



# **PHYSICAL SCIENCES**

**GRADE 12**

**SPRING CLASSES 2023**

**TOPIC: ELECTRODYNAMICS**

**SOLUTION BOOK**

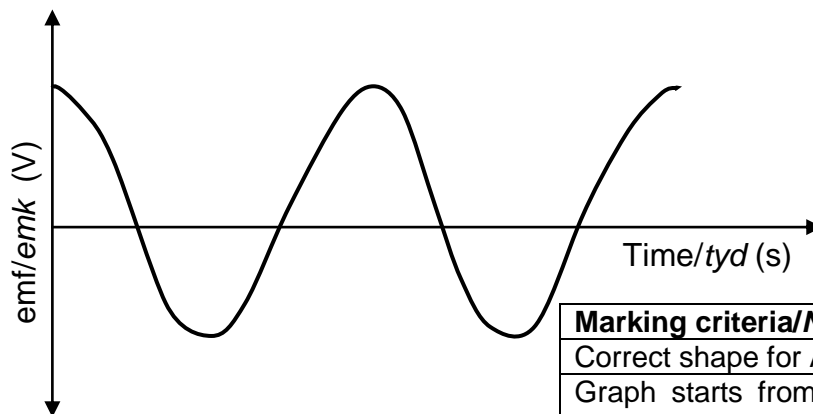
### QUESTION 1/VRAAG 1

- 1.1 A ✓✓ (2)
- 1.2 C ✓✓ (2)
- 1.3 A ✓✓ (2)
- 1.4 D ✓✓ (2)
- 1.5 C ✓✓ (2)
- [20]

### ACTIVITY 2

- 2.1.1 North pole/Noord-pool ✓ (1)
- 2.1.2 Y to X/Y na X ✓ (1)

2.1.3



Marking criteria/Nasienkriteria	
Correct shape for AC./Korrekte vorm vir WS.	✓
Graph starts from maximum value./Grafiek begin by maksimum waarde.	✓
Two complete waves/ Twee volledige golwe	✓
<b>Note/Aantekening:</b> Accept graph starting at negative max./Aanvaar grafiek wat by negatiewe maks begin.	

(3)

2.2.1

**Marking criteria/Nasienkriteria:**

- Formula to calculate  $V_{\max}$  or  $I_{\text{rms}}$ . / *Formule om  $V_{\text{maks}}$  of  $I_{\text{wgk}}$  te bereken.* ✓
- Correct substitution of  $V_{\text{rms}}$  or  $I_{\text{max}}$ . / *Korrekte vervanging van  $V_{\text{wgk}}$  of  $I_{\text{maks}}$ .* ✓
- Correct substitution to calculate  $R$ . / *Korrekte vervanging om  $R$  te bereken.* ✓
- Correct final answer / *Korrekte finale antwoord: 47,14  $\Omega$  to/tot 47,2  $\Omega$*  ✓

**OPTION 1/OPSIE 1**

$$V_{\text{rms}} = \frac{V_{\max}}{\sqrt{2}} \quad \checkmark$$

$$200 = \frac{V_{\max}}{\sqrt{2}} \quad \checkmark$$

$$V_{\max} = 282,84 \text{ V}$$

$$R = \frac{V}{I} \quad \downarrow$$

$$= \frac{282,84}{6} \quad \checkmark$$

$$R = 47,14 \Omega \quad \checkmark$$

**OPTION 2/OPSIE 2**

$$I_{\text{rms}} = \frac{I_{\max}}{\sqrt{2}} \quad \checkmark$$

$$I_{\text{rms}} = \frac{6}{\sqrt{2}} \quad \checkmark$$

$$I_{\text{rms}} = 4,24 \text{ A}$$

$$R = \frac{V}{I} \quad \downarrow$$

$$= \frac{200}{4,24} \quad \checkmark$$

$$R = 47,17 \Omega \quad \checkmark$$

**OPTION 3/OPSIE 3**

$$I_{\text{rms}} = \frac{I_{\max}}{\sqrt{2}} \quad \checkmark$$

$$I_{\text{rms}} = \frac{6}{\sqrt{2}} \quad \checkmark$$

$$I_{\text{rms}} = 4,24 \text{ A}$$

$$P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}}$$

$$= (200)(4,24)$$

$$= 848 \text{ W (848,53)}$$

$$P_{\text{ave}} = \frac{V_{\text{rms}}^2}{R}$$

$$848 = \frac{(200)^2}{R} \quad \checkmark$$

$$R = 47,17 \Omega \quad \checkmark$$

**OR/OF**

$$P_{\text{ave}} = I_{\text{rms}}^2 R$$

$$848 = (4,24)^2 R \quad \checkmark$$

$$R = 47,17 \Omega \quad \checkmark$$

(4)

2.2.2

**POSITIVE MARKING FROM QUESTION 2.2.1.****OPTION 1/OPSIE 1**

$$W = I^2 R \Delta t \quad \checkmark$$

$$= (4,24)^2 (47,17) \quad \checkmark (7200) \quad \checkmark$$

$$= 6,11 \times 10^6 \text{ J} \quad \checkmark (6,10 \times 10^6)$$

**OPTION 2/OPSIE 2**

$$W = VI \Delta t \quad \checkmark$$

$$= (200)(4,24) \quad \checkmark (7200) \quad \checkmark$$

$$= 6,11 \times 10^6 \text{ J} \quad \checkmark$$

**OPTION 3/OPSIE 3**

$$W = \frac{V^2 \Delta t}{R} \quad \checkmark$$

$$= \frac{(200^2)}{47,27} (7200) \quad \checkmark$$

$$= 6,11 \times 10^6 \text{ J} \quad \checkmark (6,10 \times 10^6)$$

**OPTION 4/OPSIE 4**

$$P = \frac{W}{\Delta t} \quad \checkmark$$

$$848 = \frac{W}{7200} \quad \checkmark$$

$$= 6,11 \times 10^6 \text{ J} \quad \checkmark$$

(4)

**[13]**

### ACTIVITY 3

- 3.1 Slip rings *sleepringe* ✓ (1)
- 3.2 Allows the slips rings to rotate while maintaining contact with the external circuit.  
*Laat die sleepringe toe om te roteer terwyl dit kontak met die eksterne stroombaan behou.*  
**OR/OF**  
Transfer/conduct current to the external circuit. ✓  
*Dra stroom oor/Gelei stroom na eksterne stroombaan.*  
**OR/OF**  
Connection between external circuit and coil/slip rings/internal circuit.  
*Verbinding tussen eksterne stroombaan en spoel/sleepringe/interne stroombaan.* (1)
- 3.3 According to the principle of electromagnetic induction, an emf/current is induced as a result of the change in the magnetic flux linkage ✓✓ with the coil. **(2 or 0)**  
*Volgens die beginsel van elektromagnetiese induksie word 'n emk/stroom geïnduseer as gevolg van die verandering in magnetiese-vloedkoppeling met die spoel. **(2 of 0)***  
  
**Accept/Aanvaar**  
When the coil rotates there is a change of magnetic flux linked/associated with the coil and according to the principle of electromagnetic induction, an emf/current is induced in the coil. **(2 or 0)**  
*Wanneer die spoel roteer is daar 'n verandering in magnetiese-vloedkoppeling met die spoel en volgens die beginsel van elektromagnetiese induksie word 'n stroom/emk in die spoel geïnduseer. **(2 of 0)***  
**Accept/Aanvaar**  
There is relative motion between the conductor and the magnetic field.**(2 or 0)**  
*Daar is relatiewe beweging tussen die geleier en die magneetveld . **(2 of 0)*** (2)
- 3.4 **P to/na Q** ✓✓ (2)

3.5

<b>OPTION 1/OPSIE 1</b> $T = \frac{1}{f} = \frac{1}{50} \checkmark$ $= 0,02 \text{ s}$ $\searrow$ $t = (1,5)(0,02) \checkmark$ $= 0,03 \text{ s} \checkmark$ <b>OR/OF</b> $t = (0,02) + \frac{1}{2} (0,02) \checkmark$ $= 0,03 \text{ s} \checkmark$	<b>OPTION 2/OPSIE 2</b> $50 \text{ waves/golwe} = 1 \text{ s} \checkmark$ $1,5 \text{ waves/golwe} \checkmark = 0,03 \text{ s} \checkmark$ <b>OPTION 3/OPSIE 3</b> $t = \frac{1,5}{50} \checkmark \checkmark = 0,03 \text{ s} \checkmark$ <b>OPTION 4/OPSIE 4</b> $t = \frac{3}{4} (0,04) \checkmark \checkmark = 0,03 \text{ s} \checkmark$
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(3)

3.6

$V_{\text{rms}} = \frac{V_{\text{max}}}{\sqrt{2}}$ $= \frac{311}{\sqrt{2}} \checkmark$ $= 219,91 \text{ V}$		$I_{\text{rms}} = \frac{V_{\text{rms}}}{R}$ $= \frac{219,91}{100} \checkmark$ $= 2,2 \text{ A (2,199)}$	
<b><u>OPTION 1/OPSIE 1</u></b> $W = \frac{V^2 \Delta t}{R} \checkmark$ $= \frac{(219,11)^2}{100} (60) \checkmark$ $= 29\,016,24 \text{ J} \checkmark$		<b><u>OPTION 2/OPSIE 2</u></b> $W = VI\Delta t \checkmark$ $\Rightarrow (219,91) \checkmark (2,2) \checkmark (60) \checkmark$ $= 29\,028,12 \text{ J} \checkmark$ $(29\,013,61 - 29\,028,12)$	
		<b><u>OPTION 3/OPSIE 3</u></b> $W = I^2 R \Delta t \checkmark$ $= (2,2^2) \checkmark \checkmark (100)(60)$ $= 29\,040 \text{ J} \checkmark$ $(29\,013,61 - 29\,040)$	
<b><u>OPTION 4/OPSIE 4</u></b> $P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}} \checkmark$ $= (219,11)(2,2) \checkmark$ $= 483,605 \text{ W}$ $P = \frac{W}{\Delta t} \checkmark$ $483,605 = \frac{W}{60} \checkmark$ $W = 29\,016,30 \text{ J} \checkmark$		<b><u>OPTION 5/OPSIE 5</u></b> $P_{\text{ave}} = \frac{V_{\text{rms}}^2}{R}$ $\Rightarrow \frac{(219,11)^2}{100} \checkmark$ $= 483,605 \text{ W}$ $P = \frac{W}{\Delta t} \checkmark$ $483,605 = \frac{W}{60} \checkmark$ $W = 29\,016,30 \text{ J} \checkmark$	
		<b><u>OPTION 6/OPSIE 6</u></b> $P_{\text{ave}} = I_{\text{rms}}^2 R$ $\Rightarrow (2,2)^2 \checkmark \checkmark (100)$ $= 483,605 \text{ W}$ $P = \frac{W}{\Delta t} \checkmark$ $483,605 = \frac{W}{60} \checkmark$ $W = 29\,016,30 \text{ J} \checkmark$	

(5)  
[14]

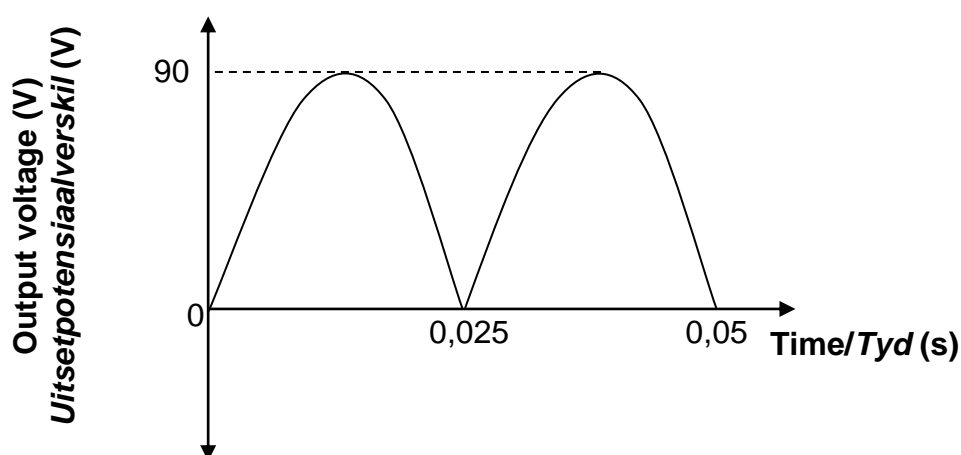
## ACTIVITY 4

4.1.1 Split ring/commutator/*Splitring/kommutator* ✓ (1)

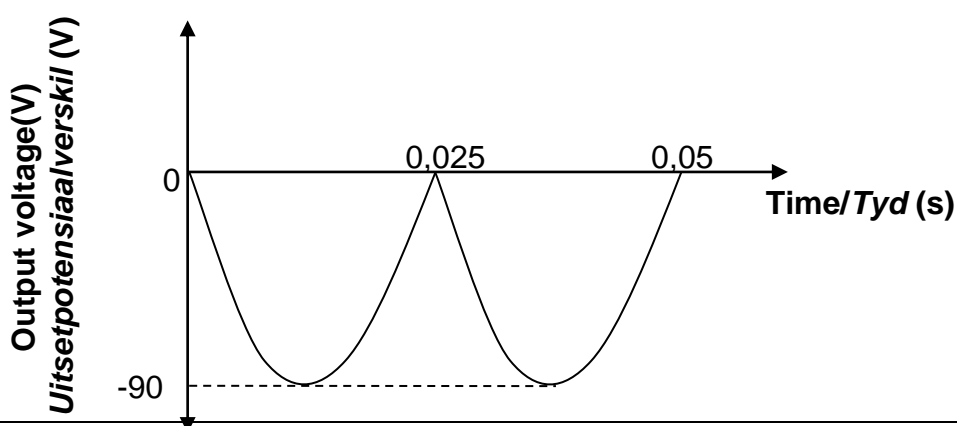
4.1.2 **Y to/na X** **OR/OF** 0 /no current/*geen stroom nie*✓ (1)

4.1.3  $T = \frac{1}{f}$   
 $T = \frac{1}{20}$   
 $T = 0,05 \text{ s}$  ✓ (1)

4.1.4 **POSITIVE MARKING FROM QUESTION 4.1.3.**



**OR/OF**



<b>Criteria for graph/Kriteria vir grafiek</b>	
Correct shape with one full cycle./Korrekte vorm met 1 volledige siklus.	✓
Curve starts at zero to first peak./Kurve begin by nulpunt tot eerste piek.	✓
Any one of the correct time values at the correct position./Enige een van die korrekte tyd waardes op die korrekte posisie.	✓
Maximum voltage of 90 V OR -90 V/ Maksimum potensiaalverskil van 90 V OF -90 V	✓
<b>NOTE/LET WEL:</b>	
- 1 mark for half cycle/incomplete cycle or more than one cycle - 1 punt vir halwe siklus/onvoltooide siklus of meer as een siklus	

(4)

4.2

**Marking criteria/Nasienkriteria**

- Formula to calculate  $W_{ave}$  (do not penalise if subscripts are omitted)./  
*Formule om  $W_{gem}$  te bereken (moenie penaliseer indien onderskrifte uitgelaat is nie).* ✓
- Substitution of 220 and 32 in correct equation. ✓  
*Vervanging van 220 en 32 in die korrekte vergelyking.*
- Substitution of 120 for  $\Delta t$ /Vervanging van 120 in  $\Delta t$ . ✓
- Correct answer in range: 181 500 J to 181 764 J ✓  
*Korrekte antwoord in gebied: 181 500 J tot 181 764 J* ✓

**OPTION 1/OPSIE 1**

$$W_{ave} = \frac{V_{rms}^2 \Delta t}{R} \checkmark$$

$$= \frac{220^2 (120)}{32} \checkmark$$

$$= 181\,500 \text{ J} \checkmark$$

**OPTION 2/OPSIE 2**

$$R = \frac{V_{rms}}{I_{rms}} \checkmark$$

$$32 = \frac{220}{I_{rms}}$$

$$I_{rms} = 6,88 \text{ A } (6,875 \text{ A})$$

$$W_{ave} = V_{rms} I_{rms} \Delta t \checkmark$$

$$= (220)(6,88)(120) \checkmark$$

$$= 181\,632 \text{ J} \checkmark$$

OR/OF

$$W_{ave} = I_{rms}^2 R \Delta t \checkmark$$

$$= (6,88)^2 (32)(120) \checkmark$$

$$= 181\,764,10 \text{ J} \checkmark$$

**OPTION 3/OPSIE 3**

$$R = \frac{V_{rms}}{I_{rms}} \checkmark$$

$$32 = \frac{220}{I_{rms}} \checkmark$$

$$I_{rms} = 6,88 \text{ A } (6,875 \text{ A})$$

$$P_{ave} = V_{rms} I_{rms}$$

$$= (220)(6,88)$$

$$= 1\,513,6 \text{ W}$$

$$(1,51 \times 10^3 \text{ W})$$

$$P_{ave} = I_{rms}^2 R$$

$$= (6,88)^2 (32)$$

$$= 1\,514,7 \text{ W } (1\,512,5 \text{ W})$$

$$(1,51 \times 10^3 \text{ W})$$

$$P = \frac{W}{\Delta t} \checkmark$$

$$1\,513,6 = \frac{W}{120} \checkmark$$

$$W = 181\,632 \text{ J} \checkmark (1,82 \times 10^5 \text{ J})$$

**OPTION 4/OPSIE 4**

$$P_{ave} = \frac{V_{rms}^2}{R}$$

$$P_{ave} = \frac{220^2}{32} \checkmark$$

$$P_{ave} = 1\,512,5 \text{ W}$$

$$(1,51 \times 10^3 \text{ W})$$

(4)  
[11]

## ACTIVITY 5

5.1.1 (DC) motor/(GS-)motor ✓ (1)

5.1.2 **POSITIVE MARKING FROM QUESTION 5.1.1**

Electrical to mechanical /kinetic (energy) ✓✓ (2 or 0)  
*Elektriese na meganiese/kinetiese (energie) (2 of 0)* (2)

5.1.3 Split ring/commutator/*Splitring/kommutator* ✓ (1)

5.1.4 Anticlockwise/*antikloksgewys* ✓✓ (2)

5.2.1 (The rms voltage/value of AC is) the AC voltage/potential difference which dissipates the same amount of energy/heat/power as an equivalent DC voltage/potential difference. ✓✓ (2 or 0)  
*(Die wgk-waarde van WS is) die WS-potensiaalverskil/spanning wat dieselfde hoeveelheid energie/hitte/drywing verbruik as 'n ekwivalente GS-spanning/potensiaalverskil. (2 of 0)*

### ACCEPT/AANVAAR

The rms voltage/value of AC is the DC potential difference which dissipates the same amount of energy/heat/power as AC.

*Die wgk-waarde van WS is die GS-potensiaalverskil wat dieselfde hoeveelheid energie/hitte/drywing verbruik as die WS.* (2)

5.2.2 **Marking criteria/Nasienriglyne**

- Appropriate formula for  $P_{ave}$ /Geskikte formule vir  $P_{ave}$  ✓
- Substitution to calculate/Vervanging vir berekening van R ✓
- Final answer/Finale antwoord: 242  $\Omega$  ✓

<b><u>OPTION 1/OPSIE 1</u></b>	<b><u>OPTION 2/OPSIE 2</u></b>	<b><u>OPTION 3/OPSIE 3</u></b>
$P_{ave} = \frac{V_{rms}^2}{R} \checkmark$ $200 = \frac{220^2}{R} \checkmark$ $R = 242 \Omega \checkmark$	$P_{ave} = V_{rms} I_{rms} \checkmark$ $200 = I_{rms} (220)$ $I_{rms} = 0,909 \text{ A (0,91)}$ $R = \frac{V_{rms}}{I_{rms}} \text{ or/of } R = \frac{V}{I}$ $R = \frac{220}{0,909} \checkmark$ $R = 242 \Omega \checkmark (241,76 \Omega)$	$P_{ave} = V_{rms} I_{rms} \checkmark$ $200 = I_{rms} (220)$ $I_{rms} = 0,909 \text{ A (0,91)}$ $P_{ave} = I_{rms}^2 R$ $200 = (0,909)^2 R \checkmark$ $R = 242 \Omega \checkmark$ $(241,52 \Omega)$

(3)



## 5.2.3

**Marking criteria for options 1,2 and 3 /Nasienriglyne vir opsies 1,2 en 3**

- Appropriate formula to calculate P or  $I_{\text{rms}}$  /Geskikte formule om P of  $I_{\text{rms}}$  te bereken ✓
- Substitution/Vervanging ✓
- Formula for P or W containing  $\Delta t$ /Formule vir P of W wat  $\Delta t$  bevat ✓
- Substitution/Vervanging ✓
- Final answer/Finale antwoord: 55 785,12 J ✓

**POSITIVE MARKING FROM QUESTION 5.2.2.****OPTION 1/OPSIE 1****Marking criteria / Nasienriglyne**

- Appropriate formula for W containing V/Geskikte formule vir W wat V bevat ✓✓
- Substitution/Vervanging ✓✓
- Final answer/Finale antwoord: 55 785,12 J ✓

$$W = \frac{V^2 \Delta t}{R} \checkmark \checkmark$$

$$= \frac{(150^2)(10 \times 60)}{242} \checkmark$$

$$= 55\,785,12 \text{ J} \checkmark$$

**OPTION 2/OPSIE 2**

$$P_{\text{ave}} = \frac{V_{\text{rms}}^2}{R} \checkmark$$

$$= \frac{150^2}{242} \checkmark$$

$$P_{\text{av}} = 92,975 \text{ W}$$

$$P = \frac{W}{\Delta t} \checkmark$$

$$92,975 = \frac{W}{(10)(60)} \checkmark$$

$$W = 55\,785,12 \text{ J} \checkmark$$

$$(55\,785,12 - 55\,896 \text{ J})$$

**OPTION 3/OPSIE 3**

$$R = \frac{V_{\text{rms}}}{I_{\text{rms}}} \checkmark / R = \frac{V}{I}$$

$$242 = \frac{150}{I_{\text{rms}}} \checkmark$$

$$I_{\text{rms}} = 0,620 \text{ A}$$

$$P_{\text{ave}} = I_{\text{rms}} V_{\text{rms}}$$

$$= (0,62)(150) \checkmark$$

$$= 92,97 \text{ W (93 W)}$$

$$P = \frac{W}{\Delta t} \checkmark$$

$$92,975 = \frac{W}{(10)(60)} \checkmark$$

$$W = 55\,785,12 \text{ J} \checkmark$$

$$(55\,785,12 - 55\,896 \text{ J})$$

**OPTION 4/OPSIE 4**

$$R = \frac{V_{\text{rms}}}{I_{\text{rms}}} \checkmark / R = \frac{V}{I}$$

$$242 = \frac{150}{I_{\text{rms}}} \checkmark$$

$$I_{\text{rms}} = 0,620 \text{ A}$$

$$W = I^2 R \Delta t \checkmark$$

$$= (0,62)^2 (242)(10)(60) \checkmark$$

$$= 55\,814,88 \text{ J} \checkmark$$

$$(55\,785,12 - 55\,896 \text{ J})$$

**OR/OF**

$$W = VI \Delta t$$

$$= (150)(0,62)(600)$$

$$= 55\,800 \text{ J}$$

**OPTION 5/OPSIE 5**

$$P_{\text{ave}} = \frac{V_{\text{rms}}^2}{R} \checkmark = \frac{150^2}{242} \checkmark = 92,975 \text{ W}$$

$$P_{\text{ave}} = I_{\text{rms}}^2 R$$

$$92,975 = I_{\text{rms}}^2 (242)$$

$$I_{\text{rms}} = 0,6198 \text{ A}$$

$$W = I^2 R \Delta t \checkmark$$

$$= (0,6198)^2 (242)(10)(60) \checkmark$$

$$= 55\,778,88 \text{ J} \checkmark$$

(5)  
[16]

## ACTIVITY 6

6.1.1 Electrical to mechanical/kinetic/rotational ✓  
*Elektries na meganies/kineties/rotasie* (1)

6.1.2 DC/GS ✓ (1)

6.1.3 Ensures continuous rotation of the coil. ✓  
*Verseker aanhoudende rotasie van spoel.*

### OR/OF

Ensures change in direction of the current in the coil. ✓  
*Verseker verandering van rigting van stroom in spoel.* (1)

## 6.2 QUESTIONS 6.2.1 AND 6.2.2

Only penalise once if subscripts are omitted.

***Penaliseer slegs een keer indien onderskrifte uitgelaat is.***

6.2.1

### Marking criteria/Nasienkriteria:

- Correct formula to calculate resistance. ✓  
*Korrekte formule om weerstand te bereken.*
- Substitute into formula to calculate resistance. ✓  
*Vervang in formule of weerstand te bereken.*
- Final answer/*Finale antwoord*: 484 to/tot 493,83  $\Omega$  ✓

#### OPTION 1/OPSIE 1

$$P_{\text{ave}} = \frac{V_{\text{rms}}^2}{R} \checkmark$$

$$100 = \frac{220^2}{R} \checkmark$$

$$R = 484 \Omega \checkmark$$

#### OPTION 2/OPSIE 2

$$P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}}$$

$$100 = 220 I_{\text{rms}}$$

$$I_{\text{rms}} = 0,45 \text{ A (0,455)}$$

$$I_{\text{rms}} = \frac{V_{\text{rms}}}{R} \checkmark$$

$$0,45 = \frac{220}{R} \checkmark$$

$$R = 488,89 \Omega \checkmark$$

#### OPTION 3/OPSIE 3

$$P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}}$$

$$100 = 220 I_{\text{rms}}$$

$$I_{\text{rms}} = 0,45 \text{ A (0,455)}$$

$$P_{\text{ave}} = I_{\text{rms}}^2 R \checkmark$$

$$100 = (0,45)^2 R \checkmark$$

$$R = 493,83 \Omega \checkmark$$

(3)

**POSITIVE MARKING FROM QUESTION 7.2.1/****Marking criteria:**

- Uses power of Y in circuit (80 W) to calculate  $I_{rms}$  of the circuit. ✓
- Determines  $V_{rms}$  across  $R_Z$  in the circuit. ✓
- Uses  $I_{rms}$  and  $V_{rms}$  across  $R_Z$  in the circuit to calculate resistance  $R_Z$ . ✓
- Use of any one relevant power equation. ✓
- Uses  $R_Z$  and 220 V to calculate X. ✓
- Final answer for X. ✓

**Accept range:**

846,07 W to 856,03 W

**Nasienriglyne:**

- Gebruik drywing van Y in stroombaan (80 W) om  $I_{wgk}$  te bereken. ✓
- Bepaal  $V_{wgk}$  oor  $R_Z$  in die stroombaan. ✓
- Gebruik  $I_{wgk}$  en  $V_{wgk}$  oor  $R_Z$  in die stroombaan om weerstand  $R_Z$  te bereken. ✓
- Gebruik van enige drywing-formule. ✓
- Gebruik  $R_Z$  en 220 V om X te bereken. ✓
- Finale antwoord vir X. ✓

**Aanvaar gebied:**

846,07 W tot 856,03 W

**For resistor Y/Vir resistor Y**

$$P_{ave} = I_{rms}^2 R$$

$$80 = I_{rms}^2 (484) \checkmark$$

$$I_{rms} = 0,407 \text{ A}$$

**OR/OF**

$$P_{ave} = \frac{V_{rms}^2}{R}$$

$$80 = \frac{V_{rms}^2}{484}$$

$$V_{rms} = 196,77 \text{ V}$$

$$I_{rms} = \frac{V_{rms}}{R}$$

$$= \frac{196,77}{484} \checkmark$$

$$= 0,407 \text{ A}$$

**For/Vir Z**

$$V_{rms} = 220 - 196,77 \checkmark$$

$$= 23,23 \text{ V}$$

$$I_{rms} = \frac{V_{rms}}{R}$$

$$[0,407 = \frac{23,23}{R}] \checkmark$$

$$R = 57,08 \Omega$$

**Range/Gebied:**56,66  $\Omega$  to/tot 57,13  $\Omega$ **X for Z/X vir Z:**

$$X = P_{ave} = \frac{V_{rms}^2}{R} \checkmark$$

$$= \frac{220^2}{57,08} \checkmark$$

$$= 847,93 \text{ W} \checkmark$$

**OR/OF**

$$I_{rms} = \frac{V_{rms}}{R}$$

$$= \frac{220}{57,08}$$

$$= 3,85 \text{ A}$$

$$X = P_{ave} = I_{rms}^2 R \checkmark$$

$$= (3,85)^2 (57,08) \checkmark$$

$$= 846,07 \text{ W} \checkmark$$

**OR/OF**

$$I_{rms} = \frac{V_{rms}}{R}$$

$$= \frac{220}{57,08}$$

$$= 3,85 \text{ A}$$

$$X = P_{ave} = V_{rms} I_{rms} \checkmark$$

$$= (220)(3,85) \checkmark$$

$$= 847 \text{ W} \checkmark$$

## ACTIVITY 7

7.1

7.1.1 Split ring / commutator ✓ / *Spleetring/ kommutator* (1)

7.1.2. Anticlockwise ✓✓ / *Antikloksgewys* (2)

7.1.3 Electrical energy ✓ to mechanical(kinetic) energy ✓  
*Elektriese energie na meganiese (kinetiese) energie* (2)

7.2

7.2.1 DC generator: split ring/commutator and AC generator has slip rings✓  
*GS-generator spleetringe/kommutator en WS-generator sleepinge*

### OR/OF

AC generator: slip ring and DC generator has split rings✓  
*WS-generator sleepinge en GS-generator spleetringe* (1)

7.2.2

$$\begin{aligned} V_{\text{rms}} &= \frac{V_{\text{max}}}{\sqrt{2}} \quad \checkmark \\ &= \frac{320}{\sqrt{2}} \quad \checkmark \\ &= 226,27 \text{ V} \quad \checkmark \end{aligned} \quad (3)$$

7.2.3

### OPTION 2/OPSIE 12

$$\begin{aligned} I_{\text{max}} &= \frac{V_{\text{max}}}{R} \\ &= \frac{320}{35} \quad \checkmark \\ &= 9,14 \text{ A} \\ I_{\text{rms}} &= \frac{I_{\text{max}}}{\sqrt{2}} \quad \checkmark \\ &= \frac{9,14}{\sqrt{2}} \quad \checkmark \\ &= 6,46 \text{ A} \quad \checkmark \end{aligned}$$

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**POSITIVE MARKING FROM 7.2.2/**

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**OPTION 2/OPSIE 2**

$$\begin{aligned} P_{\text{average}} &= \frac{V_{\text{rms}}^2}{R} \\ &= \frac{226,27^2}{35} \checkmark \\ &= 1462,80 \text{ W} \end{aligned}$$

$$\begin{aligned} P_{\text{average}} &= V_{\text{rms}} I_{\text{rms}} \checkmark \\ 1\,462,80 &= (226,27) I_{\text{rms}} \checkmark \\ I_{\text{rms}} &= 6,46 \text{ A } \checkmark \end{aligned}$$

$$\begin{aligned} P_{\text{average}} &= I_{\text{rms}}^2 R \checkmark \\ 1\,462,80 &= I_{\text{rms}}^2 (35) \checkmark \\ I_{\text{rms}} &= 6,46 \text{ A } \checkmark \end{aligned}$$

(4)

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**POSITIVE MARKING FROM 7.2.2/**

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**OPTION 1/OPSIE 1**

$$I_{\text{rms}} = \frac{V_{\text{rms}}}{R} \checkmark = \frac{226,27}{35} \checkmark = 6,46 \text{ A } \checkmark$$

(4)  
[13]

## ACTIVITY 8

8.1 Slip rings/Sleepringe ✓

### **ACCEPT/AANVAAR**

Split ring/slip ring commutator /splitring/sleepring kommutator

(1)

8.2 Y to/na X ✓✓

(2)

8.3 **Marking criteria/Nasienkriteria**

If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark./Indien enige van die onderstreepte sleutel woorde/frases in die korrekte konteks uitgelaat is, trek 1 punt af.

The AC potential difference which dissipates the same amount of energy as an equivalent DC potential difference.

Die WS-potensiaalverskil wat dieselfde hoeveelheid energie verbruik as die ekwivalente/soortgelyke GS-potensiaalverskil.

### **ACCEPT/AANVAAR**

The DC potential difference which dissipates the same amount of energy as an equivalent AC potential difference.

Die GS-potensiaalverskil wat dieselfde hoeveelheid energie verbruik as die ekwivalente/soortgelyke WS-potensiaalverskil.

(2)

8.4

<b><u>OPTION 1/OPSIE 1</u></b>	<b><u>OPTION 2/OPSIE 2</u></b>	<b><u>OPTION 3/OPSIE 3</u></b>
$V_{\text{rms/wgk}} = \frac{V_{\text{max/maks}}}{\sqrt{2}}$ $= \frac{100}{\sqrt{2}} \checkmark$ $= 70,71 \text{ V}$ $I_{\text{rms/wgk}} = \frac{V_{\text{rms/wgk}}}{R} \checkmark$ $= \frac{70,71}{25} \checkmark$ $= 2,83 \text{ A} \checkmark$ <p><b><u>ACCEPT/AANVAAR</u></b> If subscripts omitted in <math>V = IR</math> Indien onderskrifte uitgelaat is in <math>V = IR</math></p>	$I_{\text{max/maks}} = \frac{V_{\text{max/maks}}}{R}$ $= \frac{100}{25} \checkmark$ $= 4 \text{ A}$ $I_{\text{rms/wgk}} = \frac{I_{\text{max/maks}}}{\sqrt{2}} \checkmark$ $= \frac{4}{\sqrt{2}} \checkmark$ $= 2,83 \text{ A} \checkmark$	$P_{\text{ave}} = \frac{V_{\text{rms}}^2}{R}$ $= \frac{100^2}{25} \checkmark = 200 \text{ W}$ $P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}} \checkmark$ $200 = \left( \frac{100}{\sqrt{2}} \right) I_{\text{rms}} \checkmark$ $I_{\text{rms}} = 2,83 \text{ A} \checkmark$

(4)

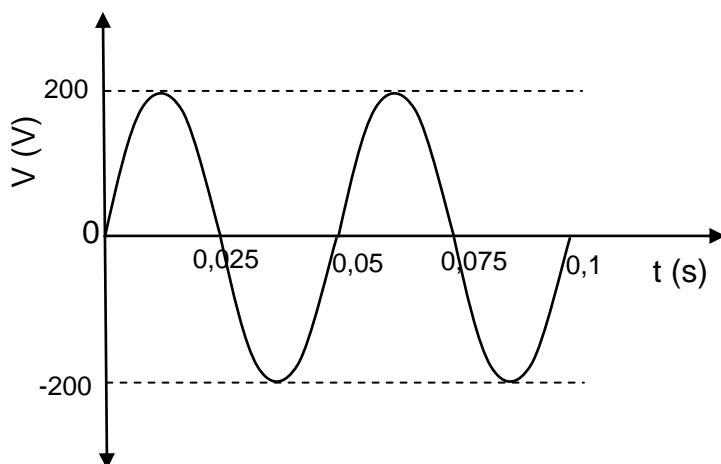
8.5

**POSITIVE MARKING FROM QUESTION 8.4 /  
POSITIEWE NASIEN VANAF VRAAG 8.4**

<p><b>OPTION 1/OPSIE 1</b></p> $P_{ave/gem} = \frac{V_{rms/wgk}^2}{R} \checkmark$ $= \frac{70,71^2}{25} \checkmark$ $= 200,00 \text{ W} \checkmark (200 \text{ W})$	<p><b>OPTION 2/OPSIE 2</b></p> $P_{ave} = V_{rms} I_{rms} \checkmark$ $= (70,71)(2,83) \checkmark$ $= 200,11 \text{ W} \checkmark$	<p><b>OPTION 3/OPSIE 3</b></p> $P_{ave/gem} = I_{rms/wgk}^2 R \checkmark$ $= (2,83)^2 (25) \checkmark$ $= 200,22 \text{ W} \checkmark$
<p><b>OPTION 4/OPSIE 4</b></p> $I_{rms/wgk} = \frac{I_{max/maks}}{\sqrt{2}}$ $2,83 = \frac{I_{max}}{\sqrt{2}}$ $I_{max/maks} = 4 \text{ A}$ $P_{ave/gem} = \frac{V_{max/maks} I_{max/maks}}{2} \checkmark$ $= \frac{(100)(4)}{2} \checkmark$ $= 200 \text{ W} \checkmark$		

(3)

8.6



**Marking criteria/Nasienkriteria**

- 2 waves  $\checkmark$   
2 golwe
- Period of wave is 0,05 s  $\checkmark$   
Periode van golf is 0,05 s
- Amplitude = 200 V  $\checkmark$

(3)

**[15]**