OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

P4.2 USES OF MAGNETISM

SCORE	PERCENTAGE
/89	%

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Gateway Physics A (9-1)

Uses of magnetism

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

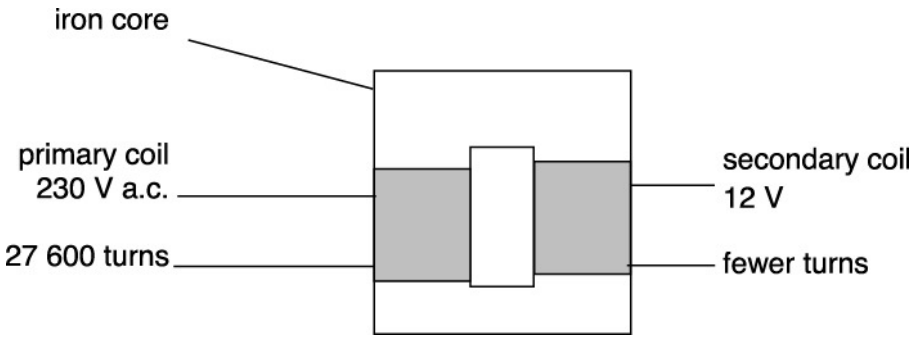
- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **89**.
- The total number of marks may take into account some 'either/or' question choices.

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1(a) The diagram below shows the structure of a transformer.



Explain why there is more alternating current in the secondary coil than in the first.

---

[3]

(b) The secondary coil produces an output of 12 V.

Calculate the number of turns needed on the secondary coil.

Show your working.

---

[2]

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(c) Voltage is increased before transmission through the National Grid.

It is increased from 25 000 V up to 400 000 V. This increases the voltage 16 times.

(i) How much would this increase in voltage affect the current?

---

[2]

(ii) Use the formula: **power = current^2 × resistance**

to explain why this voltage increase is important to power loss in transmission cables.

---

[2]

2 Which of the following is **not** needed to generate a.c. in an alternator?

A changing magnetic field
B coil of wire
C commutator
D rotating magnet

Your answer ☐

[1]

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3 The diagram shows two poles of a magnet.



X is the position of a wire carrying a current perpendicularly into the paper.

Which direction does the wire move?

A ↓
B →
C ←
D ↑

Your answer ☐

[1]

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4(a)

(i) Write down the name of the rule which can be used to predict the direction of the force perpendicular to a current-carrying conductor in a magnetic field.

---

[1]

A student places four wires of different lengths perpendicular to different magnetic fields with different currents flowing.

Look at the table of their results.

Wire	Magnetic flux density (T)	Current (A)	Length (m)
A	0.10	2.5	0.50
B	0.15	2.0	0.75
C	0.20	4.5	0.25
D	0.25	5.0	1.00

(ii) Use the data to show that wire **D** experiences the highest force.

Show your working.

---

[2]

(b)

(i) The student decides to build a model transformer.

The transformer is a step-up transformer which doubles the input voltage.

Describe how they could build this step-up transformer in a science laboratory.

---

[4]

(ii) Suggest **one** risk associated with this experiment and how it can be reduced.

---

[2]

(c) Describe how a microphone works.

---

[2]

5 Mia has a simple electric motor.

She can increase the speed of the motor by increasing the current.

Write down one other way she can change her motor to increase its speed.

---

[1]

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6 The National Grid transfers power from power stations to homes and factories.

Transformers are used as part of the National Grid to change voltages.

Jack has completed his homework on transformers.

He asks John to check his homework.

John finds two mistakes in the **voltage columns**.

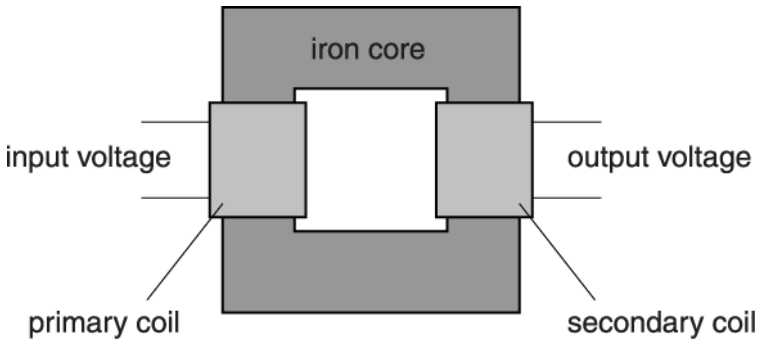
Row	Primary coils	Secondary coils	Input voltage in V	Output voltage in V	Step up / down
A	25	250	10	100	Step-up
B	2000	10000	40	200	Step-up
C	400	20	50	1000	Step-down
D	30	600	10	1000	Step-up

Identify which two rows in the table, **A**, **B**, **C** or **D** are incorrect and explain why.

---

[2]

7 This question is about transformers.



Transformers are used to change the voltage of an AC supply.

Susan has completed her homework on identifying step-up and step-down transformers.

	Input voltage in V	Output voltage in V	Step-up or step-down
A	10	20	Step-up
B	40	100	Step-down
C	25	50	Step-down
D	50	10	Step-down

Susan spots **two** mistakes in her work.

Which two rows, **A**, **B**, **C** or **D** are incorrect?

_____ and _____

Explain your choices.

_____

_____

_____ [2]

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8 Elin's phone charger plugs into the 230 V mains.

The charger reduces the voltage to 12 V.

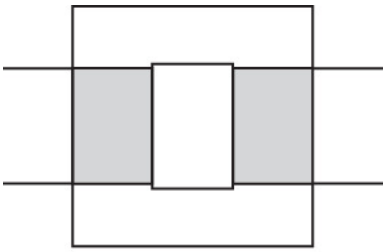
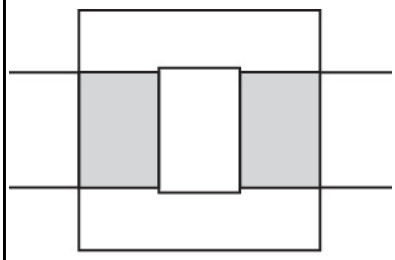
Name the device in the charger that is used to reduce the voltage.

---------- [1]

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9 This question is about transformers.

Look at the information about two different transformers.

	 transformer A	 transformer B
Type of core	iron	iron
Number of primary turns	500	1000
Number of secondary turns	1000	500
Input voltage	20 volts AC	20 volts AC

Write about the similarities and differences between transformer **A** and transformer **B**.

Include information about their construction, output voltage and uses.

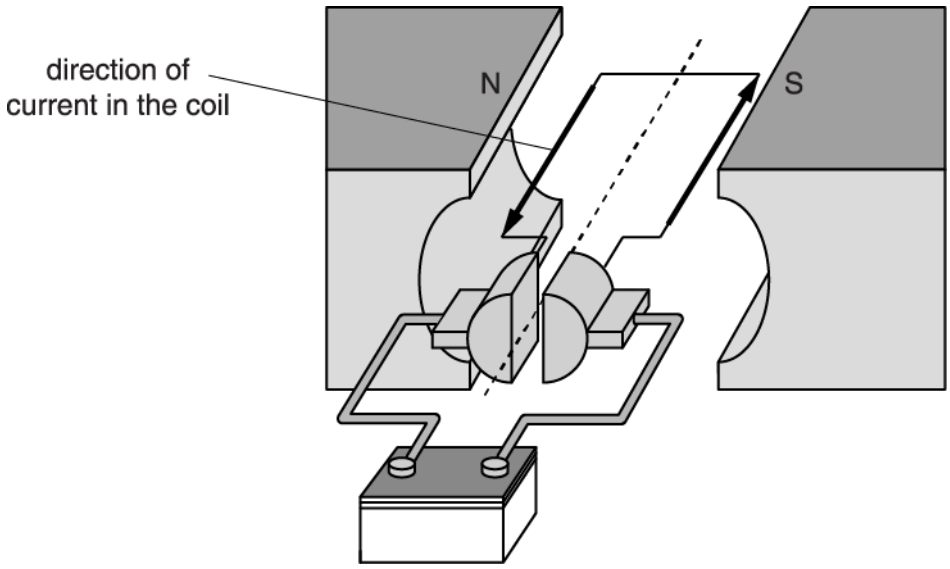
The quality of written communication will be assessed in your answer to this question.

[6]

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10(a) DC electric motors are used in many different appliances.

Look at the diagram of a DC motor.



Use Fleming's Left Hand rule to predict if the coil will spin **clockwise** (↺) or **anti-clockwise** (↻) in the following arrangements.

The motor is set up as shown in the diagram. It will spin _____ .

The current is reversed. It will now spin _____ .

With the current still reversed, the north and south poles are also reversed.

It will now spin _____ .

[1]

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(b) Many motors have different speed settings.

(i) Suggest how the **same** motor can be made to have different speed settings.

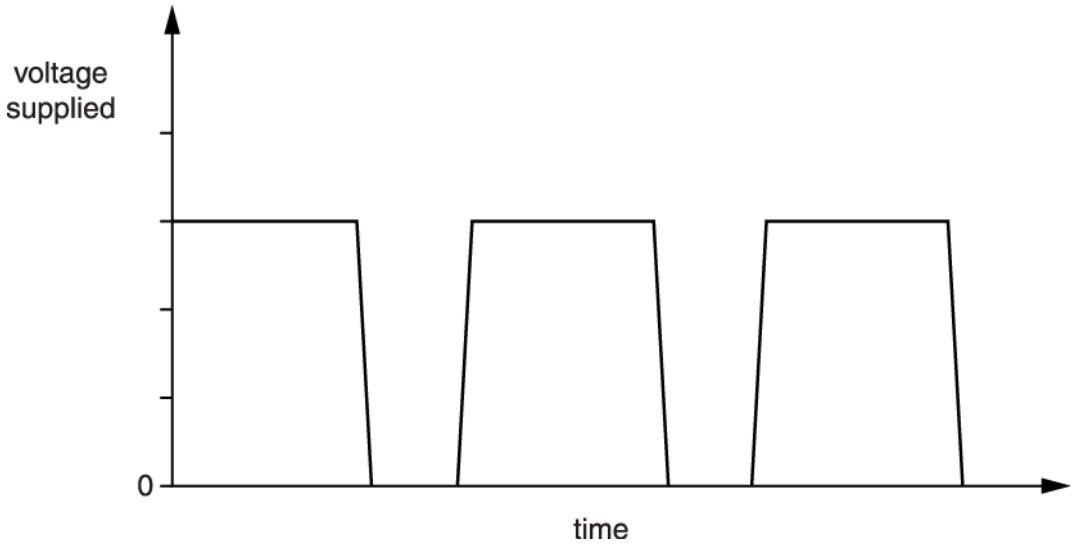
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[1]

(ii) Look at the data on the graphs.

They show how the voltage supplied and the speed of the motor are related.

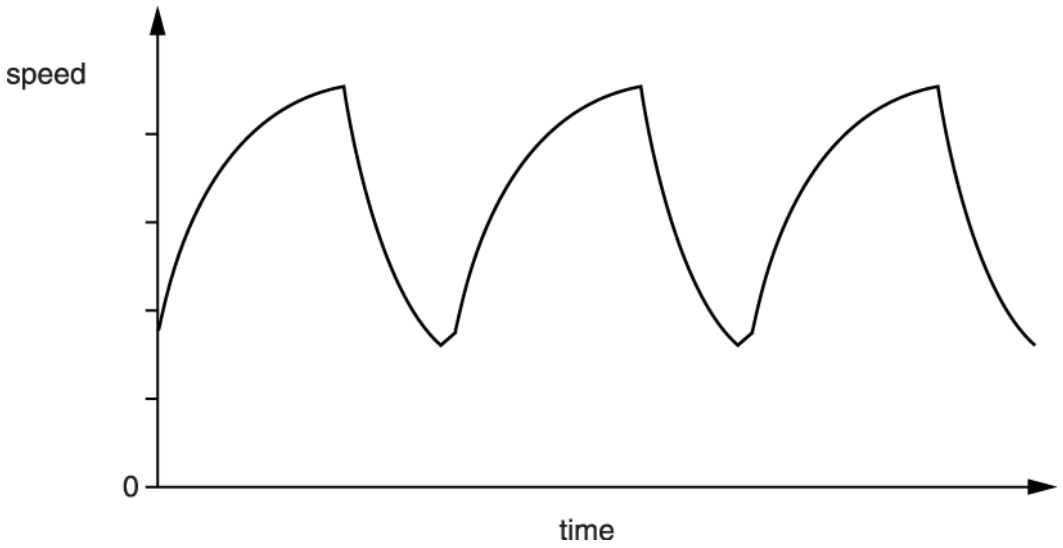
The supply voltage is switched on **and** off regularly.



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Describe what happens to the speed of the motor as the voltage is regularly switched on and off.

---[2]

(iii) Suggest how the speed of the motor will vary if the supply voltage is switched on and off more frequently.

---[1]

11 This question is about electrical devices.

Look at the information about five different transformers.

Put a tick (?) in the correct column to identify each type of transformer.

The first one has been done for you.

Input voltage	Output voltage	Step up	Step down	Isolating
12	240	?		
500	10			
230	230			
240	80			
1000	10000			

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[2]

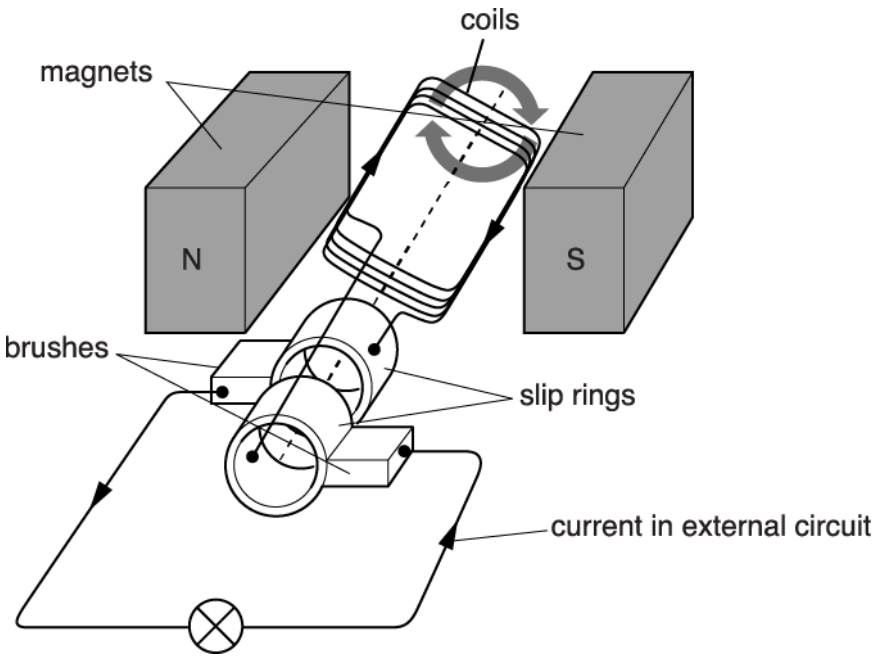
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12(a) AC generators are used to generate electricity.

Here is a diagram of a small AC generator.



Explain how this AC generator works.

Use **all** the labels in the diagram in your explanation.

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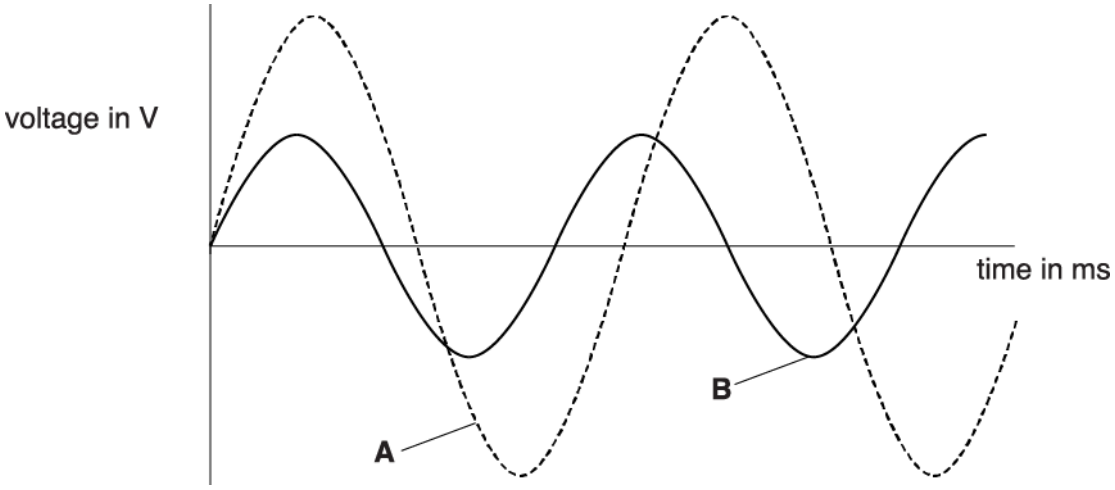
[2]

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(b) Look at the diagram.



Graph **A** shows the output from this small AC generator.

The generator can also produce the output shown by graph **B**.

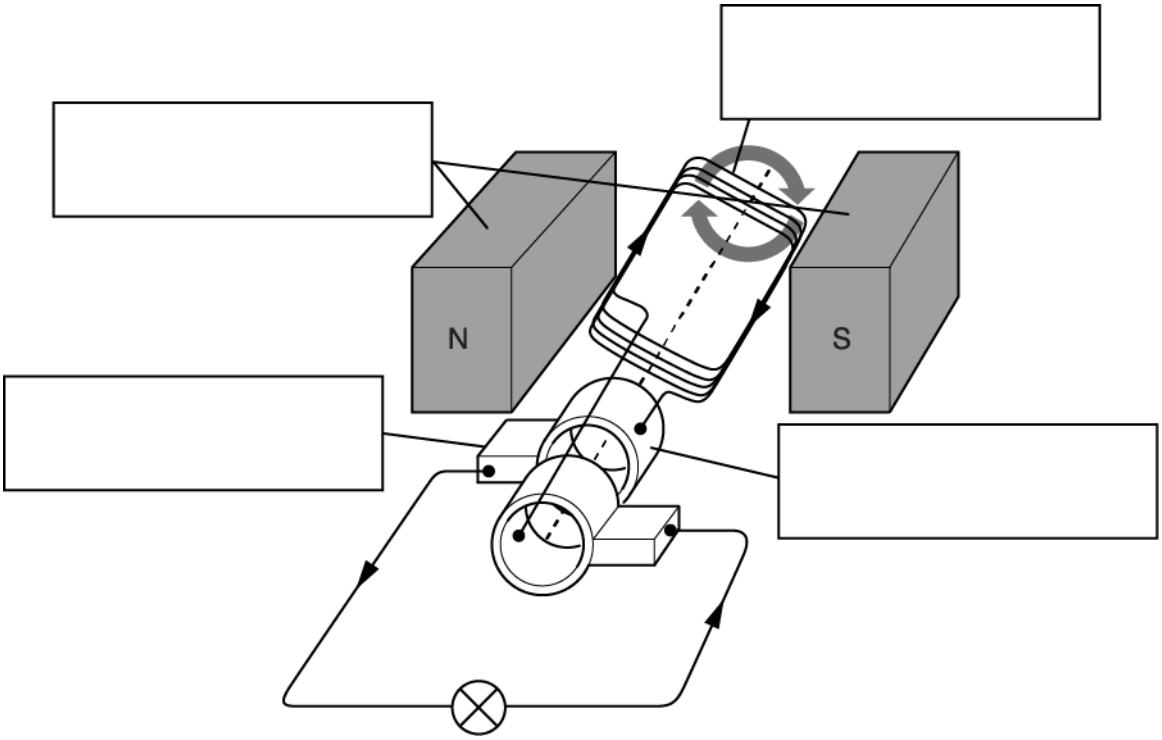
Suggest what changes are needed to produce the output shown by graph **B**.

---

[2]

13(a) AC generators are used to generate electricity.

Here is a diagram of a small AC generator.



Label the four parts of the generator on the diagram.

Use the words

brush coil magnet slip ring

[1]

(b) This AC generator generates electricity by rotating the coils of wire.

Describe another way electricity can be generated using an AC generator.

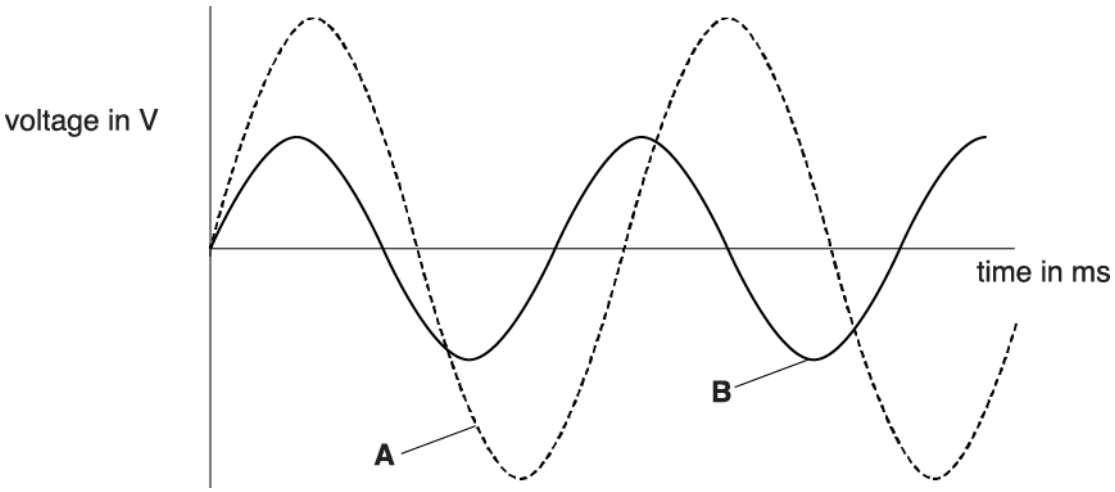
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[1]

(c) The mains electricity in the UK is supplied at a frequency of 50 Hz.

Look at the diagram.

It shows two different AC voltages.



A has a frequency of 50 Hz and a supply voltage of 230 V.

Compare these values with the frequency **and** supply voltage of **B**.

How does the frequency **and** supply voltage of **B** compare with **A**?

---

[2]

14 Complete the sentences about transformers.

Use a **different** word for each sentence.

Choose words from

AC **DC** **isolating** **step-down** **step-up**

Transformers are devices that work with _____ .

Phone chargers use _____ transformers.

Bathroom shaver sockets producing 230 V output use _____

transformers.

[2]

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15 Wendy's mobile phone charger contains a transformer.

Look at the information about the transformer.

Input voltage	230 V AC
Input current	50 mA
Output voltage	5 V

Describe, in detail, the construction of the transformer and explain how applying a 230 V input produces a 5 V output.

Include a diagram and a calculation in your answer.



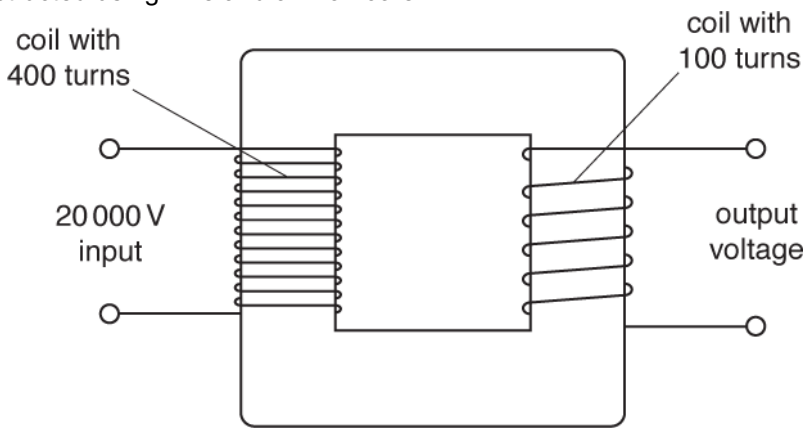
The quality of written communication will be assessed in your answer to this question.

[6]

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16(a)

Transformers are constructed using wire and an iron core.



(i) Describe the construction of **this** transformer.

---

[2]

(ii) Calculate the output voltage.

---

answer _____ V **[2]**

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(b) Isolating transformers have two main features:

- the primary and secondary coils have equal numbers of turns
- they improve safety in some mains circuits.

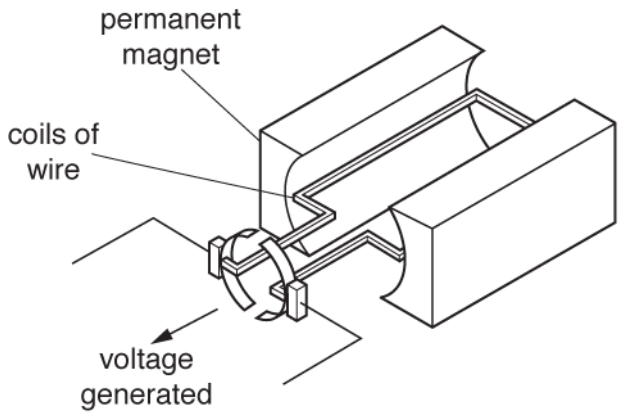
Explain why these **two** features are important in a bathroom shaver socket.

---

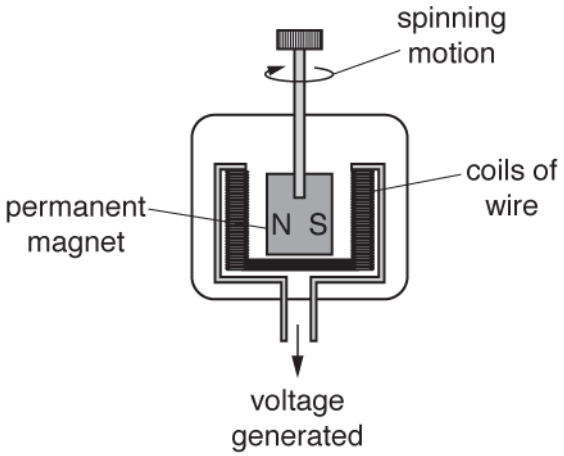
[2]

17 Tanya compares two generators

- a simple generator
- a generator in a power station.



simple generator



generator in a power station

Write about the similarities and differences in the way the two generators work.

Describe how the **size** of the voltage generated can be changed in the two generators.

The quality of written communication will be assessed in your answer to this question.

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---

[6]

18(a)

There are three types of transformers

- isolating transformer
- step-down transformer
- step-up transformer.

Which type is used in a bathroom shaver socket?

Explain your answer.

---

[2]

(b) Tick (✓) the **two** correct sentences about transformers.

Step-down transformers are used in mobile phone chargers. ☐

Step-up transformers are used in laptops. ☐

Transformers change AC to DC. ☐

Transformers only work with AC. ☐

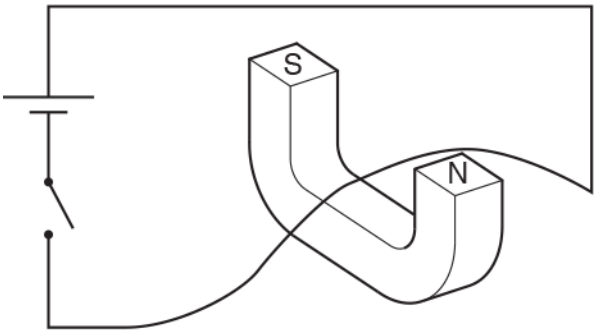
Transformers only work with DC. ☐ **[2]**

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19 A wire is placed inside a horseshoe magnet.



Which direction will the wire move when the switch is closed?

A Downwards

B Left

C Right

D Upwards

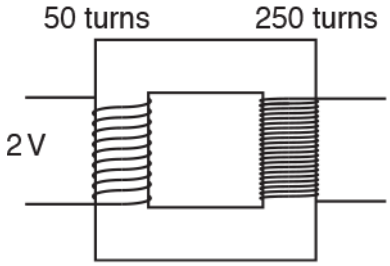
Your answer ☐ **[1]**

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20 What output voltage does the transformer produce?



A 0.2 V

B 0.4 V

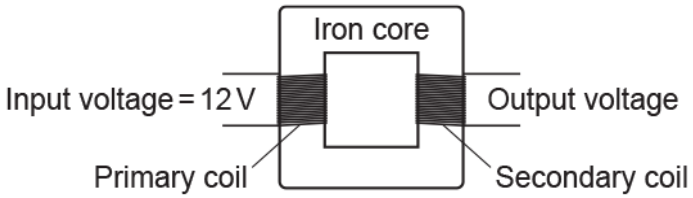
C 5 V

D 10 V

Your answer ☐ **[1]**

21 A student investigates building model transformers in the laboratory.

Look at the diagram.



The student builds four different transformers, each with different primary and secondary coils.

Using an input voltage of 12 V the student measures the output voltage.

Look at the results.

Attempt	Number of turns in primary coil	Number of turns in secondary coil	Output voltage (V)
A	100	200	23
B	200	100	6

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C	300	600	23
D	600	300	6

* Explain how a transformer works and if this data supports the expected output voltages.

[6]

22 A 0.5 m length of wire is placed inside four different magnetic fields.

Magnetic Field	Force on wire (N)	Current in wire (A)
A	2.0	0.1
B	2.0	0.2
C	4.0	0.1
D	4.0	0.4

Which magnetic field has the **greatest** magnetic flux density?

Your answer [ ] **[1]**

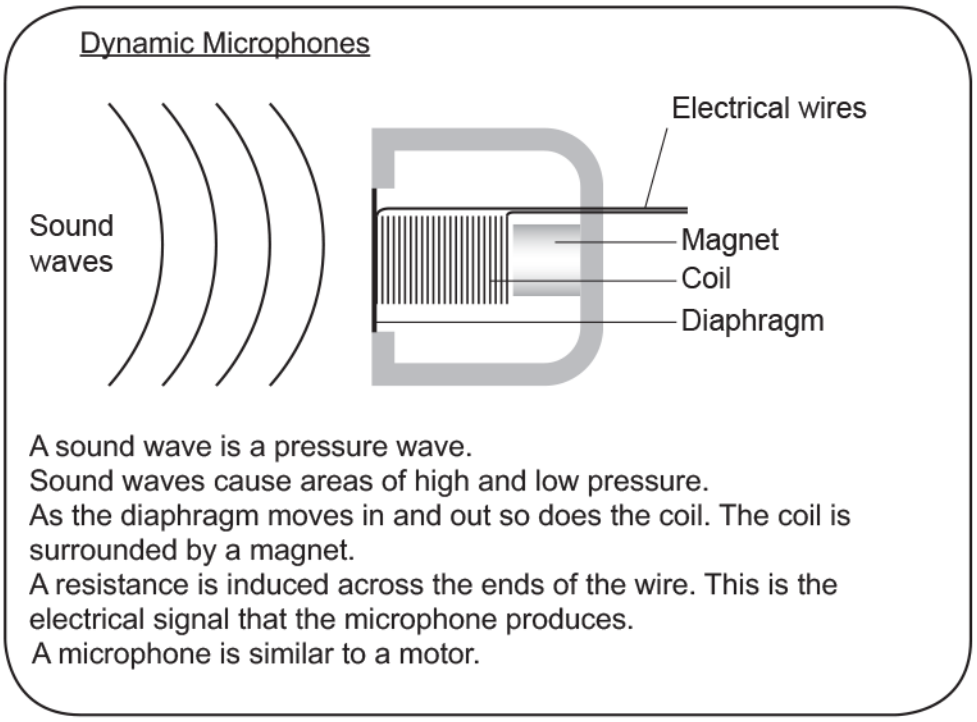
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23 A student completes a project on how dynamic microphones work.

Look at her project. The student uses two incorrect words in her work.



(i) Identify **one** of the incorrect words **and** write a correct sentence to replace the mistake.

Incorrect word ----------

Corrected sentence ----------

---

[2]

(ii) Name a device which uses this effect in reverse.

---

[1]

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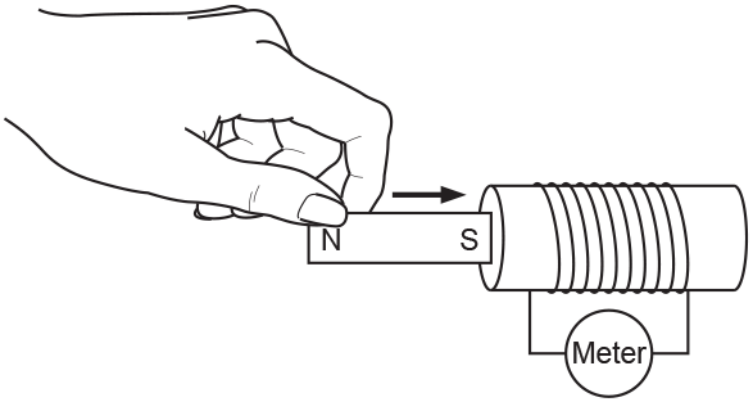
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24 Which row in the table is correct for a **step-down** transformer?

	Current	Potential difference
A	Decreases	Decreases
B	Decreases	Increases
C	Increases	Decreases
D	Increases	Increases

Your answer [1]

25 A student inserts a magnet into a coil of wire.



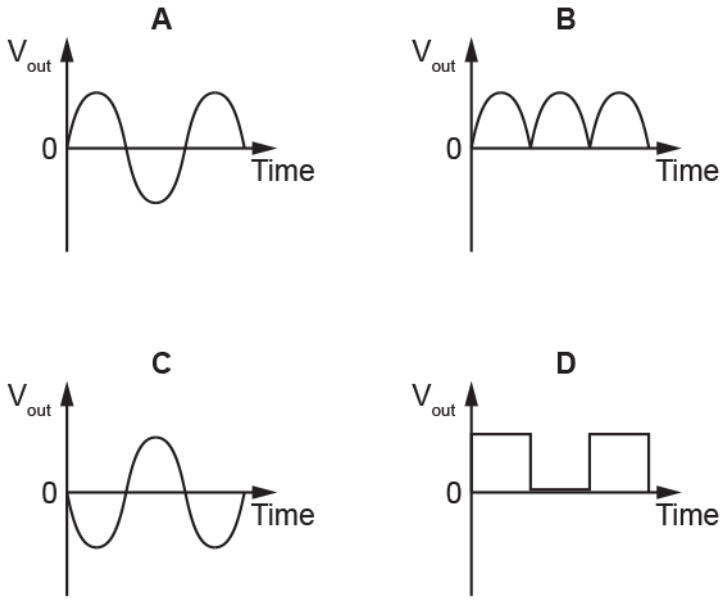
What is induced across the ends of the coil of wire?

A Charge
B Magnetism
C Potential difference
D Resistance

Your answer [1]

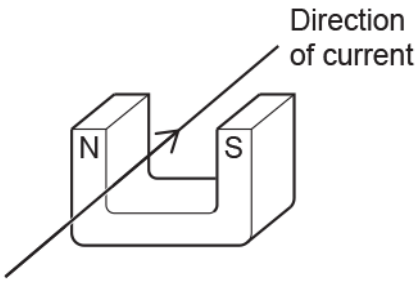
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26 Which of the following graphs shows the typical output potential difference, V_{out}, for a dynamo?



Your answer [1]

27 A wire is placed between the poles of a magnet, perpendicular to the magnetic field lines.



Which direction will the wire move when a current flows?

A Down
B Left
C Right
D Up

Your answer [1]

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