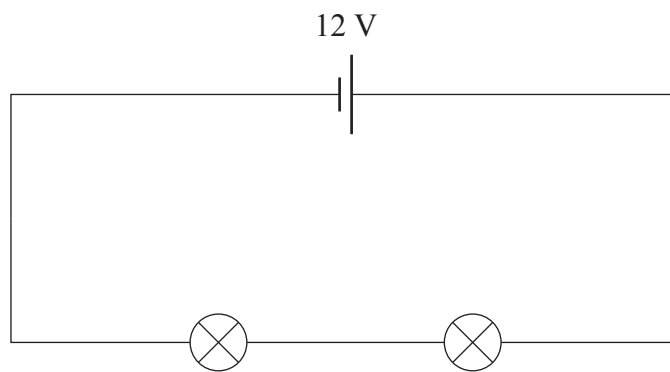


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Current: \_\_\_\_\_

- (c) In the following circuit, two **identical** 6.0 V bulbs, similar to the ones used in Circuit 1, are connected in series across a 12 V battery.

**Circuit 2**



Compare the brightness of bulbs in this circuit to the brightness of bulbs in Circuit 1.  
Explain your answer.

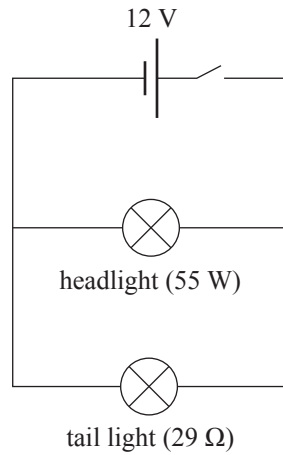
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- (d) The diagram below shows the wiring of the headlight and the tail light in a quad bike. Both bulbs are designed to work across a 12 V battery. When the switch is turned on, the power output of the headlight is 55 W and the working resistance of the tail light is  $29 \Omega$ .



- (i) Calculate the total current drawn from the battery when the switch is closed.

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Total current: \_\_\_\_\_

- (ii) The headlight has printed on it “12 V, 55 W”.

What does “12 V, 55 W” mean?

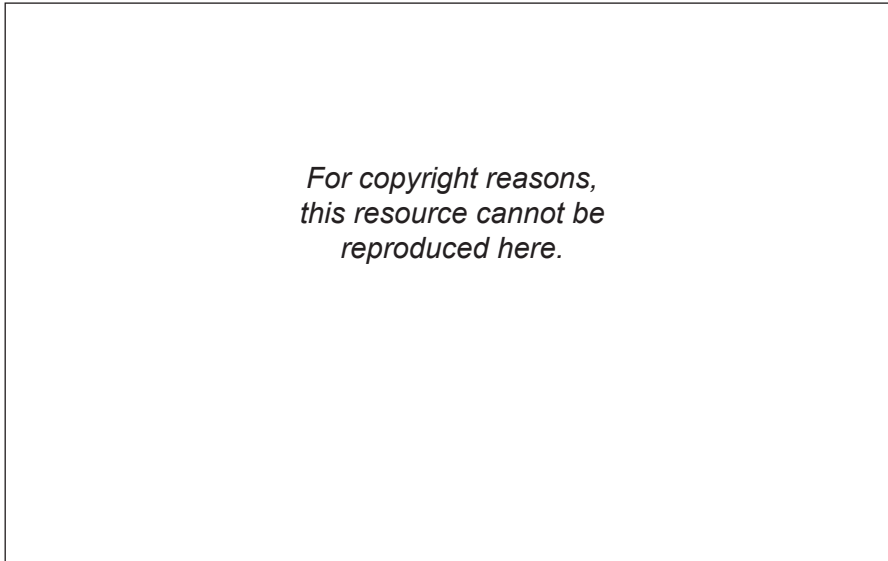
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**QUESTION TWO: STATIC ELECTRICITY**

Zoe uses a plastic brush to groom her dog. She notices that on dry days the hair sticks out after she has brushed it, as shown in the picture below.



[www.pamperedpuppy.com/doggydesktops/](http://www.pamperedpuppy.com/doggydesktops/)

- (a) Explain what causes the dog's hair to stick out after Zoe has removed the brush.

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- (b) After brushing, Zoe notices that when she holds the brush closer to the dog, the hair moves towards the brush.

Explain why the hair moves towards the brush when Zoe holds the brush closer to the hair.

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- (c) Explain what would happen to her dog's hair if Zoe now strokes it with her bare hand.

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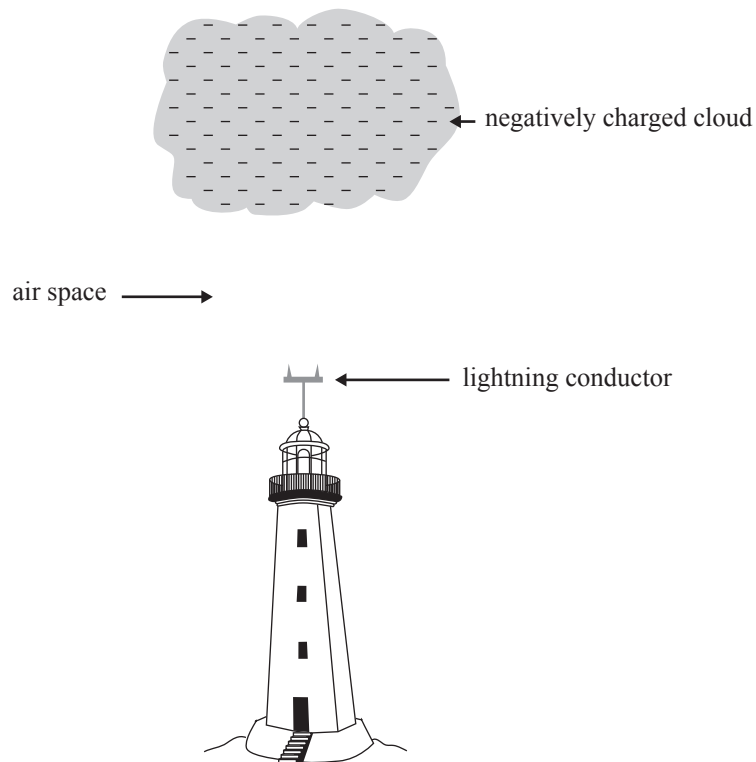


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- (d) The diagram shows a large, negatively charged thundercloud passing over a lighthouse with a lightning conductor.



- (i) On the diagram, draw the charge distribution in the **air space** between the lightning conductor and the charged cloud.
- (ii) Explain what causes the charges to be distributed as shown in your diagram.

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- (iii) Lightning strikes can damage the structure of a building. The lightning conductor protects the building from lightning strikes.

Explain how the lightning conductor gives protection to the building from lightning strikes.

In your explanation you should include:

- the type of material used for a lightning conductor
- why this material is used as the lightning conductor
- how the lightning conductor works.

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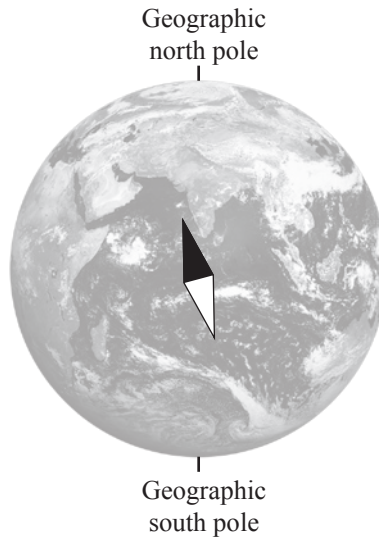
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### QUESTION THREE: MAGNETIC EFFECTS

The diagram below shows the **geographic** north and south poles of the Earth.



Adapted from: [http://jewell.com/data\\_images/out/75/1134759-earth.jpg](http://jewell.com/data_images/out/75/1134759-earth.jpg)

- (a) The Earth behaves like a giant magnet and creates a magnetic field around itself.

Describe what is meant by the term “magnetic field”.

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- (b) A compass needle on Earth points in the direction as shown in the diagram.

- (i) On the above diagram, using letters “N” and “S”, label the north and the south poles of the **compass needle**.

- (ii) Explain why the compass needle points in the direction shown in the diagram.

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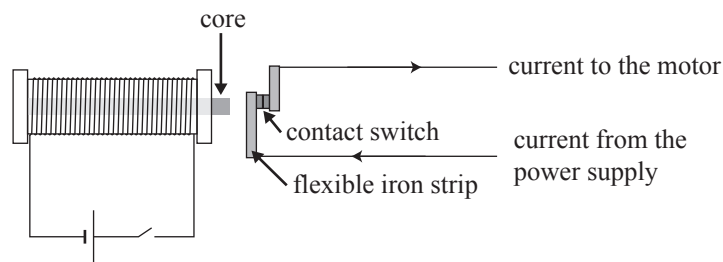
- (c) The diagram below shows two magnetic north poles placed close to each other.



On the diagram, draw lines to show the **pattern** of the magnetic field formed between the two north poles.

Use **arrows** to indicate the direction of the magnetic field.

- (d) The diagram shows an electromagnetic relay switch used to **switch off** an electric motor in a factory. The relay consists of a coil outside an inner core. It is placed at a fixed distance from a contact switch, which turns the electric motor on or off. One arm of the switch is made from a flexible iron strip, and is placed near the core of the electromagnetic relay.



- (i) Name a suitable material for the core, and give a reason for your answer.

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- (ii) The switch is now turned on.

Explain how the relay works.

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

- (iii) When the motor is operating, the current-carrying cable to the motor produces a magnetic field of  $1.6 \times 10^{-5}$  T at a distance of 25 cm from the cable.

Calculate the size of the current in the cable.

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Current: \_\_\_\_\_



