

Electromagnetism Memo

2023 Eastern Cape November Paper 1 Q 9

- 9.1 The magnitude of the induced emf across the ends of a conductor ✓ is directly proportional to the rate of change in the magnetic flux linkage the conductor. ✓
Die grootte van die geïnduseerde emk oor 'n geleier ✓ is direk eweredig aan die tempo van verandering van die magnetiese vloed in die geleier. ✓ (2)

- 9.2 Pull the solenoid out of the magnetic field faster. }
Increase the number of turns on the coil. } (Any two)
Increase the area of the coil. } ✓✓
Use a stronger magnetic field. }

- Trek die solenoïed vinniger uit die magnetiese veld* }
Vermeerder die aantal windings in die spoel. } (Enige twee)
Vergoot die oppervlakte van die spoel. }
Gebruik 'n sterker magneetveld. } (2)

- 9.3.1 $\Phi = BA \cos \theta$ ✓
 $\Phi = 0,4 \times 0,06 \cos 0$ ✓
 $\Phi = 0,024 \text{ Wb}$ ✓ (3)

- 9.3.2 $\varepsilon = -N \frac{\Delta \Phi}{\Delta t}$ ✓
 $\varepsilon = -350 \frac{0 - 0,024}{0,3}$ ✓
 $\varepsilon = 28 \text{ V}$ ✓ (3)
[10]

2021 Gauteng November Exemplar Paper 1 Q 6

- 6.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. / *Die grootte van die geïnduseerde emk oor die ente van 'n geleier is direk eweredig aan die tempo van verandering van magnetiese vloed in die geleier.* ✓✓ (2)
- 6.2 6.2.1 There will be a reading registered on the galvanometer. / *Daar sal 'n geregistreerde lesing op die galvanometer wees.* ✓
OR/OF
The galvanometer will deflect to a side. / *Die galvanometer sal na een kant toe uitwyk.* (1)
- 6.2.2 NO reading on the galvanometer / Zero reading / *GEEN lesing op die galvanometer / Nul lesing* ✓ (1)
- 6.3 6.3.1 North pole / *Noordpool* ✓ (1)
- 6.3.2 A to B / *A na B* ✓✓ (2)
- 6.3.3 Use the right hand rule (for solenoids).
The thumb of the right hand will indicate the North pole ✓ and the fingers of the right hand will indicate the direction the current will flow in the solenoid. ✓
Gebruik die regterhandreël (vir solenoïede)
Die duim van die regterhand sal die rigting van die Noordpool ✓ aandui en die vingers van die regterhand sal die rigting van die stroomvloeï in die solenoïed aandui. ✓ (2)
- [9]**

2022 KwaZulu Natal November Paper 1 Q 4

QUESTION 4

- 4.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓ (2)
- 4.2 4.2.1 South Pole ✓ (1)
- 4.2.2 B to A ✓ (1)
- [4]**

2025 Eastern Cape November Paper 1 Q 8

8.1 North pole / Noordpool ✓✓ (2)

8.2 Towards Q / Na Q ✓✓ (2)

8.3 8.3.1 The magnitude of the induced emf across the end of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓

Die grootte van die geïnduseerde emk oor die punt van 'n geleier is direk eweredig aan die tempo van verandering in die magnetiese vloed-koppeling in die geleier. (2)

8.3.2 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) ✓✓
*Trek die solenoïde vinniger uit die magneetveld.
Verhoog die aantal windings op die spoel.
Vergroot die oppervlakte van die spoel.
Gebruik 'n sterker magnetiese veld.*
(Enige TWEE) (2)

8.3.3 $\Phi = BA \cos \theta$ ✓
 $= 0,6 (0,08) \cos 0^\circ$ ✓
 $= 0,048 \text{ Wb}$ ✓ (3)

8.3.4 $\mathcal{E} = \frac{-N\Delta\Phi}{\Delta t}$ ✓
 $\mathcal{E} = - \frac{350 (0 - 0,048)}{0,25}$ ✓
 $\mathcal{E} = 67,2 \text{ V}$ ✓ (3)

[14]

2015 November Paper 1 Q 10

- 10.1.1 The magnitude of the induced emf (in a conductor) is equal to the rate of change of magnetic flux linkage. ✓✓

Die grootte van die geïnduseerde emk (in 'n geleier) is gelyk aan die tempo van verandering van magnetiese vloedkoppeling

OR/OF

The emf induced in a conducting loop is equal to the negative of the rate at which the magnetic flux through the loop is changing with time ✓✓

Die geïnduseerde emk in 'n geleidende lus is gelyk aan die negatiewe van die tempo waarteen die magnetiese vloedlyne deur die lus verander met tyd.

ACCEPT/AANVAAR

The emf induced in a conductor is proportional to the rate at which magnetic field lines are cut by a conductor. ✓✓

Die geïnduseerde emk in 'n geleier is eweredig aan die tempo waarteen die magneetveldlyne deur 'n geleier gesny word. (2)

- 10.1.2 Move the magnet quickly inside the coil. ✓

Use a stronger magnet. ✓

Verhoog die sterkte van die magneet.

Gebruik 'n sterker magneet. (2)

- 10.2.1 $\Phi = BA \cos \theta$ ✓

$$\Phi = (0,4)(0,6) \cos 0^\circ \checkmark$$

$$\Phi = 0,24 \text{ Wb/T} \cdot \text{m}^2 \checkmark \quad (3)$$

- 10.2.2 $\Phi = BA \cos \theta$

$$\Phi_{1/2} = (0,4)(0,3) \cos 0^\circ \\ = 0,12 \text{ Wb/T} \cdot \text{m}^2 \checkmark$$

$$\varepsilon = -N \frac{\Delta \Phi}{\Delta t} \checkmark \\ = -N \frac{(\Phi_f - \Phi_i)}{\Delta t}$$

$$9 = -N \frac{(0,12 - 0,24)}{120} \checkmark$$

$$N = 9\,000 \text{ turns/windings} \checkmark$$

(4)
[11]

2022 Gauteng November Paper 1 Q 6

- 6.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓

Die grootte van die geïnduseerde emk oor die ente van die geleier is direk eweredig aan die tempo van verandering in magnetiese vloed. ✓✓

(2)

- 6.2 TOWARDS/NA ✓

A current will flow in the coil/solenoid, which will produce a magnetic field, with a North pole at A and a South pole at B. ✓ The South pole will attract the North pole of the magnet; thus it will move towards the coil/solenoid. ✓/

Die stroom sal in die spoel/solenoid vloei wat 'n magneetveld sal induseer, met 'n Noordpool by A en 'n Suidpool by B. ✓ Die Suidpool sal die Noordpool van die magnet aantrek en dit sal na die spoel/solenoid beweeg. ✓

(3)

- 6.3 Increase the number of turns/coils on the solenoid. ✓
Increase the current in the solenoid. ✓
Use a stronger magnet on the right. ✓
Use a soft metal bar inside the solenoid.
(Any THREE)

Vermeerder die aantal windinge om die solenoïed. ✓

Vermeerder die stroom in die solenoïed. ✓

Gebruik 'n sterker magnet aan die regterkant. ✓

*Gebruik 'n sagte metaalstaaf aan die binnekant van die solenoïed.
(Enige DRIE)*

(3)

[8]

2019 Eastern Cape November Paper 1 Q 10

- 10.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓
Die grootte van die geïnduseerde emk oor die ente van 'n geleier is direk eweredig aan die veranderingstempo in die magnetiese vloedverbinding met die geleier. (2)

10.2.1 $\epsilon = -N \frac{\Delta\Phi}{\Delta t}$ ✓
 $0,25 = -200 \frac{\Delta\Phi}{0,01}$ ✓
 $\Delta\Phi = 1,25 \times 10^{-5} \text{ Wb}$ ✓ (3)

10.2.2 $\Delta\Phi = (B_2 - B_1) A \cos\theta$
 $\Delta\Phi = (B_2 - B_1) (\pi r^2) \cos\theta$ } Any one ✓
 $1,25 \times 10^{-5} = (8 - 0) (\pi \times 0,001^2) \cos\theta$ ✓
 $\theta = 60,17^\circ$ ✓ (4)

- 10.3 Increase. ✓
Toeneem (1)
[10]

2024 Gauteng June Paper 1 Q 6

- 6.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. (When a conductor is moved in a magnetic field, a potential difference is induced across the conductor.) ✓✓

Die grootte van die geïnduseerde emk oor die ente van 'n geleier is direk eweredig aan die tempo van verandering in magnetiese vloedkoppeling met die geleier. (Wanneer 'n geleier in 'n magneetveld beweeg word, word 'n potensiaalverskil in die geleier geïnduseer.) ✓✓

(2)

- 6.2 6.2.1 $\Phi_i = \beta A \cos \theta$ ✓
 $= (0,15) \pi r^2 \cos \theta$
 $= (0,15)(\pi \times 0,3^2)$ ✓ $\cos 0^\circ$
 $= 4,24 \times 10^{-2} \text{ Wb}$
 $\Delta \Phi_i = \Phi_i - \Phi_{if}$ ✓
 $= 0 - 4,24 \times 10^{-2}$
 $= -4,24 \times 10^{-2} \text{ Weber.}$ ✓

Marking Guideline/Nasienriglyne:

- ✓ Formula for Φ_i /Formule vir Φ_i
- ✓ Substitute into area/
- ✓ Intervanging in area
- ✓ Change in Φ_i Φ_i
- ✓ Verandeing in Φ_i
- ✓ Answer in weber/
- ✓ Antwoord in weber

(4)

6.2.2 POSITIVE MARKING FROM QUESTION 6.2.1/ POSITIEWE NASIEN VANAF VRAAG 6.2.1

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

$$= \frac{(-60)(-4,24 \times 10^{-2})}{1,6}$$

$$= 1,59 \text{ V}$$

Marking Guideline/Nasienriglyne:

- ✓ Formula for emf/
- ✓ Formule vir emk
- ✓ Substitution/
- ✓ Substitusie
- ✓ Answer in webber/
- ✓ Antwoord in weber

(3)

- 6.3 DECREASE ✓/AFNEEM ✓

The emf is inversely proportional to the time of rotation, ✓ thus if the time increases the emf will decrease. ✓

Die emk is omgekeerd eweredig aan die tyd van rotasie, ✓ dus as die tyd toeneem sal die emk afneem. ✓

(3)

[12]

2016 KwaZulu Natal September Paper 1 Q 3

QUESTION 3

- 3.1 The induced emf in a conductor is directly proportional to the rate of change of magnetic flux through the circuit. ✓✓ (2)

3.2.1

$$\Phi_i = B \cos \theta. A = 1,20 \cos 90^\circ. A = 0 \text{ Wb} \checkmark$$

$$\Phi_f = B \cos \theta. A = 1,20 \cos 0 \times (0,25 \times 0,30) \checkmark = 0,09 \text{ Wb}$$

$$\Delta \Phi = \Phi_f - \Phi_i = 0,09 - 0 = 0,09 \text{ Wb} \checkmark (3)$$

MARK POSITIVELY FROM 3.2.2

$$3.2.2 \quad \varepsilon = -N \frac{\Delta \Phi}{\Delta t} \checkmark = -150 \frac{0,09}{0,2} \checkmark = -67,50 \text{ V} \checkmark (3)$$

$$3.2.3 \quad I = \frac{\varepsilon}{R} \checkmark = \frac{67,50}{50} \checkmark = 1,35 \text{ A} \checkmark (3)$$

[11]

2017 November Paper 1 Q 9

- 9.1 The magnitude of the induced *emf* across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓
Die grootte van die geïnduseerde emk oor die ente van 'n geleier is direk eweredig aan die tempo van verandering van die magnetiese vloedkoppeling met die geleier. ✓✓ (2)

- 9.2 Accept any correct combination of coordinates from the graph for example:
 $(\frac{1}{\Delta t}; \epsilon)$ can be (1,8 ; 3) OR (1,2 ; 2) OR (0,6 ; 1)
*Aanvaar enige korrekte kombinasie van koördinate vanaf die grafiek
 byvoorbeeld: $(\frac{1}{\Delta t}; \epsilon)$ kan wees (1,8 ; 3) OF (1,2 ; 2) OF (0,6 ; 1)*

OPTION 1/OPSIE 1 $\epsilon = \frac{-N\Delta\Phi}{\Delta t}$ ✓ $3 \checkmark = (-200) \checkmark \Delta\Phi(1,8)$ ✓ $\Delta\Phi = -0,0083 \text{ Wb}$ ✓	OPTION 2/OPSIE 2 $\epsilon = \frac{-N\Delta\Phi}{\Delta t}$ ✓ $3 \checkmark = (-200) \checkmark \Delta\Phi(\frac{1}{0,56})$ ✓ $\Delta\Phi = -0,0083 \text{ Wb}$ ✓
OPTION 3/OPSIE 3 gradient = $\epsilon\Delta t = -N\Delta\Phi$ ✓ $3 \checkmark(0,56) \checkmark = (-200) \checkmark \Delta\Phi$ $\Delta\Phi = -0,0083 \text{ Wb}$ ✓	

(5)

- 9.3 **POSITIVE MARKING FROM 9.2**
POSITIEWE NASIEN VANAF VRAAG 9.2
 $\Delta\Phi = \Phi_f - \Phi_i$ ✓
 $-0,0083 \checkmark = \frac{(4,86 \times 10^{-3})(2,4) \cos 90^\circ - (4,86 \times 10^{-3})(2,4) \cos \theta}{\checkmark}$
 $\theta = 44,64^\circ$ ✓

(4)
[11]

2023 Gauteng November Paper 1 Q 8

- 8.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓

Die grootte van die geïnduseerde emk oor die ente van die geleier is direk eweredig aan die tempo van verandering van magnetiese vloedkoppeling met die geleier. ✓✓ (2)

- 8.2 Current is induced into the coil. ✓/Stroom word in die spoel geïnduseer ✓ (1)

- 8.3 The right-hand solenoid rule. ✓/Die regterhand solenoïde reël. ✓ (1)

- 8.4 Increase the number of turns/coils on the solenoid. ✓
Increase the current in the solenoid. ✓
Use a stronger magnet on the right. ✓
Use a soft metal bar inside the solenoid.

(Any THREE)

*Verhoog die aantal windinge in die solenoïde. ✓
Verhoog die stroom in die solenoïde. ✓
Gebruik 'n sterker magneet aan die regterkant. ✓
Gebruik 'n sagte metaalkern binne in die solenoïde.* (Enige DRIE) (3)

8.5 $\varepsilon = N \frac{\Delta \Phi}{\Delta t}$ ✓

$$= -200 \frac{(1 \times 10^{-4} - 5 \times 10^{-4})}{0,2}$$

$$= 0,4 \text{ V} \checkmark$$

(3)
[10]

2016 November Paper 1 Q 9

9.1 $\Phi = BA \cos \theta$ ✓
 $\Phi = (3,2)\pi(0,04)^2 \cos 0^\circ$ ✓
 $\Phi = 0,016 \text{ Wb}$ ✓ (or 0,02 Wb) (3)

9.2 **POSITIVE MARKING FROM 9.1**
POSITIEWE NASIEN VAN 9.1

$\varepsilon = \frac{N\Delta\Phi}{\Delta t}$ ✓
 $2,8 = \frac{-250(0,016 \cos 25^\circ - 0,016 \cos 0^\circ)}{\Delta t}$ ✓
 $\Delta t = 0,13 \text{ s}$ ✓ (0,17 s if 0,02 Wb was used/ gebruik was) (4)

9.3 Faraday's law. ✓ The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓
Faraday se wet. Die grootte van die geïnduseerde emk oor die ente van 'n geleier is direk eweredig aan die tempo van verandering in die magnetiese vloedkoppeling met die geleier. (2)

9.4.1 Smaller ✓
Kleiner as (2)

9.4.2 The area of a square is smaller than the area of a circle with the radius equal to the side length of the square ✓
Die oppervlakte van 'n vierkant is kleiner as die oppervlakte van 'n sirkel met die radius gelyk aan die sylengte van die vierkant.

OR/OF

$0,04^2 < \pi \times 0,04^2$ area of square is smaller than area of circle.

$0,04^2 < \pi \times 0,04^2$ oppervlakte van vierkant is kleiner as oppervlakte van sirkel.

OR/OF

ε directly proportional to A ✓

ε direk eweredig aan A

(2)
[12]

2019 November Paper 1 Q 9

9.1 Faraday's law of electromagnetic induction ✓
Faraday se wet van elektromagnetiese induksie (1)

9.2.1 $\Delta\Phi = \Delta BA \cos \theta$ ✓
 $= (2,8 \times 10^{-3})(2,5)(\cos 90^\circ - \cos 0^\circ)$ ✓
 $= -0,007 \text{ Wb}$ ✓ (3)

9.2.2 **POSITIVE MARKING FROM QUESTION 9.2.1.**
POSITIEWE NASIEN VANAF VRAAG 9.2.1.

$\varepsilon = - \frac{N\Delta\phi}{\Delta t}$ ✓
 $3,5 = - \frac{200(-0,007)}{\Delta t}$ ✓
 $\Delta t = 0,4 \text{ s}$ ✓ (3)

9.3 Emf will be halve/two times smaller ✓
Emf is directly proportional to number of windings ✓
Emk sal die helfte wees/twee keer kleiner
Emk is direk eweredig aan die aantal windings (2)
[9]

2018 November Paper 1 Q 11

- 11.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓
Die grootte van die geïnduseerde emk oor die punte van 'n geleier is direk eweredig aan die tempo van verandering van die magnetiese vloedkoppeling met die geleier.
 [2 or/of 0] (2)

11.2 $\epsilon = \frac{-N \Delta\phi}{\Delta t}$ ✓
 $7 = \frac{-400 \Delta\phi}{0,08}$ ✓
 $\Delta\phi = -1,4 \times 10^{-3} \text{ Wb}$ ✓ (-0,0014) (3)

- 11.3 **POSITIVE MARKING FROM QUESTION 11.2**
POSITIEWE NASIEN VANAF VRAAG 11.2

$\Delta\phi = AB(\cos \theta_f - \cos \theta_i)$
 $-0,0014 \checkmark = (0,03)^2 B(\cos 45^\circ - \cos 0^\circ)$ ✓
 $B = 5,31 \text{ T}$ ✓ (4)

- 11.4 Increase/*Toeneem* ✓ (1)

11.5 $\epsilon \propto \frac{1}{\Delta t}$ ✓
OR/OF
 Emf is inversely proportional to time.
Emk is omgekeerd eweredig aan tyd.
 If the time decreases, the emf will increase.
Indien die tyd verminder, sal die emk toeneem. (1)

- 11.6 North/*Noord* ✓ (1)

- 11.7 From A to B/*Van A na B* ✓ (1)

[13]

2023 Eastern Cape June Paper 1 Q 7

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

7.2.1 $\varepsilon = -N \frac{\Delta\phi}{\Delta t}$ ✓
 $0.3 = -(9) \frac{\Delta\phi}{2 \times 60}$ ✓
 $\Delta\phi = 4 \text{ Wb}$ ✓ (4)

7.2.2 $\Delta\phi = (B_f - B_i)A \cos\theta$ ✓
 $4 = (12 - 0.12) \pi r^2 \cos 0^\circ$ ✓
 $r = 0.33 \text{ m}$ ✓ (4)

[10]