



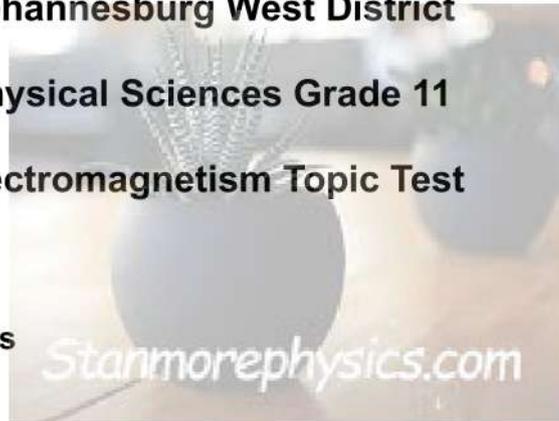
Total: 27 marks

Duration: 35 minutes

Johannesburg West District

Physical Sciences Grade 11

Electromagnetism Topic Test



Instructions and information

1. Write your name in the appropriate space on the ANSWER BOOK.
2. Number the answers correctly according to the numbering system used in this question paper.
3. Leave ONE line between two sub-questions, e.g. between QUESTION 2.1 and QUESTION 2.2.
4. You may use a non-programmable calculator.
5. You may use appropriate mathematical instruments.
6. Show ALL formulae and substitutions in ALL calculations.
7. Round off your FINAL numerical answers to a minimum of TWO decimal places.
8. Give brief motivations, discussions, etc. where required.
9. You are advised to use the attached DATA SHEETS.
10. Write neatly and legibly.

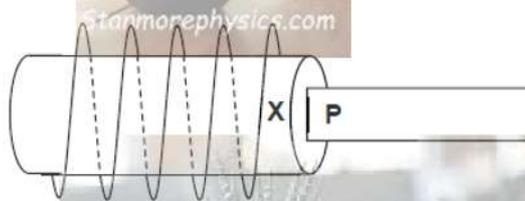
Question 1

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the best answer and only write down (A–D) next to the question numbers (1.1–1.10) in the ANSWER BOOK, for example 1.11 D.

1.1.1 The North pole of the magnet is moved into a coil consisting of 20 turns of insulated conducting wires. Which ONE of the following changes will INCREASE the induced emf?

- A. Increasing the time taken for the magnet to move into the coil.
- B. Decreasing the number of turns in the coil.
- C. Moving the South pole of the magnet into the coil
- D. Increasing the speed at which the magnet is moved into the coil (2)

1.1.2 The diagram below shows a coil and a magnet with a pole, **P**. A magnetic field is induced in the coil due to the motion of the magnet.



Which ONE of the following combinations will result in an induced magnetic field with a NORTH POLE at point X?

	DIRECTION OF MOTION OF MAGNET	POLARITY OF P
A	Into the coil	North
B	Up and down inside the coil	North
C	Into the coil	South
D	Up and down inside the coil	South

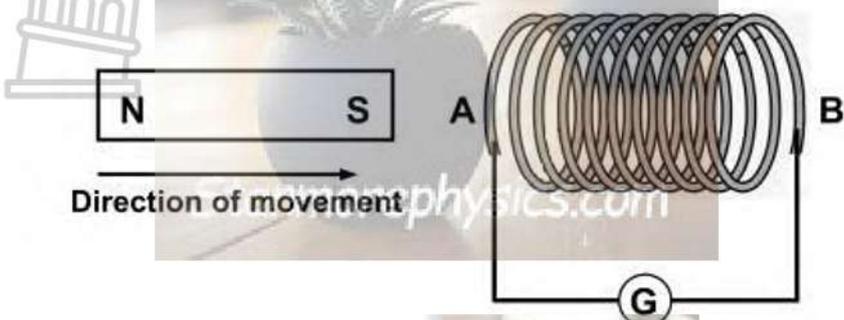
(2)

[4]

Question 2

2.1 State *Faraday's Law of Electromagnetic Induction* in word (2)

2.2 The SOUTH pole of the magnet is inserted on the LEFT-HAND side of the solenoid (as shown)



2.2.1 What is the polarity (NORTH POLE or SOUTH POLE) of the left-hand side of the solenoid (A) as the bar magnet approaches? (1)

2.2.2 In which direction (A to B or B to A) does the induced current flow in the coil? (2)



[5]

Question 3

3.1 The diagram below represents a current-carrying conductor. Draw the magnetic field pattern around this conductor. (2)



3.2 A solenoid with a radius of 5 cm and 350 turns is pulled out of a magnetic field of strength 5,20 T in 0,1 second. The solenoid is placed perpendicular to the magnetic field.

3.3.1 Calculate the magnetic flux linkage (Φ) with the solenoid. (3)

3.3.2 Calculate the induced emf in the solenoid. (3)

[8]

Question 4

Consider the solenoid of 9 turns with unknown radius, r . The solenoid is subjected to a magnetic field of 0,12T. The face of the solenoid is perpendicular to the magnetic field. When the field is uniformly switched to 12T over a period of 2 minutes, an emf of -0,3V is induced.

4.1 Mention TWO ways in which the induced emf can be increased. (2)

4.2. Calculate the:

4.2.1 change in magnetic flux (4)

4.2.2 the radius of the solenoid (4)

[10]

TOTAL: 27 marks



TABLE 2: FORMULAE

ELECTROMAGNETISM/ ELEKTROMAGNETISME

$\varepsilon = -N \frac{\Delta\Phi}{\Delta t}$	$\Phi = BA \cos \theta$
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Electromagnetism Topic Test Memo

Question 1

1.1.1 D✓✓

1.1.2 A✓✓

[4]

Question 2

2.1 The magnitude of the induced emf across a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓ (2)

2.2 South Pole✓ (1)

2.3 B to A✓✓ (2)

[5]

Question 3

3.1



CRITERIA FOR MARKING/ KRITERIA VIR NASIEN	
Circular shape/ Korrekte vorm	✓
Field direction/ Veldrigting	✓

(2)

3.2 *Stanmorephysics.com*

$$\left. \begin{aligned} \Phi &= B A \cos \theta \\ \Phi &= B (\pi r^2) \cos \theta \end{aligned} \right\} \text{Any one/Enige een } \checkmark$$

$$\Phi = 3,5 (\pi \times 0,05^2) \cos 0^\circ \checkmark$$

$$\Phi = 0,03 \text{ Wb } \checkmark (0,027 \text{ Wb}) \quad (3)$$

3.3

$$\varepsilon = \frac{-N\Delta\Phi}{\Delta t} \checkmark$$

$$\varepsilon = \frac{-350(0 - 0,03)}{0,1} \checkmark$$

$$\varepsilon = 105 \text{ V } \checkmark \quad (3)$$

Question 4

4.1

- Pull the solenoid out of the magnetic field faster.
- Increase the number of turns on the coil.
- Increase the area of the coil.
- Use a stronger magnetic field.

(Any two)

✓✓

(2)

4.2.1

$$\varepsilon = \frac{-N\Delta\Phi}{\Delta t} \checkmark$$

$$-0.3 \checkmark = -(9) \frac{\Delta\Phi}{2 \times 60} \checkmark$$

$$\Delta\Phi = 4 \text{ Wb} \checkmark$$

4.2.2

$$\Delta\Phi = (B_f - B_i)A \cos\theta \checkmark$$

$$4 = (12 - 0.12) \checkmark \pi r^2 \cos 0^\circ \checkmark$$

$$r = 0.33 \text{ m} \checkmark$$

(4)

(4)

[10]