AQA GCSE Physics | 8463

SPECIFICATION POINT 4.7.3.1

Induced potential (HT only)

Past-paper questions

Tier	**Higher**
Question groups	**7**
Available paper years	**2009–2023**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

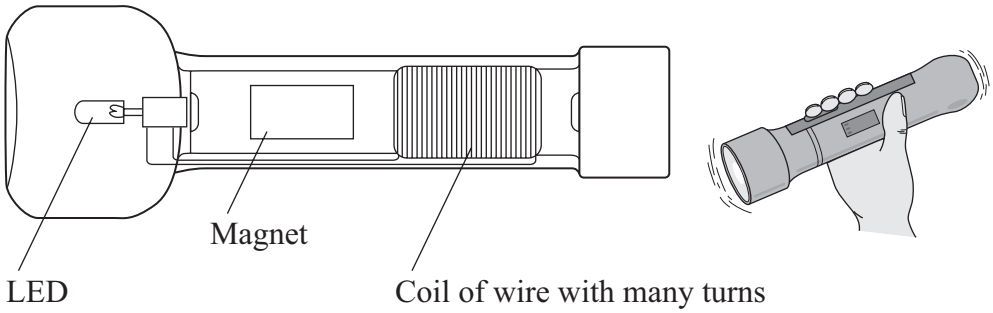
4.7.3.1 Induced potential (HT only)

Question 01

June 2009 | PHY3H | Original Q2 | Legacy

2 The diagram shows some parts of a torch which works without batteries.
The coil is part of a complete circuit with the LED (light-emitting diode).

You have to shake the torch for a short time and then it is ready to use.



2 (a) Arrange the letters, **A**, **B**, **C**, **D** and **E**, in the correct order to explain how shaking the torch produces an electric current.

A An electric current is induced in the circuit.

B The magnetic field cuts through the coil.

C The magnet moves in and out of the coil.

D A potential difference (p.d.) is induced across the ends of the coil.

E The torch is shaken to and fro.

The first letter has been done for you.

E				

(2 marks)

2 (b) Give **two** changes which you would make to the design of the torch to increase the size of the induced potential difference.

1 .....

.....

2 .....

.....

(2 marks)

4.7.3.1 Induced potential (HT only)

Question 01 · continued

for mark

2 (c) A few minutes after shaking, the LED gets dimmer and then stops giving out light.

A student tests the torch. She shakes it for a period of time. Then she switches it on and times how long the light lasts.

These are her results.

Period of time torch is shaken measured in seconds	How long the light lasts measured in seconds
30	168
60	312
90	420
120	546
150	654

2 (c) (i) What conclusion can the student come to on the basis of these results?

.....

.....

(1 mark)

2 (c) (ii) The student's friend says that the results are **not** reliable. Her friend is correct.

Give **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

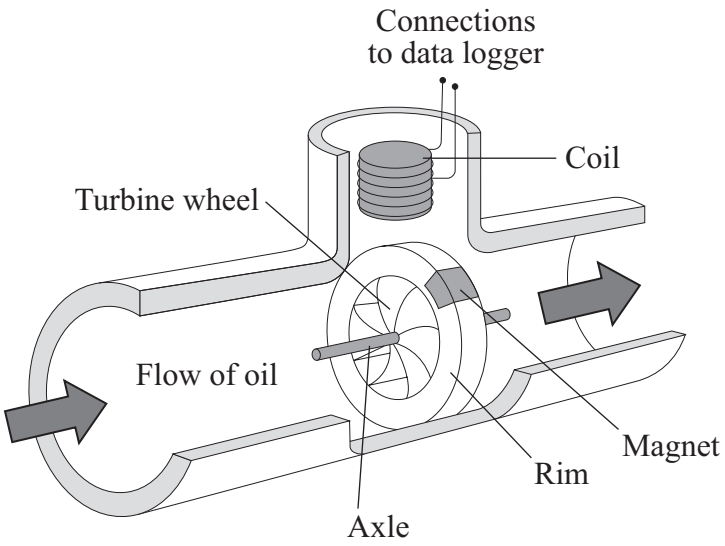
7

4.7.3.1 Induced potential (HT only)

Question 02

January 2010 | PHY3H | Original Q6 | Legacy

6 The diagram shows the inside of an oil pipeline and a student's design for a meter to measure the flow of oil.



As oil flows through the pipeline, the oil rotates a turbine wheel. Above the turbine wheel is a coil of wire connected to a data logger. There is a magnet in the rim of the turbine wheel. The turbine wheel spins and this induces a varying potential difference (p.d.) across the ends of the coil. This varying p.d. is recorded by the data logger.

6 (a) Complete the sentence by writing in the space.

The faster the oil flows through the pipeline, the ..... the maximum p.d. across the coil.

(1 mark)

6 (b) Explain why a varying p.d. is induced across the coil even when the rate of flow of oil remains constant.

.....

.....

.....

.....

.....

.....

(3 marks)

4.7.3.1 Induced potential (HT only)

Question 02 · continued

for mark

6 (c) Suggest **two** changes to the design of the meter which would increase the maximum p.d. across the coil for the same flow of oil.

Change 1 .....

.....

Change 2 .....

.....

(2 marks)

6

Turn over for the next question

4.7.3.1 Induced potential (HT only)

Question 03

June 2018 | 8463/2H | Original Q3

0 3 P-waves and S-waves are two types of seismic wave caused by earthquakes.

0 3 . 1 Which **one** of the statements about P-waves and S-waves is correct?

Tick **one** box.

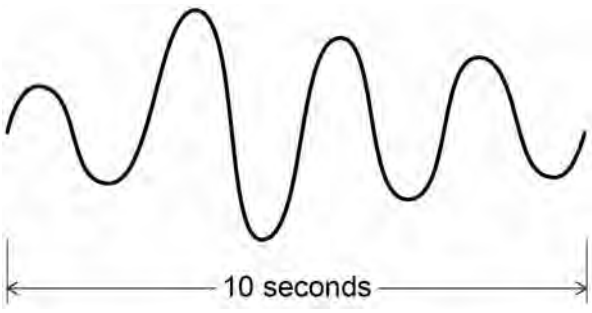
[1 mark]

- P-waves and S-waves are transverse. ☐
- P-waves and S-waves are longitudinal. ☐
- P-waves are transverse and S-waves are longitudinal. ☐
- P-waves are longitudinal and S-waves are transverse. ☐

Seismometers on the Earth's surface record the vibrations caused by seismic waves.

Figure 3 shows the vibration recorded by a seismometer for one P-wave.

Figure 3



0 3 . 2 Calculate the frequency of the P-wave shown in **Figure 3**.

[1 mark]

Frequency = _____ Hz

4.7.3.1 Induced potential (HT only)

Question 03 · continued

0 3 . 3 Write down the equation which links frequency, wavelength and wave speed.

[1 mark]

0 3 . 4 The P-wave shown in **Figure 3** is travelling at 7200 m/s.

Calculate the wavelength of the P-wave.

[3 marks]

Wavelength = _____ m

0 3 . 5 Explain why the study of seismic waves provides evidence for the structure of the Earth's core.

[2 marks]

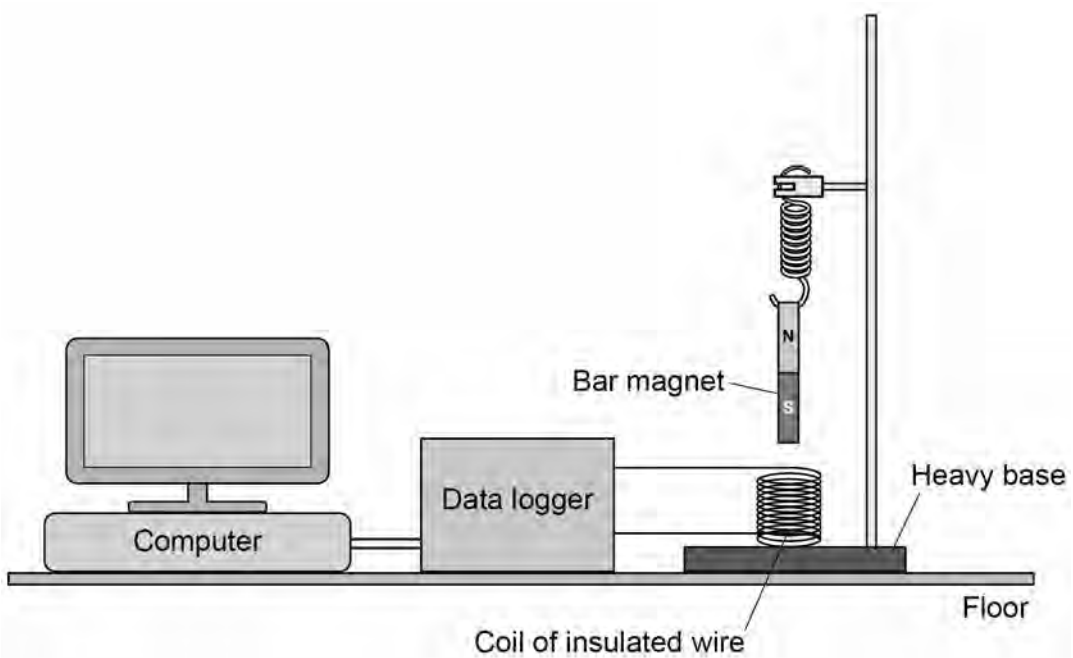
Question 3 continues on the next page

4.7.3.1 Induced potential (HT only)

Question 03 · continued

Figure 4 shows a simple seismometer made by a student.

Figure 4



To test that the seismometer works, the student pushes the bar magnet into the coil and then releases the bar magnet.

0 3 . 6 Why does the movement of the bar magnet induce a potential difference across the coil?

[1 mark]

0 3 . 7 Why is the induced potential difference across the coil alternating?

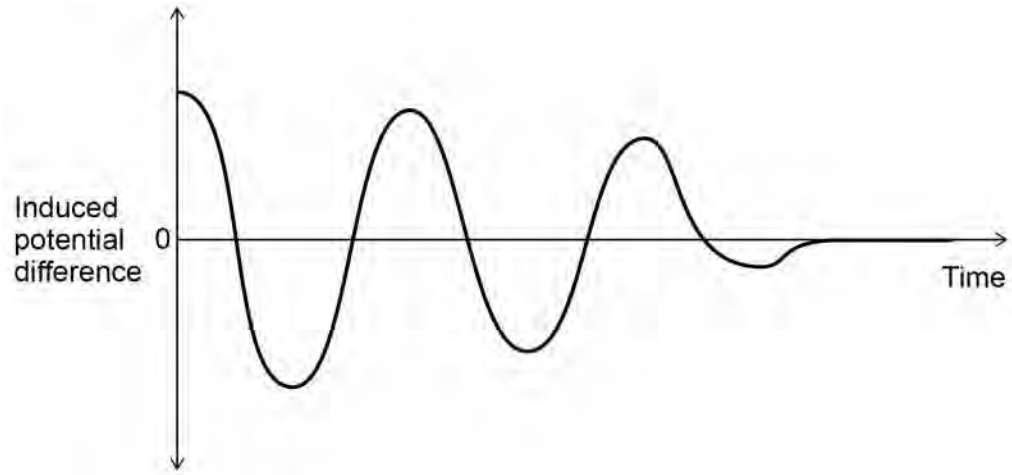
[1 mark]

4.7.3.1 Induced potential (HT only)

Question 03 · continued

0 3 . 8 **Figure 5** shows how the potential difference induced across the coil varies after the bar magnet has been released.

Figure 5



Which statement describes the movement of the magnet when the induced potential difference is zero?

Tick **one** box.

[1 mark]

Accelerating upwards. ☐

Constant speed upwards. ☐

Decelerating downwards. ☐

Stationary. ☐

0 3 . 9 The seismometer cannot detect small vibrations.

Suggest **two** changes to the design of the seismometer that would make it more sensitive to small vibrations.

[2 marks]

1 _____

_____

2 _____

_____

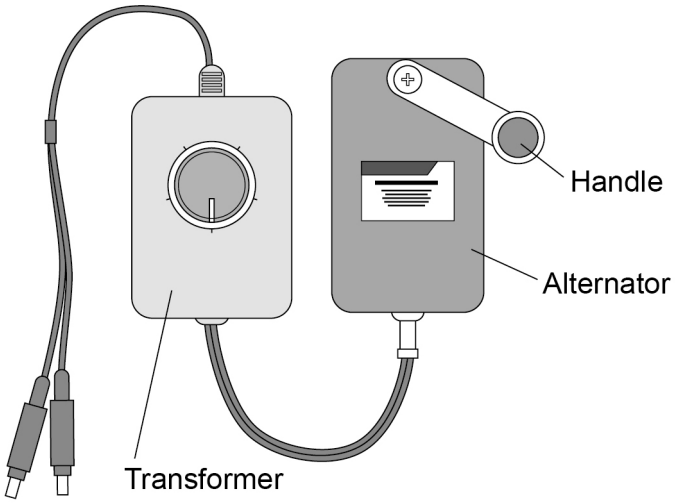
13

4.7.3.1 Induced potential (HT only)

Question 04

0 7 **Figure 10** shows a portable power supply.

Figure 10



0 7 . 1 The portable power supply has an alternator connected to a transformer.

The transformer can be adjusted to have different numbers of turns on the secondary coil.

Suggest why.

[2 marks]

4.7.3.1 Induced potential (HT only)

Question 04 · continued

0 7 . 2 A lamp is connected to the power supply.

The lamp requires an input potential difference of 5.0 V.

The alternator generates a potential difference of 1.5 V.

The primary coil of the transformer has 150 turns.

Calculate the number of turns needed on the secondary coil.

[3 marks]

Number of turns on the secondary coil = _____

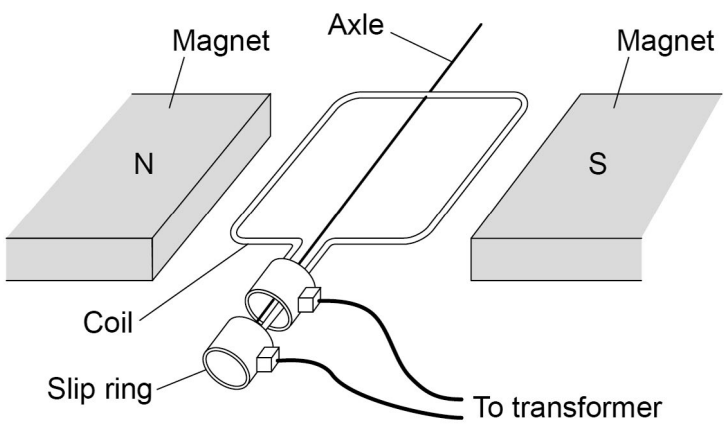
Question 7 continues on the next page

4.7.3.1 Induced potential (HT only)

Question 04 · continued

Figure 11 shows the inside parts of the alternator.

Figure 11



0 7 . 3 The handle of the alternator is turned, causing the coil to rotate.

Explain why an alternating current is induced in the coil.

[5 marks]

4.7.3.1 Induced potential (HT only)

Question 04 · continued

0 7 . 4 Suggest the purpose of the slip rings.

[1 mark]

0 7 . 5 The alternator from the portable power supply is disconnected from the transformer and lamp.

Explain why the handle of the alternator becomes much easier to turn.

[3 marks]

14

4.7.3.1 Induced potential (HT only)

Question 05

June 2022 | 8463/1H | Original Q3

0 3 An engineering company has invented pavement tiles that generate electricity as people walk on them.

Figure 3 shows someone walking on the pavement tiles.

Figure 3



Use the Physics Equations Sheet to answer questions **03.1** and **03.2**.

0 3 . 1 What equation links current (I), potential difference (V) and power (P)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{V}{I}$ ☐

$P = V \times I$ ☐

$I = P \times V$ ☐

$V = I^2 \times P$ ☐

4.7.3.1 Induced potential (HT only)

Question 05 · continued

0 3 . 2 When a person walks on a tile, a potential difference of 40 V is induced across the tile.

The power output of the tile is 4.4 W.

Calculate the current in the tile.

[3 marks]

Current = _____ A

Question 3 continues on the next page

4.7.3.1 Induced potential (HT only)

Question 05 · continued

Use the Physics Equations Sheet to answer questions **03.3** and **03.4**.

0 3 . 3 What equation links efficiency, total power input and useful power output?

[1 mark]

Tick (✓) **one** box.

Efficiency = $\frac{\text{useful power output}}{\text{total power input}}$ ☐

Efficiency = $\frac{\text{total power input}}{\text{useful power output}}$ ☐

Efficiency = useful power output × total power input ☐

0 3 . 4 The tiles are used to power LED lights in the pavement.

An LED light has a total power input of 4.0 W.

The efficiency of the LED light is 0.85

Calculate the useful power output of the LED light.

[3 marks]

Useful power output = _____ W

8

4.7.3.1 Induced potential (HT only)

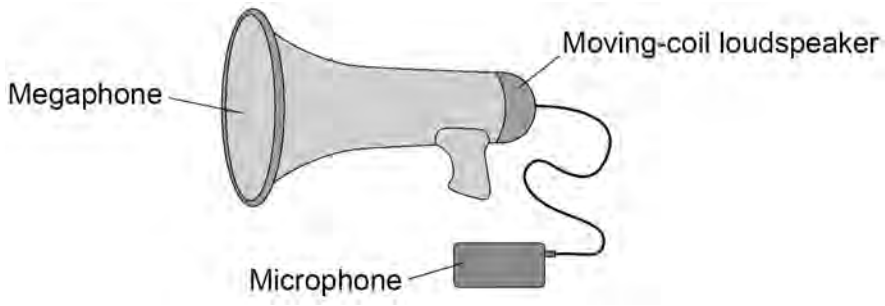
Question 06

June 2023 | 8463/2H | Original Q4

0 4 A megaphone uses a loudspeaker to amplify sounds that are detected by a microphone.

Figure 10 shows a megaphone and microphone.

Figure 10



0 4 . 1 Complete the sentence.

[1 mark]

The microphone is used to convert the pressure variations in sound waves into variations in _____ .

4.7.3.1 Induced potential (HT only)

Question 06 · continued

0 4 . 2 The loudspeaker contains a permanent magnet.

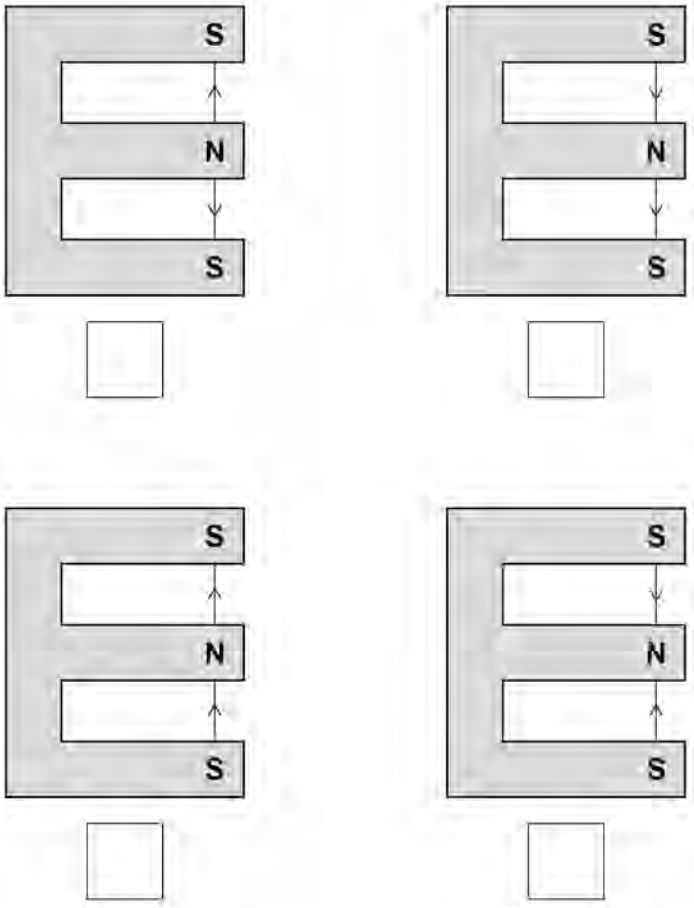
Which diagram in **Figure 11** shows the direction of the magnetic field between the north pole and the south pole of the magnet?

The magnets are shown in cross-section.

[1 mark]

Tick (✓) **one** box.

Figure 11



0 4 . 3 Some magnets are permanent magnets and some are induced magnets.

What is an induced magnet?

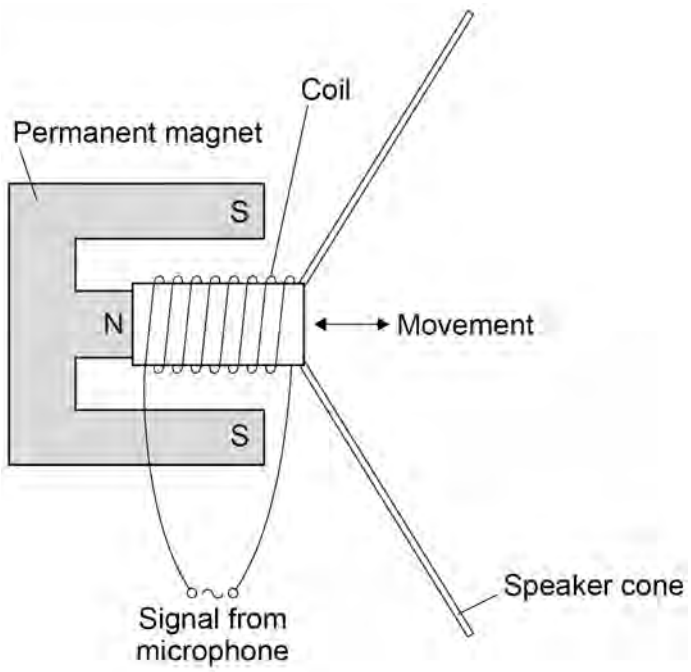
[1 mark]

4.7.3.1 Induced potential (HT only)

Question 06 · continued

Figure 12 shows the parts of the loudspeaker in the megaphone.

Figure 12



A current in the coil of the loudspeaker causes the coil to move.

0 4 . 4 What is the name of the effect that causes the coil to move?

[1 mark]

Tick (✓) **one** box.

- Electromagnet effect ☐
- Induction effect ☐
- Motor effect ☐
- Speaker effect ☐

4.7.3.1 Induced potential (HT only)

0 4 . 5 When the current in the coil is 16 mA, the force on the coil is 0.013 N.

The length of the wire that makes up the coil is 6.5 m.

Calculate the magnetic flux density around the coil in the electromagnet.

Use the Physics Equations Sheet.

[4 marks]

Magnetic flux density = _____ T

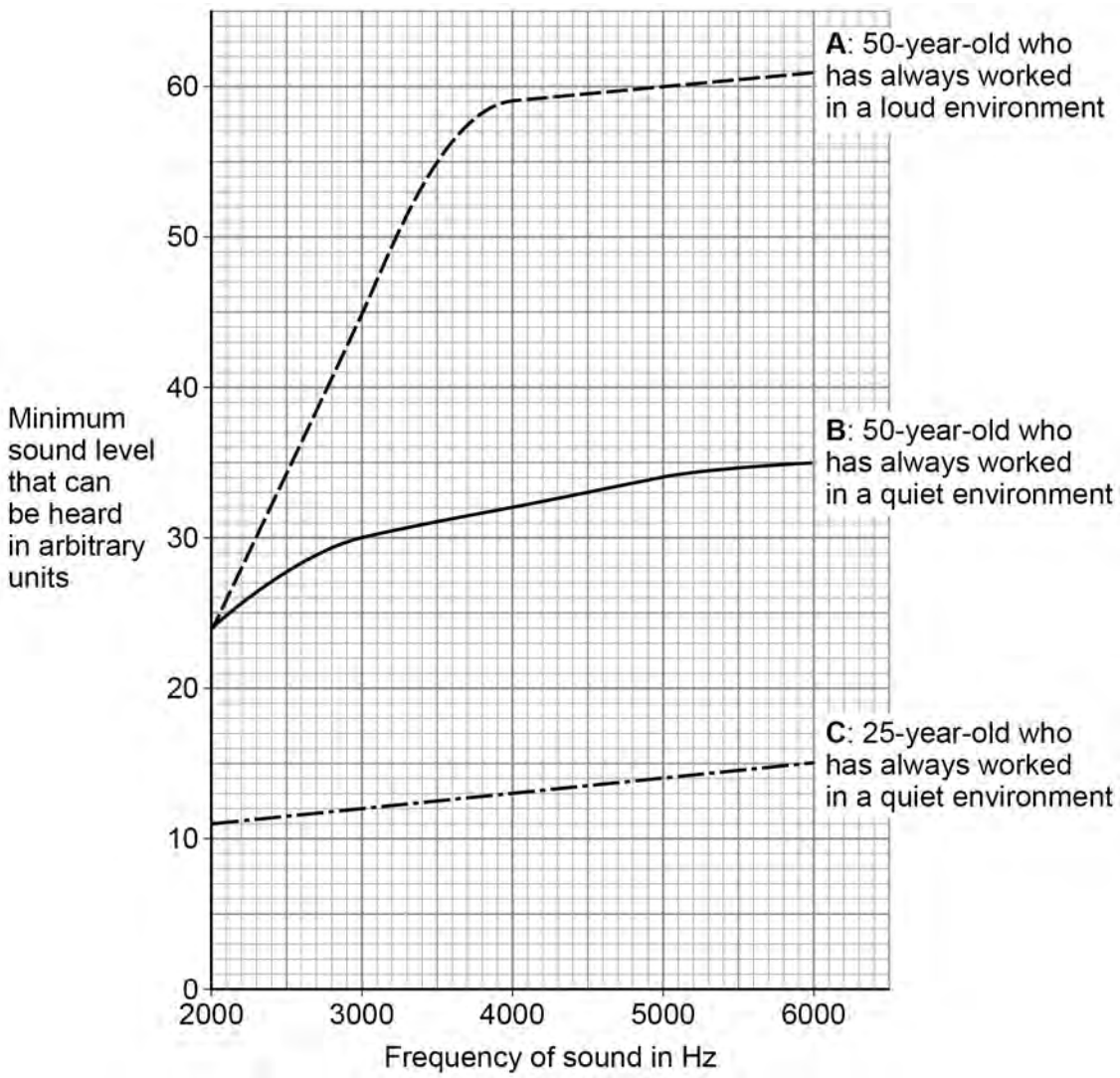
Question 4 continues on the next page

0 4 . 6 Megaphones can produce very loud sounds.

A person's hearing can be affected by age and by working in a loud environment.

Figure 13 shows how frequency affects the minimum sound level that can be heard by three different people, **A**, **B** and **C**.

Figure 13



4.7.3.1 Induced potential (HT only)

Question 06 · continued

Compare how different factors affect the minimum sound level that these people can hear.

[4 marks]

12

4.7.3.1 Induced potential (HT only)

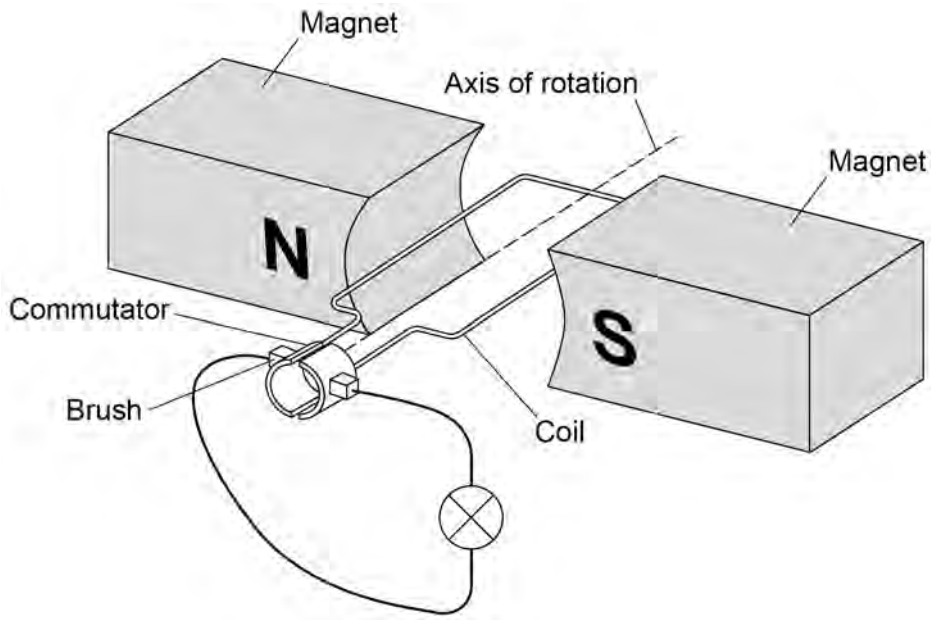
Question 07

June 2023 | 8463/2H | Original Q9

0 9 A dynamo is used to generate an electric current.

Figure 22 shows the inside parts of the dynamo connected to a lamp.

Figure 22



0 9 . 1 The coil is rotated.

Explain why a direct current is induced in the coil.

[5 marks]

4.7.3.1 Induced potential (HT only)

Question 07 · continued

0 9 . 2 Sketch a graph on **Figure 23** to show how the potential difference generated across the lamp varies for **two** complete revolutions of the dynamo coil.

[1 mark]

Figure 23



0 9 . 3 The lamp is disconnected from the dynamo.

Explain why the dynamo becomes much easier to turn.

[3 marks]

9