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MANA TOHU MĀTAURANGA O AOTEAROA

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Level 1 Physics, 2011

90937 Demonstrate understanding of aspects of electricity and magnetism

2.00 pm Thursday 24 November 2011
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.

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

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You are advised to spend 60 minutes answering the questions in this booklet.

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QUESTION ONE: WRAPPING LUNCH

When Sally runs her hand over a piece of plastic lunch-wrap to straighten it, it becomes electrically charged.

(a) Explain what causes the lunch-wrap to become electrically charged.

(b) Sally's dad thinks that the lunch-wrap becomes electrically charged because charges are **created** when Sally runs her hand over the piece of plastic lunch-wrap.

Explain whether Sally's dad is correct.

(c) (i) When Sally picks up the lunch wrap, it sticks to her hand. Her hand is positively charged.

In the diagram below draw the charge distribution on the lunch-wrap.

(ii) Sally then straightens a piece of wrinkled aluminium foil in the same way. When she picks it up, she notices that it does **not** stick to her hand.

Using physics concepts, explain why the plastic lunch-wrap sticks to her hand, but the aluminium foil does not stick to her hand.

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QUESTION TWO: DECORATIVE LIGHTS

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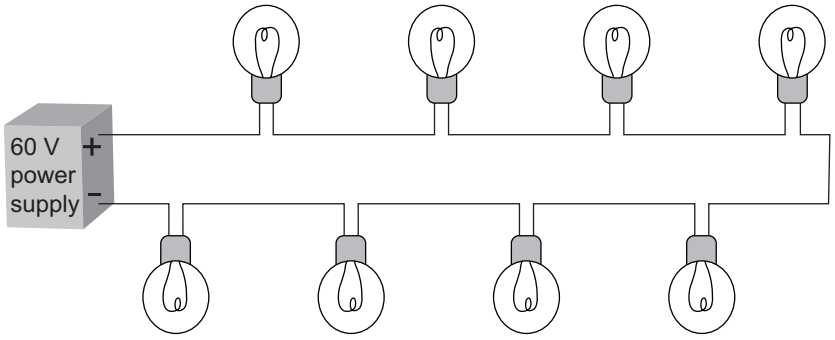
A small display in a shop window is lit with 8 identical light bulbs connected to a 60 V power pack, as shown in the diagram below.



(a) The resistance of each light bulb is 12.5 Ω.

Calculate the total resistance of the circuit.

Resistance _____

(b) The light bulbs only glow very dimly.

Give a possible reason for this.

(c) One light bulb in the circuit stops working.

State how this affects the circuit.

Explain why.

(d) The resistance of each light bulb is 12.5 Ω. The voltage of the power supply is 60 V.

Calculate the energy drawn from the supply in 2 minutes.

Energy _____

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QUESTION THREE: MAGNETIC FIELDS

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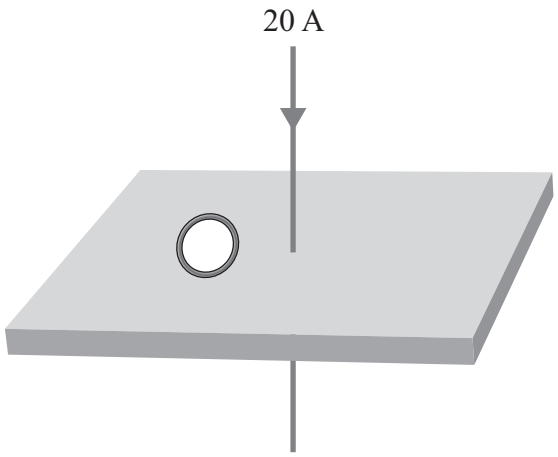
For this question you may use $k = 2.0 \times 10^{-7}$ T m A^{-1}.

A constant current is passing through a straight wire in the downward direction. A magnetic compass is placed near the wire as shown in the diagram below.



(a) (i) On the diagram, draw an arrow to show the direction of the magnetic needle inside the compass.

(ii) Explain why you have drawn the arrow in the direction shown in (a) (i).

(b) Calculate the strength of the magnetic field 0.14 m away from the wire, due to the constant current.

State the unit of the magnetic field strength.

Magnetic field strength _____ unit _____

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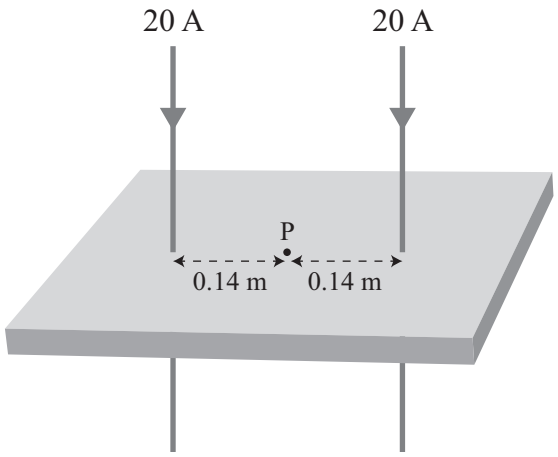
(c) An identical wire, carrying a constant current of 20 A, is now placed near the existing wire. Current flows in the downward direction in both wires as shown in the diagram. The point P is 0.14 m away from each wire.



State the strength of the magnetic field at the point P, and explain your answer.

(d) The diagram below shows the magnetic field of the Earth.

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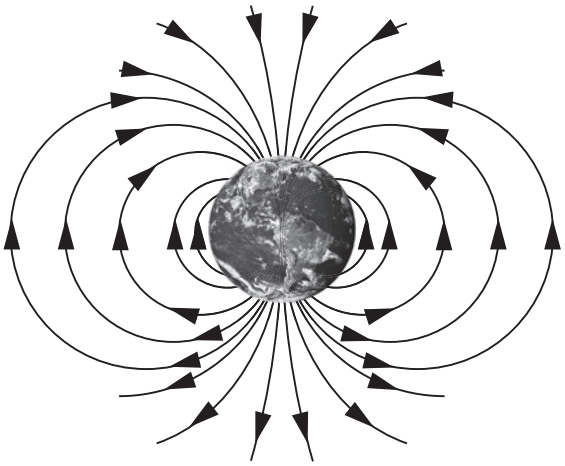

On the above diagram use the letter 'W' to mark two positions where the field is the weakest.

Explain why you selected those positions.

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QUESTION FOUR: ELECTROMAGNET

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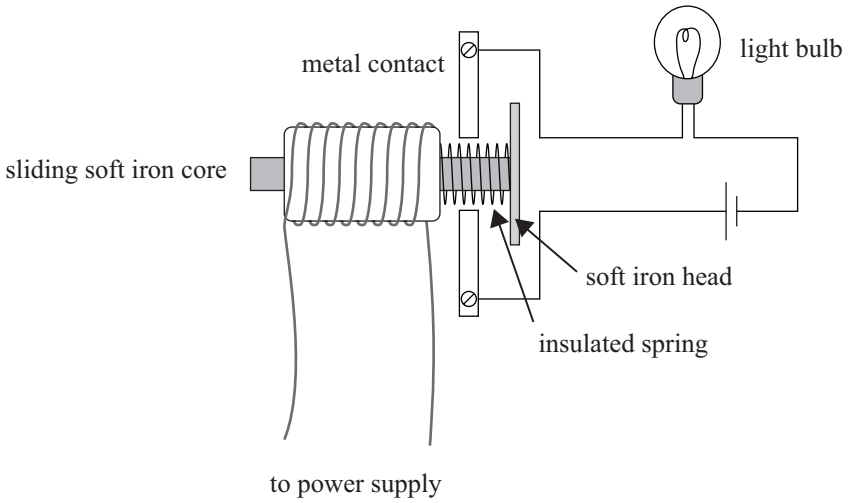
A relay is an electrically operated switch. The electric circuit shown below uses the relay to switch on a light bulb. The relay has a coil containing a sliding iron core to turn on the light bulb.



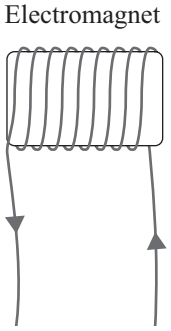
(a) Explain how the light bulb is turned on by the coil.

(b) The power supply for the coil is now turned on. See the diagram below for the direction of the current through the coil.

On the diagram below:

(i) use letters N and S to mark the north and south poles of the coil

(ii) draw the magnetic field pattern produced **outside** the coil. Indicate the direction of the magnetic field with arrows.



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(c) Describe two modifications that can be made to increase the strength of the magnetic field produced by the coil.

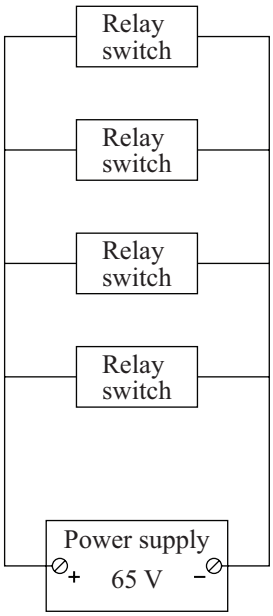
(1) _____

_____

(2) _____

_____

(d) A circuit in a factory contains four relay switches, as shown in the diagram. The relay switches are wired in parallel to a 65 V power supply. Each relay has a power consumption of 35 W.



Calculate the **combined** resistance of the relay switches.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Combined resistance _____

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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