Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

STEM | Exam Builder

Electromagnetic induction

Time allowed: 1 hour

Subject code **0625**

Physics

Questions from Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 64

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 64 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

STEM | Exam Builder

Print at 100% (Actual size) so diagrams keep their real measurements.

1 A solenoid with many turns is connected across a sensitive centre-zero millivoltmeter, as shown in Fig. 9.1.

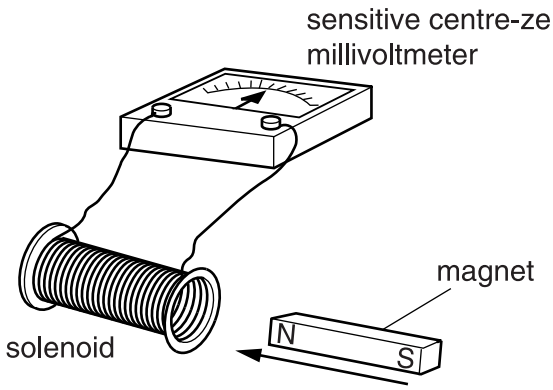


Fig. 9.1

(a) The N pole of a magnet is moved into the solenoid, and then held stationary in the solenoid.

Describe what happens to the needle of the millivoltmeter during this process.

.....

..... [2]

(b) The N pole is then removed from the solenoid.

Describe what happens to the needle during this process.

.....

..... [1]

(c) Complete the following sentence.

When the N pole moves into the solenoid, ... is

..... in the solenoid. [2]

[Total: 5]

Electromagnetic induction and the a.c. generator Click for more variations

STEM | Exam Builder

2 A student demonstrates electromagnetic induction.

(a) Describe how to demonstrate electromagnetic induction using a magnet, a coil of wire and a sensitive ammeter. You may include a diagram.

.....

.....

.....

..... [3]

(b) State **two** factors that affect the size of an induced electromotive force (e.m.f.)

1. .....

2. ..... [2]

[Total: 5]

Electromagnetic induction and the a.c. generator Click for more variations

STEM | Exam Builder

3 A rotating-coil generator consists of a rectangular coil of wire that rotates at constant speed between the poles of a permanent magnet.

Figs. 10.1, 10.2 and 10.3 show views from one end of the coil, when the coil is in different positions.

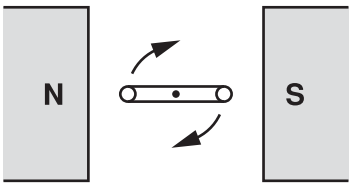


Fig. 10.1

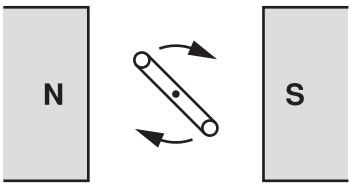


Fig. 10.2

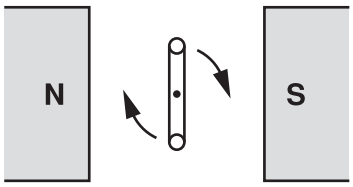


Fig. 10.3

(a) Which diagram shows the coil in the position where

(i) the induced e.m.f. in the coil is at its maximum, ...

(ii) the induced e.m.f. in the coil is zero? ..... [2]

(b) On Fig. 10.4, sketch the graph of e.m.f. against time, for two complete rotations of the coil.



Fig. 10.4

[4]

[Total: 6]

Electromagnetic induction and the a.c. generator Click for more variations

STEM | Exam Builder

4 A coil P is joined to a battery and a switch S. A similar coil Q is joined to a sensitive centre-zero millivoltmeter G.

P and Q are placed end to end, as shown in Fig. 10.1.

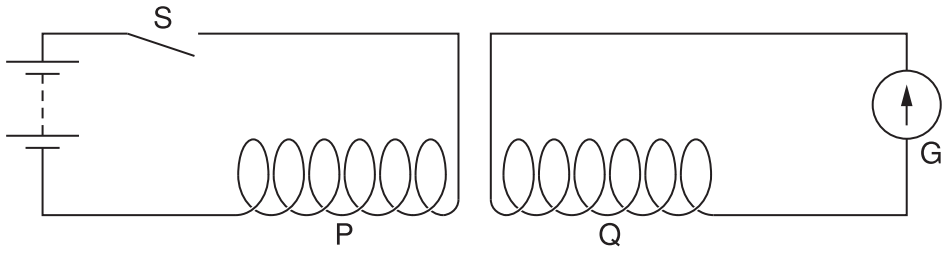


Fig. 10.1

(a) Describe what is seen happening to the reading of G

(i) as switch S is closed,

.....

.....

.....[2]

(ii) as switch S is opened again.

.....

.....

.....[1]

(b) A soft iron bar, as long as the combined lengths of P and Q, is placed inside P and Q.

State what difference this makes to what is observed on G as S is closed.

.....

.....[1]

(c) The bar in **(b)** is removed and the battery is changed for one with a smaller e.m.f.

State what difference this makes to what is observed on G as S is closed.

.....

.....[1]

STEM | Exam Builder

(d) The battery is replaced by an a.c. power supply of frequency 50 cycles per second, and then S is closed.

Describe what is seen on G.

.....

.....[1]

[Total: 6]

Electromagnetic induction and the a.c. generator Click for more variations

STEM | Exam Builder

5 In Fig. 7.1, XY is a copper rod placed between the N and S poles of a magnet.

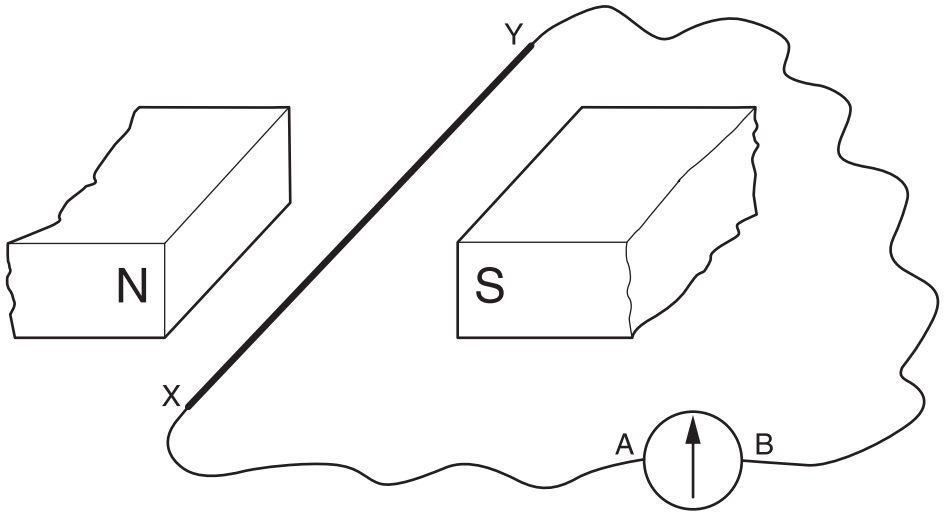


Fig. 7.1

XY is connected to the terminals A and B of a sensitive, centre-zero instrument that measures current.

(a) State the name of this instrument. .....[1]

(b) When there is no current, the pointer on the instrument points half-way between A and B.

State what, if anything, is **seen** happening to the pointer when XY is

(i) held stationary,

.....[1]

(ii) moved horizontally at a steady speed towards the N pole,

.....[1]

(iii) moved horizontally at a steady speed towards the S pole,

.....[1]

(iv) moved repeatedly up and down at right angles to the magnetic field.

.....[2]

(c) Suggest one electrical device that makes use of the effect demonstrated in **(b)**.

.....[1]

[Total: 7]

STEM | Exam Builder

Electromagnetic induction and the a.c. generator Click for more variations

6 **(a)** The apparatus in Fig. 10.1 is set up in a laboratory. The metal wheels are rolled along the rails from the left-hand end to the right-hand end.

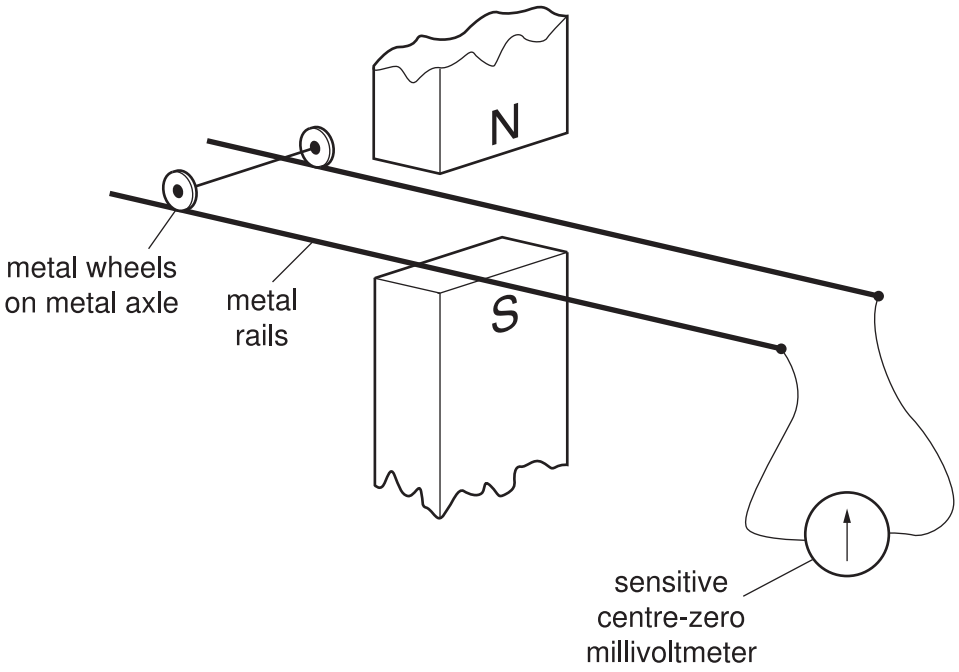


Fig. 10.1

(i) Describe what is seen happening to the pointer on the sensitive centre-zero millivoltmeter.

.....

..... [2]

(ii) Explain why this happens.

.....

.....

.....

.....

..... [3]

(iii) The metal wheels are now rolled back to the left-hand end again.

Describe what now happens to the millivoltmeter pointer.

.....

..... [1]

STEM Exam Builder

(b) Fig. 10.2 shows a magnet suspended above a coil of wire.

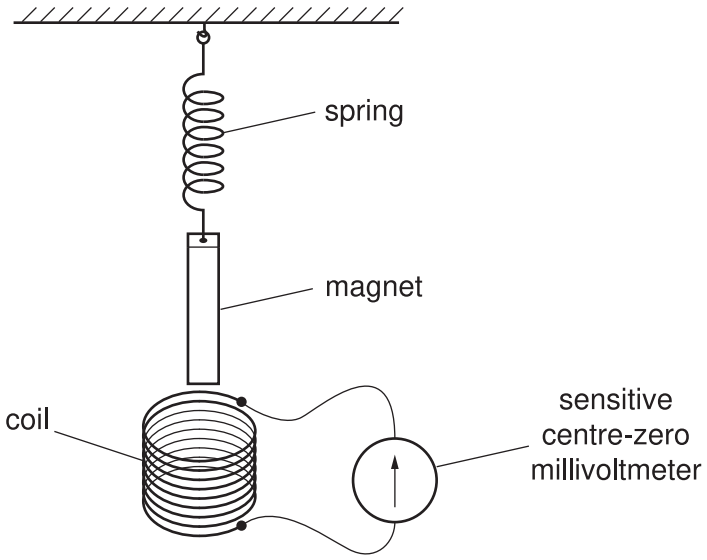


Fig. 10.2

The end of the magnet is pushed into the coil and released, so that it bounces repeatedly in and out of the coil.

Describe what is seen on the sensitive centre-zero millivoltmeter.

.....

..... [1]

[Total: 7]

Electromagnetic induction and the a.c. generator Click for more variations

STEM | Exam Builder

7 A coil is wound on a cylindrical cardboard tube and connected to a sensitive centre-zero millivoltmeter.

Figs. 8.1, 8.2 and 8.3 show three situations involving the coil and a magnet.

(a) On the lines alongside each situation, describe what, if anything, is seen happening on the millivoltmeter.

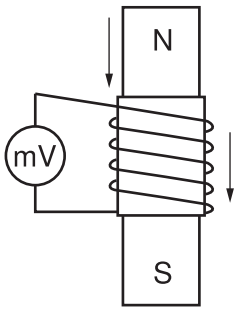


Fig. 8.1

magnet inside coil, both moving at same speed

.....

.....

.....

.....

..... [1]

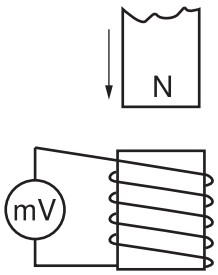


Fig. 8.2

magnet moving towards coil

coil stationary

.....

.....

.....

.....

..... [1]

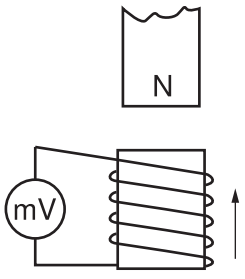


Fig. 8.3

magnet stationary

coil moving towards magnet

.....

.....

.....

.....

..... [2]

STEM | Exam Builder

(b) Choose one of the situations in **(a)** where something is seen happening to the millivoltmeter. For this situation, state three changes which could be made to increase the magnitude of what is seen.

1. .....

2. .....

3. ..... [3]

[Total: 7]

Electromagnetic induction and the a.c. generator Click for more variations

STEM | Exam Builder

8 In the laboratory demonstration shown in Fig. 11.1, a copper rod rolls at a steady speed down the sloping parallel copper rails. The rails are in the region of a strong magnetic field that acts vertically downwards.

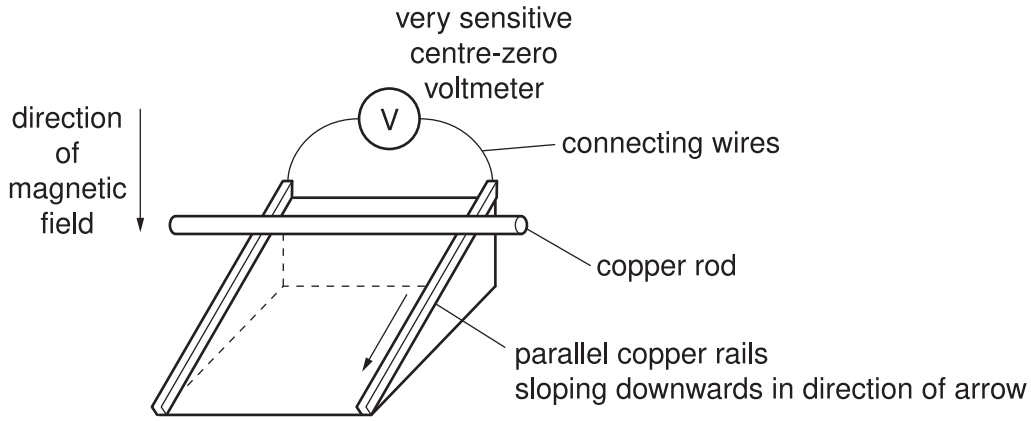


Fig. 11.1

(a) Explain why the voltmeter shows a deflection.

.....

.....

.....

..... [2]

(b) State, with reasons, the effect on the voltmeter deflection of the following changes:

(i) increasing the strength of the magnetic field,

deflection .....

reason .....

.....

.....

(ii) slightly increasing the slope of the copper rails,

deflection .....

reason .....

.....

.....

STEM | Exam Builder

(iii) changing the direction of the magnetic field so it is parallel to the copper rails and directed down the slope.

deflection .....

reason .....

.....

.....

[4]

[Total: 6]

Electromagnetic induction and the a.c. generator Click for more variations

STEM | Exam Builder

9 A student holds a magnet above a solenoid, which is connected to a centre-zero milli-ammeter as shown Fig. 8.1.

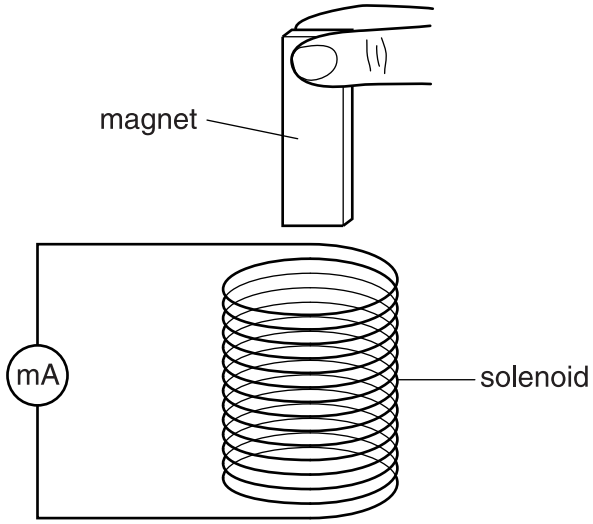


Fig. 8.1

(a) The student drops the magnet so that it falls through the solenoid.

State and explain what would be observed on the milliammeter

(i) as the magnet enters the solenoid,

.....

.....

..... [2]

(ii) as the magnet speeds up inside the solenoid.

.....

.....

..... [2]

(b) As the magnet passes into the coil in part **(a)**, the coil exerts a force on the magnet even though there is no contact between them.

(i) State the direction of this force.

.....

(ii) Explain how this force is caused.

.....

.....

.....

[3]

[Total: 7]

Electromagnetic induction and the a.c. generator Click for more variations

STEM | Exam Builder

10 A student turns the handle of an alternating current (a.c.) generator and the coil rotates.

Fig. 8.1 represents the structure of the a.c. generator.

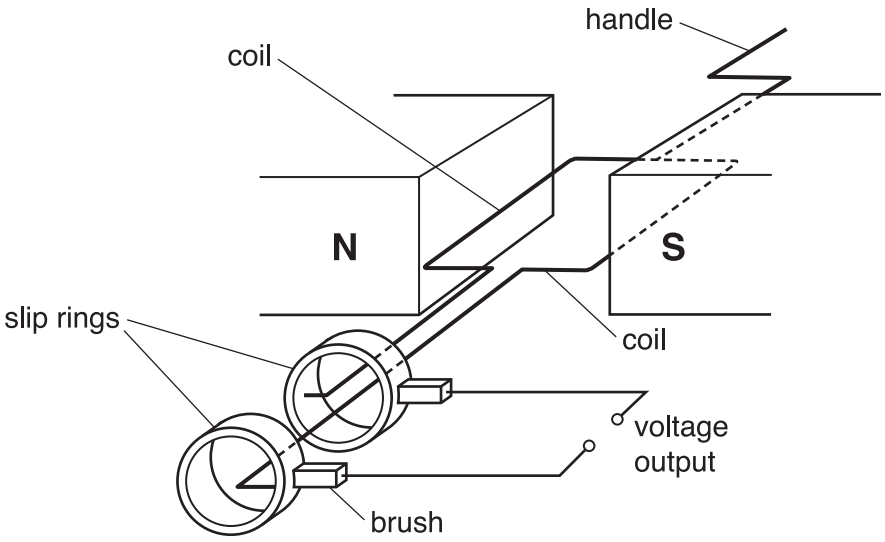


Fig. 8.1

(a) There is an alternating voltage output between the two terminals.

(i) Explain why rotating the coil produces an output voltage.

.....

.....

.....

..... [3]

(ii) State the position of the rotating coil when the alternating output voltage is at a maximum value and explain why the maximum output occurs at this position.

.....

.....

..... [2]

STEM | Exam Builder

(b) A lamp and an open switch are connected in series to the output terminals of the a.c. generator.

The switch is closed and the lamp lights up. The student has to apply a greater force on the handle.

Explain why a greater force is needed to keep the lamp lit.

.....

.....

.....

..... [3]

[Total: 8]

Electromagnetic induction and the a.c. generator Click for more variations

STEM | Exam Builder