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Student number

Name

Date

Attempt/Time taken

GCSE
PHYSICS

Topic Paper: 7.2 & 7.3 The motor effect, induced potential, transformers, national grid (Higher tier physics)
Part 2

Time allowed: 45 minutes

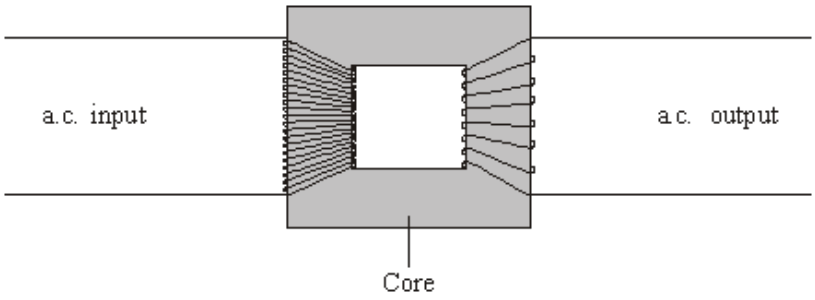
Materials
For this paper you must have:
- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

41 Marks

Q8. (a) The diagram shows a transformer.



(i) Is the transformer in the diagram being used as a step-up transformer or as a step-down transformer?

Put a tick (✓) in the box next to your answer.

a step-up transformer ☐

a step-down transformer ☐

Explain your answer.

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(1)

(ii) Why is insulated wire, and not uninsulated wire, used to make the coils?

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(1)

(iii) Why is the core made of iron?

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(1)

(b) A transformer has 500 turns on its primary coil and 7500 turns on its secondary coil. The potential difference across the primary coil is 150 volts.

Use the equation in the box to calculate the potential difference across the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

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Potential difference across the secondary coil = ... volts

(2)

(c) Step-down transformers are used between power lines and people's houses.

Explain why.

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(2)

(d) Before 1926, large towns had their own local power stations. After 1926, these power stations were connected to form the National Grid.

Explain the advantage of having a National Grid system.

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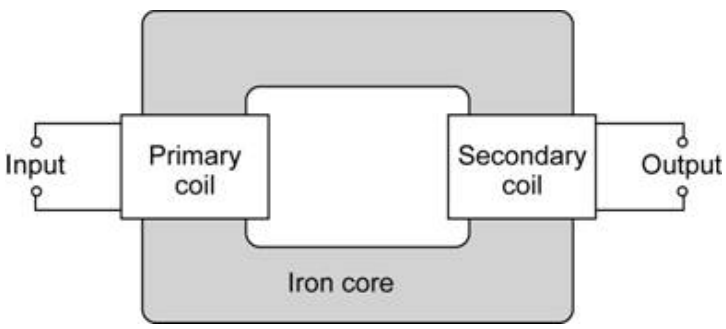
(2)
(Total 9 marks)

Q9. The diagram shows the basic structure of a transformer.



(a) Explain how a transformer works.

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(5)

(b) A transformer is used to change the 230 volt mains electricity supply to the 12 volts needed to operate a low voltage halogen lamp. The current through the halogen lamp is 4 amps.

Calculate the current drawn by the transformer from the mains electricity supply.

Assume that the transformer is 100 % efficient.

Write down the equation you use, and then show clearly how you work out your answer.

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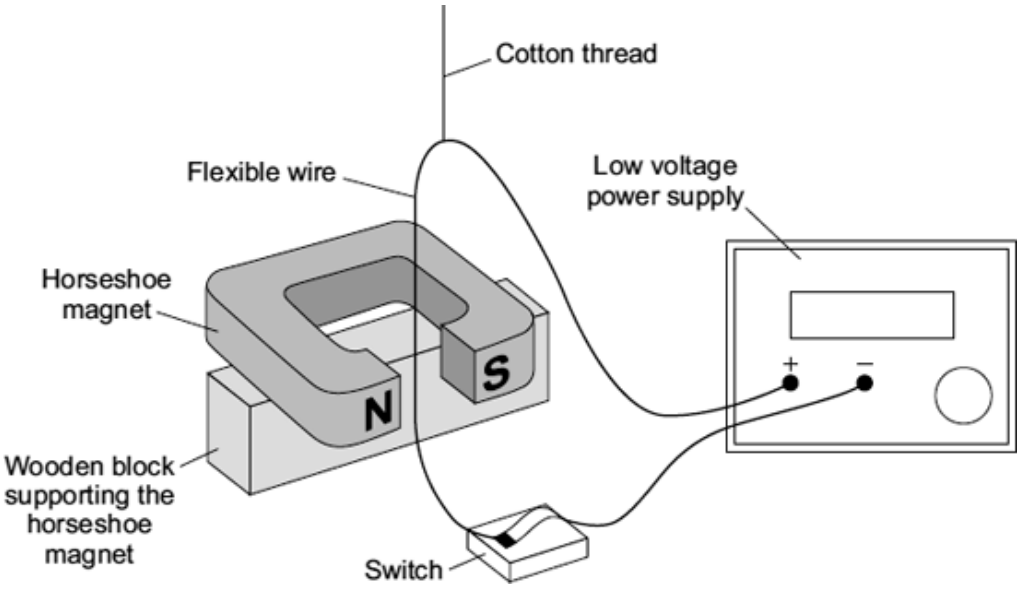
Current = ... amps

(2)

(Total 7 marks)

Q10. (a) A laboratory technician sets up a demonstration.



A flexible wire is suspended between the ends of a horseshoe magnet. The flexible wire hangs from a cotton thread. When the switch is closed, the wire kicks forward.

Identify the effect which is being demonstrated.

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(1)

(b) A teacher makes some changes to the set-up of the demonstration.

What effect, if any, will each of the following changes have?

(i) more powerful horseshoe magnet is used.

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(1)

(ii) The connections to the power supply are reversed.

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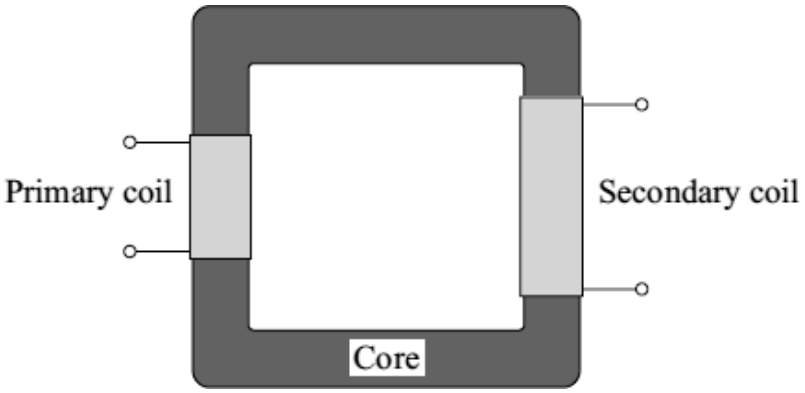
(1)

(Total 3 marks)

Q11. (a) The diagram shows the basic structure of a step-up transformer.



(i) What is the core made of?

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(1)

(ii) Explain how an alternating input produces an alternating output.

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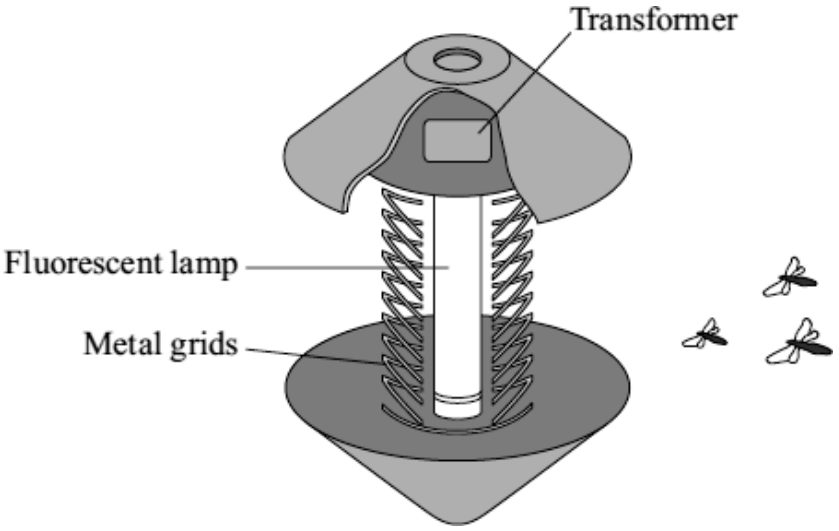
(3)

(b) Fly killers are used in kitchens and food stores because flying insects carry diseases which cause food poisoning.

The diagram shows the inside of one design. Insects are attracted to a fluorescent lamp. The metal grids have a high potential difference (p.d.) between them. The insects are killed as they fly between the grids.



A transformer is used in the fly killer. There is a p.d. of 230 V across the primary coil. There are 300 turns of wire on the primary coil and 4000 turns on the secondary coil.

Use the equation in the box to calculate the p.d. across the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

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Potential difference = ...V

(3)

(Total 7 marks)

Q12. (a) In the National Grid, very large step-up transformers link power stations to the transmission cables.

A transformer used for this purpose has 800 turns on its primary coil and 12 800 turns on its secondary coil. The p.d. (potential difference) across its primary coil is 25 kV.

Use the equation in the box to calculate the p.d. across its secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer **and** give the unit.

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p.d. across secondary coil = ...

(3)

(b) The primary and secondary coils of a transformer are made of insulated wire.

Why is this insulation necessary?

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(1)

(c) Describe what happens when an alternating potential difference is applied across the primary coil of a transformer.

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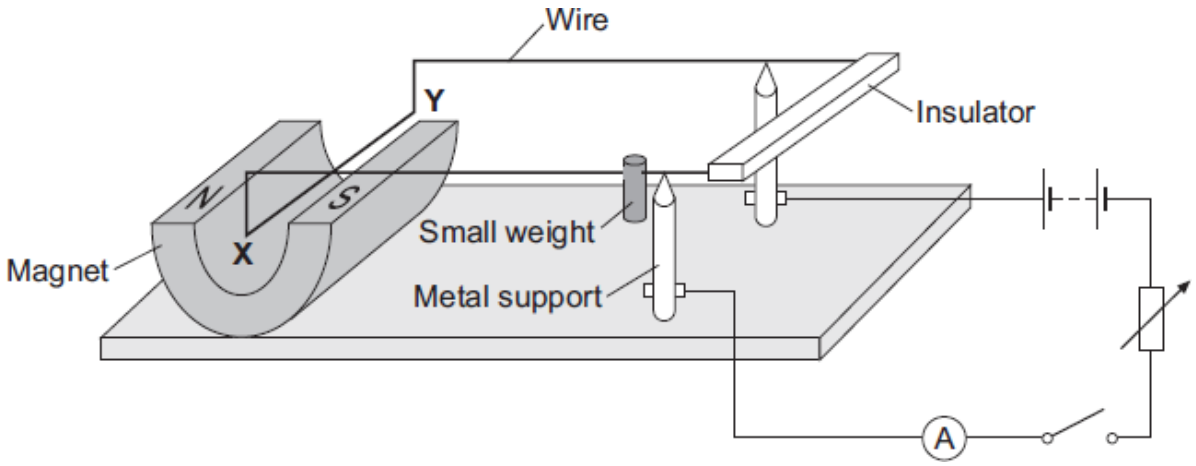
(3)
(Total 7 marks)

Q13. The diagram shows a device called a current balance.



(a) (i) When the switch is closed, the part of the wire labelled **XY** moves upwards.

Explain why.

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(2)

(ii) What is the name of the effect that causes the wire **XY** to move?

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(1)

(iii) An alternating current (a.c.) is a current which reverses direction. How many times the current reverses direction in one second depends on the frequency of the alternating supply.

Describe the effect on the wire **XY** if the battery is replaced by an a.c. supply having a frequency of 5 hertz.

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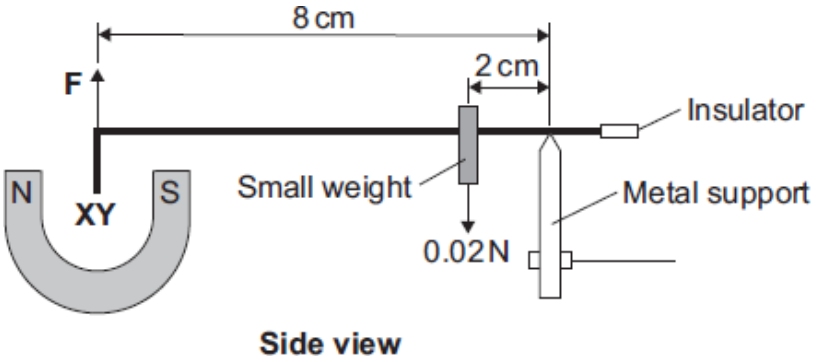
(2)

(b) The diagram shows how a small weight can be used to make the wire **XY** balance horizontally.



Side view

Use the data in the diagram and the equation in the box to calculate the force, **F**, acting on the wire **XY**.

moment	=	force	×	perpendicular distance from the line of action of the force to the axis of rotation

Show clearly how you work out your answer.

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Force = ... N

(3)

(Total 8 marks)