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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

SUPERVISOR'S USE ONLY

Level 1 Physics, 2013

90937 Demonstrate understanding of aspects of electricity and magnetism

2.00 pm Monday 25 November 2013

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 space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–10 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.

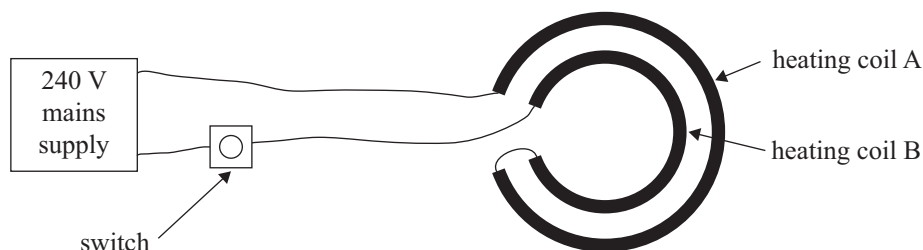
TOTAL

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

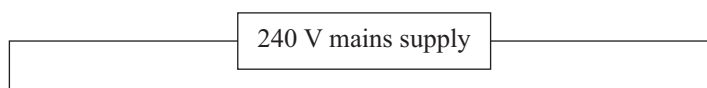
QUESTION ONE: ELECTRIC STOVE TOP

The diagram shows the wiring of an electric stove heating element. The element consists of two heating coils connected through a switch to a 240 V power supply, as shown in the diagram below.



- (a) The heating coils can be considered as two resistors connected in series with the switch and the power supply. The switch is in the **off** position.

In the space below, use appropriate circuit symbols to complete the circuit diagram.



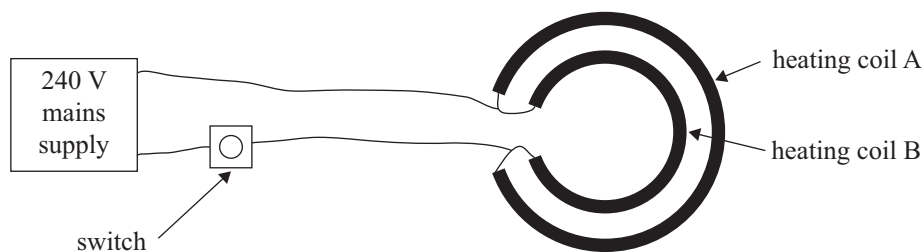
- (b) The circuit is now switched on.

Explain why the same current flows through both heating coils.

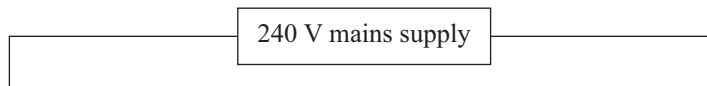
- (c) Heating coil A has a resistance of $50\ \Omega$, and heating coil B has a resistance of $40\ \Omega$.

Calculate the amount of power output when the circuit is connected to a 240 V mains supply.

A second element uses the same heating coils as the one used in the first element, but they are connected as shown in the diagram below.



- (d) The element is switched on. In the space below, use appropriate circuit symbols to complete the circuit diagram.



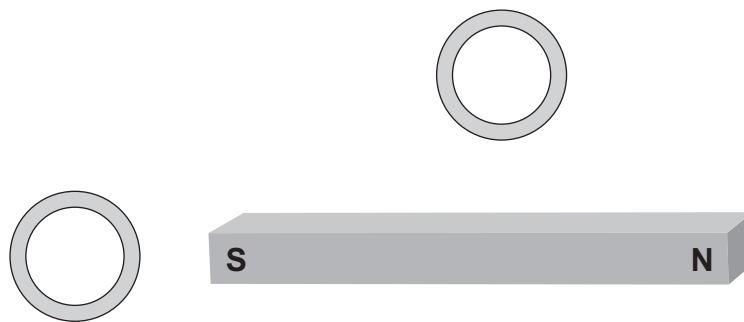
- (e) State and explain how the power output of the above element differs from that in the first element in Question One (a), when both elements are connected to a 240 V mains supply.

QUESTION TWO: MAGNETIC EFFECTSASSESSOR'S
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- (a) (i) Describe what is meant by the term **magnetic field**.

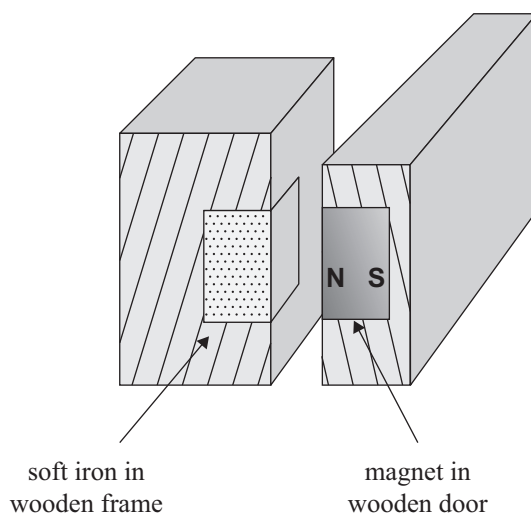
- (ii) Two compasses are placed near a bar magnet, as shown in the diagram below.

Draw an arrow inside each circle to show the direction in which the compass needle will point.



- (b) Explain why a magnet attracts an iron nail but not a pencil lead.

The diagram below shows the arrangement of a magnetic catch on the wooden door of a kitchen cupboard. It consists of a magnet set in the wooden door and a piece of soft iron set in the wooden frame.



- (c) Use the idea of induced magnetic poles to explain what takes place as the magnet in the door approaches the soft iron in the frame, and why the door is firmly held against the frame when it is shut.

You may draw on the diagram to aid your explanation.

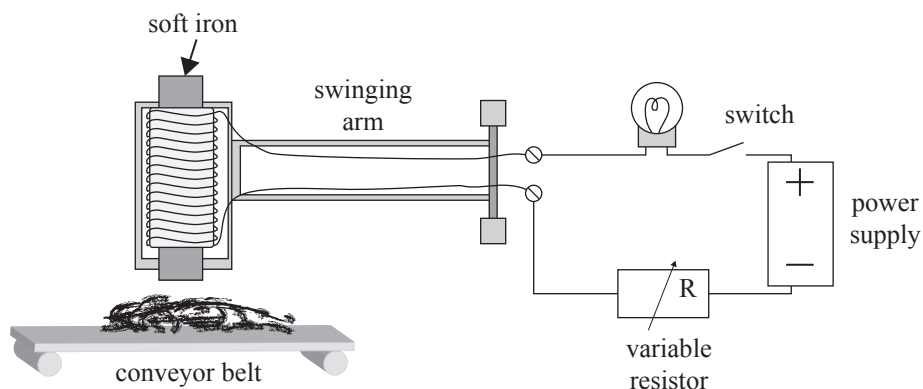
- (d) You are given a magnet and a metal bar. The metal bar is either a soft iron or a magnet.

Explain how you could find out if the metal bar is a magnet or not.

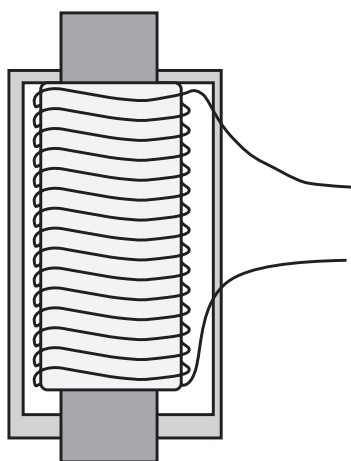
QUESTION THREE: MORE MAGNETIC EFFECTS

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The diagram below shows the features of a magnetic separator used in a recycling station to extract iron from a mixture on a conveyor belt. It consists of an electromagnet with a soft iron core connected to a power supply. The arm swings above the conveyor belt and the switch is closed. The arm then swings over to a container and the switch is opened to release the material into the container.

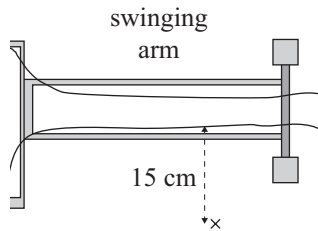


- On the diagram below, use the letters 'N' and 'S' to label the north and the south poles of the electromagnet.
- On the same diagram, draw the shape and the direction of the magnetic field **inside** the iron core.



The cables inside the swinging arm connect the electromagnet to the power supply. When the current passes through the cable, a magnetic field is set up around it.

The value of k is $2.0 \times 10^{-7} \text{ T m A}^{-1}$.



- (c) The power supply is set at 150 V, and the total resistance of the circuit is 25Ω , including the variable resistor.

Calculate the strength of the magnetic field due to the **lower cable** at a point 15 cm away from it.

Strength _____

- (d) (i) Explain why the variable resistor is included in the circuit.

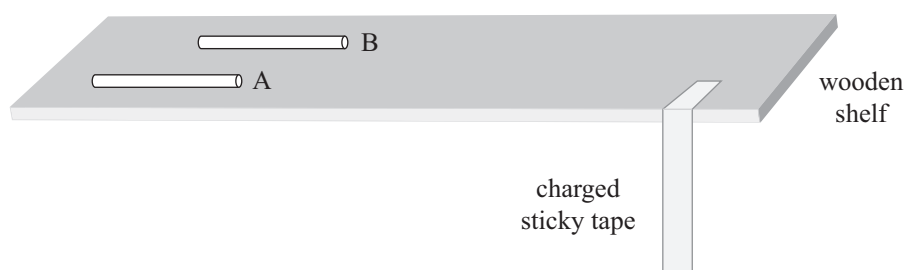
- (ii) Explain why the device would still work if the polarity of the power supply is reversed.

QUESTION FOUR: CHARGE INTERACTIONSASSESSOR'S
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- (a) When hair is combed with a plastic comb, the comb becomes negatively charged.

State the type of charge on the hair, and explain why hair becomes charged this way.

- (b) The diagram shows a **charged** strip of sticky tape hung from a wooden shelf. There are two charged rods on the wooden shelf. Rod A is positively charged, and rod B is negatively charged.



Explain how you could find out the type of charge on the tape using the rods.

- (c) Some apple growers use electrostatic spraying of chemicals to protect plants from insects. In the diagram, the apple tree in the soil is earthed. The spray gun is connected to a high voltage positive supply.

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http://biology.phillipmartin.info/biology_apple_tree.html

Explain why both sides of the leaves receive spray when electrostatic spraying is used.

- (d) A pair of pants and a shirt are dried in an electric tumble clothes dryer. When taken out of the dryer, the clothes stick together.

Using the idea of static electricity, explain why the dry clothes stick to each other after being removed from the dryer.

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

QUESTION
NUMBER

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