1

90937

909370

SUPERVISOR'S USE ONLY

NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

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.

Achievement

TOTAL 11

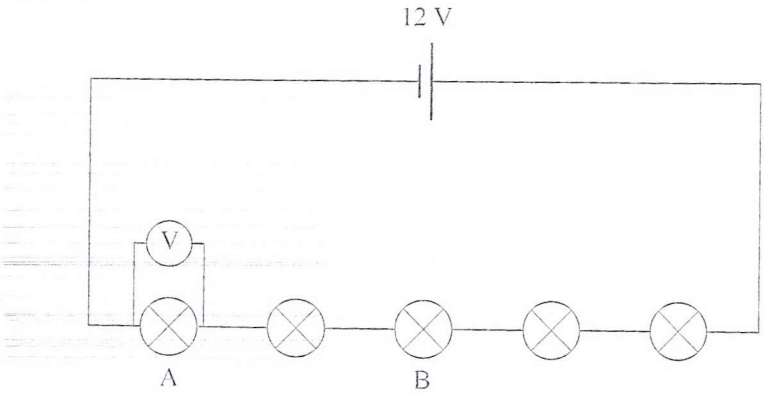
ASSESSOR'S USE ONLY

QUESTION ONE: DC ELECTRICITY

ASSES USE

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 Ω. 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?

2.4V

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

The 12V is shared out among the bulbs evenly

a

for m needs to explain that voltage is split evenly because bulbs all have the same resistance

(b) Calculate the current through the circuit.

$I = V/R \rightarrow I = 12/12.5 \rightarrow I = 0.96A$

$R = 2.5 \times 5$

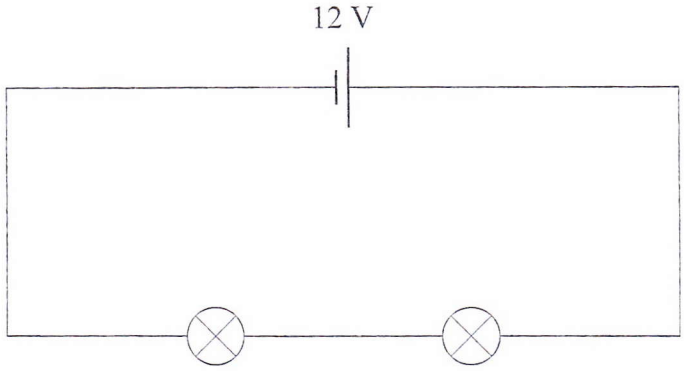
M

Current: 0.96A

ASSESSOR'S USE ONLY

(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



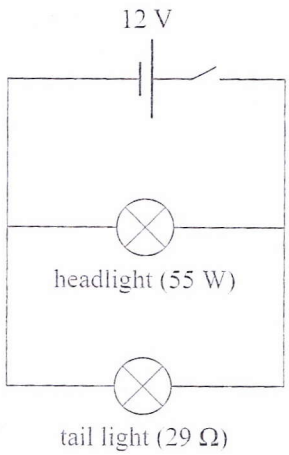
Compare the brightness of bulbs in this circuit to the brightness of bulbs in Circuit 1.

Explain your answer.

The bulbs in this circuit would be brighter than the bulbs in circuit 1, because there are less bulbs, which means each component receives more voltage.

M

(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 Ω.



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

$I = P/V \rightarrow I = 55/12 \rightarrow I = 4.58\,A$

for e also need to calculate the current through the tail light and add it to the head light current

a

Total current: 4.58A

(ii) The headlight has printed on it "12 V, 55 W".

What does "12 V, 55 W" mean?

The headlight can sustain 12 V, and use up to 55w

m5

QUESTION TWO: STATIC ELECTRICITY

ASSESSOR'S USE ONLY

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/

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

The brush is made of plastic, which is an insulator. Because of this, The ~~this~~ friction from the brushing causes a build up of charge, which can't be grounded. The brush gains or loses electrons in this process, and so the opposite charge is attracted, and the same one repelled, causing them to separate and ~~spread~~ move as far from eachother as possible, causing the dog's hair to ~~stand up~~ stick out.

a

For m need to explain that all the hairs have received the same charge and repel

(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.

Because the brush is charged, the oppositely charged particles in the dogs hair are attracted to it, which causes the hair to move towards the brush. This is because opposite charges attract.

a
m

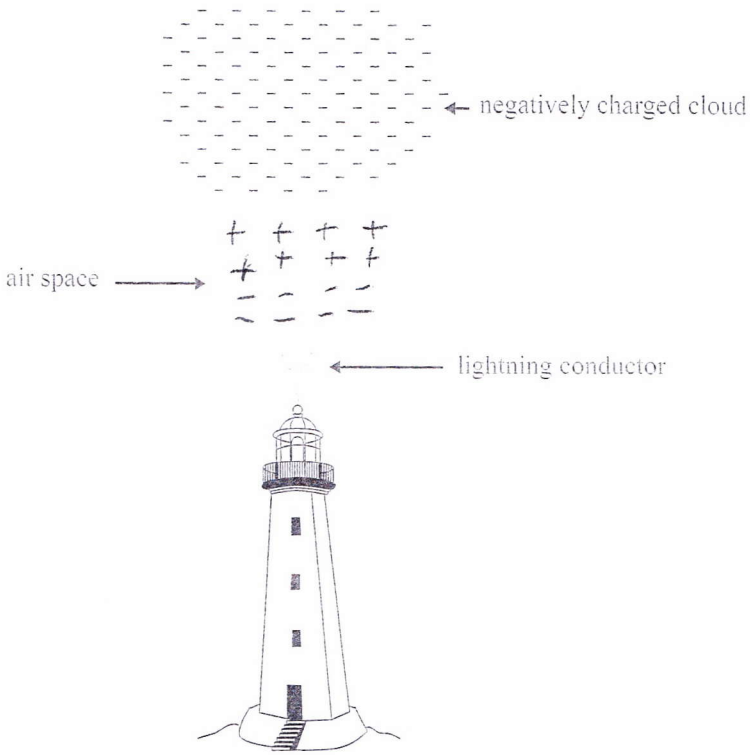
(c) Explain what would happen to her dog's hair if Zoe now strokes it with her bare hand.

The hair would attract to her hand a bit, but would quickly lose charge and fall flat.

for m need to explain that hair loses its charge because charge is transfered to Zoe

a

(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.

The cloud is negatively charged, so the positive charges in the air are attracted to it, and the negative ones are repelled.

ASSESSOR'S USE ONLY

(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.

The ~~co~~ lightning conductor would most likely be made out of metal, as metals are good conductors. The lightning conductor would make it easier for the lightning to pass through to the ground, giving it less time to ~~[illegible]~~ damage a building.

a

for m the answer needs to explain that the charges are transfered to the earth and are therefore harmless, as they are spread through the vast mass of the earth. The answer could also explain that the lightning conductor is situated high up as it will be more likely to be hit by lightning than the building.

A4

QUESTION THREE: MAGNETIC EFFECTS

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

Adapted from: http://jeweell.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".

A magnetic field is a space around a magnetised object that has a specific charge; creating an attractive/repelling bubble around the magnet.

(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**.

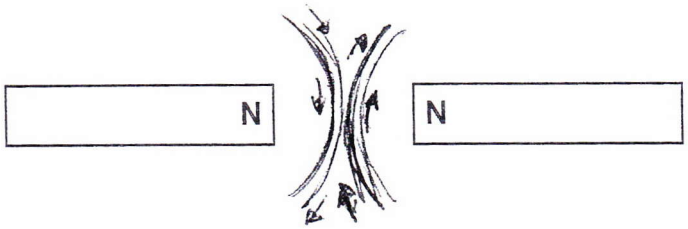
(ii) Explain why the compass needle points in the direction shown in the diagram.

The earth's axis is tilted, so the magnetic poles are slightly different to the ~~[illegible]~~ Geographic poles.

for m would need to identify that magnetic north is offset from the geographic north, rather than refer to tilt of the earth.
The explanation could also refer to the earths north pole in fact being the equivalent of a south pole on a magnet.

ASSESSOR'S USE ONLY

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

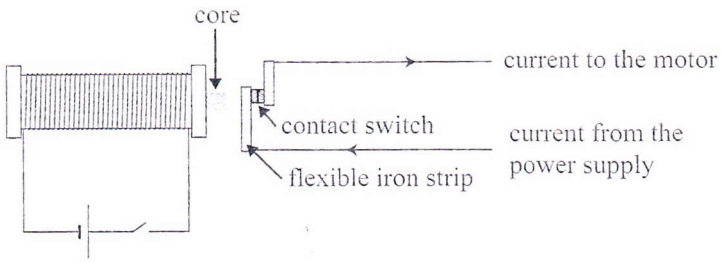


n

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.

a metal like iron or steel, which can easily be magnetised, so that when the electromagnet is switched on, it can attract the contact switch, and open it.

(ii) The switch is now turned on.

Explain how the relay works.

The current in the circuit charges the core, and it becomes magnetised. ~~When the circuit is opened~~

a

for m need to expand to explain the consequence of this. attracting the iron strip, pulling the contacts apart and stopping the current to the motor

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 1.6×10^{-5} T at a distance of 25 cm from the cable.

Calculate the size of the current in the cable.

$I = fT \rightarrow I = 1.6 \times 10^{-5} \times 25 \rightarrow I = 25,160\text{A}$

Current: 25,160A

ASSESSOR'S USE ONLY

N2