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NZQA

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SUPERVISOR'S USE ONLY

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.

Merit

TOTAL 18

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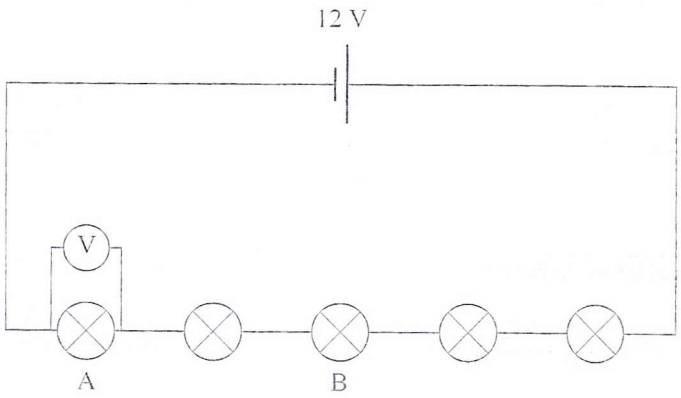
QUESTION ONE: DC ELECTRICITY

ASSE 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?

2V

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

as each bulb in the series circuit has 2.5 Ω of resistance the left over voltage is 2 as 2.5 × 4 = 10

(b) Calculate the current through the circuit.

I = V/R

V = 12 V

R = 12.5 Ω

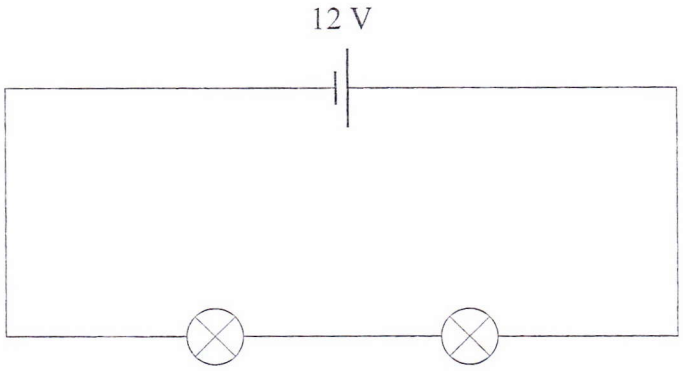
I = 0.96

Current: 0.96I

(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.

ASSESSOR'S USE ONLY

Circuit 2



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

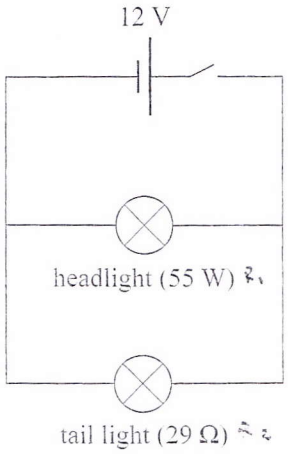
Explain your answer.

each bulbs brightness as they are using the full 6V to convert to light.

a

For M the answer needs to explain why each bulb has 6V and compare with circuit 1

(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.

$R_T = R_1 = R_2$

$V = IR = I = V/R$

$V = 12\ V$

$R = 29\ \Omega$

$I = 0.41\ I$

$I = P/V$

$P = 55\ W$

$V = 12\ V$

$I = 4.58\ I$

Total current: 4.99 I

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

What does "12 V, 55 W" mean?

it is being powered by 12 V and is using 55w of power

For E the answer needs to make clear that the lamp consumes 55W of power when it is connected to the 12V supply.

E7

QUESTION TWO: STATIC ELECTRICITY

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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 plastic brush will extract the outer electrons from the dogs hair causing the hair to become positively charge. Like charges repel each other. Each hair strand is positively charged which will cause them to repel each other causing them to stick out

M

(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.

Opposite charges attract each other. From gathering the lossely held electrons from the dogs hair the brush becomes negatively charged. The hair is positively charged. Due to this the hair will be attracted to the brush

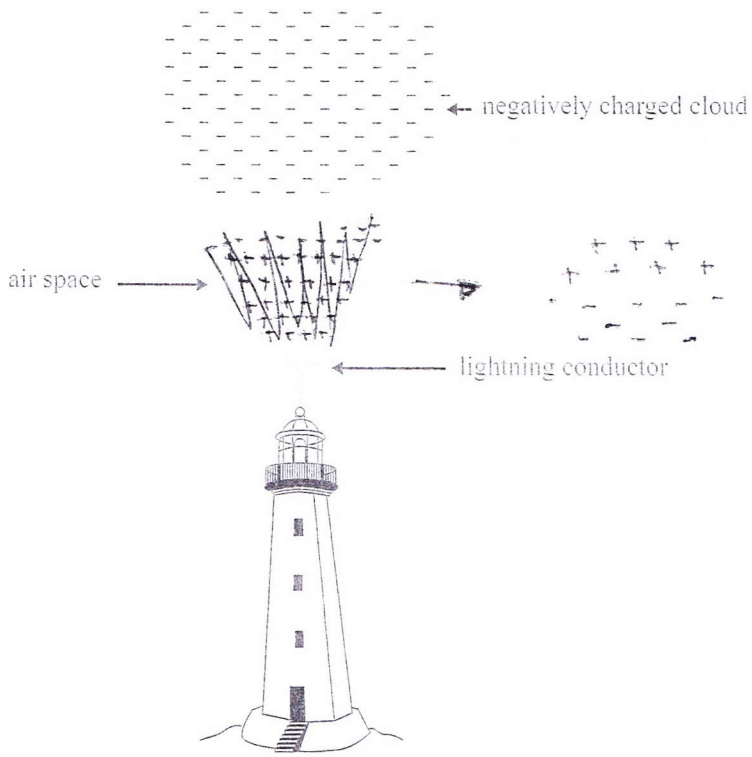
M

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

The hair will attract the loosly held outer electrons from the bare hands causing the hair to become neutral again and will lay back down

M

(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 negatively charged cloud repels the electons causing them to move away from the cloud and attracts to ~~positive~~ protons toward the cloud

M

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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.

The material that should be used in a lightning conductor is ~~metal~~ Metal as the are good conductors of electricity

Metal should be used as conducts / absorbs the charge or burst of electricity in itself rather than allowing it to hit the building.

The lightning conductor works by absorbing the electricity given by the lightning rather than it hitting the building

to gain e the answer needs to explain that conuctor allows charge to flow, not be absorbed. The answer also needs to explain what happens to the charge when earthed, and why the lightening conductor is placed high up.

M6

QUESTION THREE: MAGNETIC EFFECTS

ASSESSC
USE ON

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".

(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 magnetic north is attracted to the geographic south, vice versa causing it to point in the 'wrong' direction.

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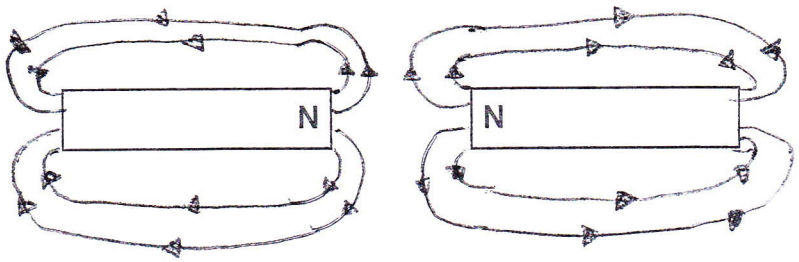
(c) The diagram below shows two magnetic north poles placed close to each other.

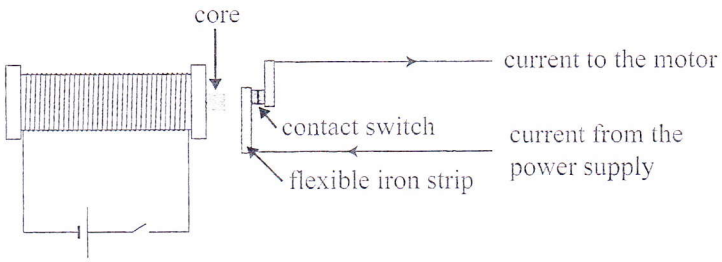


M

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 suitable material for the core would be a metal as it is a good conductor and it can be magnitised

(ii) The switch is now turned on.

Explain how the relay works.

once the switch is on it creates a solenoid, magnetising the core. This will attract the flexible iron strip causing the contact switch and the circuit to be broken which will turn the electric motor off

M

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.

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Calculate the size of the current in the cable.

I = Bd/K

Bd = $(1.6 \times 10^{-5}) \times 25$

K = 2.0×10^{-7}

I = 2000

Current: 2000 A

for e needs to make sure that the distance is converted to SI units and also identify that soft iron is the suitable material for the core of the solenoid

ms