



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE/GRAAD 12

SEPTEMBER 2013

**PHYSICAL SCIENCES P1/
FISIESE WETENSKAPPE V1
MEMORANDUM**

MARKS: 150
PUNTE

This memorandum consists of 18 pages./*Hierdie memorandum
bestaan uit 18 bladsye.*

LEARNING OUTCOMES AND ASSESSMENT STANDARDS LEERUITKOMSTE EN ASSESSERINGSTANDAARDE		
LO/LU1	LO/LU2	LO/LU3
<p>AS 12.1.1 Plan and conduct a scientific investigation to collect data systematically with regard to accuracy, reliability and the need to control variables.</p> <p><i>Beplan en voer 'n wetenskaplike ondersoek uit om data sistematies te versamel ten opsigte van akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.</i></p>	<p>AS 12.2.1 Define and discuss basic prescribed and scientific knowledge.</p> <p><i>Definieer en bespreek basiese voorgeskrewe wetenskaplike kennis.</i></p>	<p>AS 12.3.1 Recognise, discuss and compare scientific and indigenous knowledge systems and knowledge claims by indicating the correlation among them, and explain the acceptance of different claims.</p> <p><i>Herken, bespreek en vergelyk wetenskaplike en inheemse kennissisteme en kennis aansprake deur die ooreenkoms aan te dui en verduidelik die aanvaarding van verskillende aansprake.</i></p>
<p>AS 12.1.2 Seek pattern and trends, represent them in different forms to draw conclusions, and formulate simple generalisations.</p> <p><i>Soek patrone en tendense, stel dit in verskillende vorms voor om gevolgtrekkings te maak en om eenvoudige veralgemenings te formuleer.</i></p>	<p>AS 12.2.2 Express and explain prescribed scientific theories, models and laws by indicating the relationship between different facts and concepts in own words.</p> <p><i>Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite konsepte in eie woorde aan te dui.</i></p>	<p>AS 12.3.2 Identify ethical and moral issues related to the development of science and technology and evaluate the impact (pros and cons) of the relationship from a personal viewpoint.</p> <p><i>Identifiseer etiese en morele uitkomst in verband met die ontwikkeling van die wetenskap en tegnologie en evalueer die impak (voordele en nadele) van die verhouding van 'n persoonlike oogpunt.</i></p>
<p>AS 12.1.3 Apply known problem-solving strategies to solve multi-step problems.</p> <p><i>Pas bekende probleemoplossingstrategieë toe om veelvuldige-stapprobleme op te los.</i></p>	<p>AS 12.2.3 Apply scientific knowledge in everyday life contexts.</p> <p><i>Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.</i></p>	<p>AS 12.3.3 Evaluate the impact of scientific and technological knowledge on sustainable development of resources and suggest long-term and short-term strategies to improve the management of resources in the environment.</p> <p><i>Evalueer die impak van wetenskaplike en tegnologiese kennis op volhoubare ontwikkeling van bronne en om kort-termyn en lang-termyn strategieë voor te stel om die bestuur van bronne in die omgewing te verbeter.</i></p>
<p>AS 12.1.4 Communicate and present scientific arguments with clarity and precision.</p> <p><i>Kommunikeer en verdedig wetenskaplike argument duidelik en presies.</i></p>		

GUIDELINES FOR MARKING/RIGLYNE VIR NASIEN

This section provides guidelines for the way in which marks will be allocated. The broad principles must be adhered to in the marking of Physical Sciences tests and examinations.

Hierdie afdeling verskaf riglyne vir die manier waarop punte toegeken sal word. Die breë beginsels moet tydens die nasien van Fisiese Wetenskappe toetse en eksamens gevolg word.

1.1 MARK ALLOCATION/PUNTE TOEKENNING

1.1.1 Calculations/Berekeninge:

- Marks will awarded for: correct formula, correct substitution, correct answer with unit.
- *Punte sal toegeken word vir: korrekte formule, korrekte substitusie, korrekte antwoord met eenheid.*
- No marks will be awarded if an incorrect or inappropriate formula is used, even though there may be relevant symbols and applicable substitutions.
- *Geen punte sal toegeken word waar 'n verkeerde of ontoepaslike formule gebruik word nie, selfs al is daar relevante simbole en relevante substitusies.*

1.1.2 Explanations and interpretations/Verduidelikings en interpretasie:

Allocation of marks to questions requiring interpretation or explanation e.g. AS 1.4, 2.2, 2.3, 3.1, 3.2 and 3.3, will differ and may include the use of rubrics, checklists, memoranda, etc. In all such answers emphasis must be placed on scientific concepts relating to the question.

Toekenning van punte by vrae wat interpretasie of verduideliking vereis bv. AS 1.4, 2.2, 2.3, 3.1, 3.2 en 3.3, sal verskil en mag die gebruik van rubrieke, kontrolelyste, memoranda, ens. insluit. By al hierdie antwoorde moet die beklemtoning op die wetenskaplike konsepte, met betrekking tot die vraag, val.

1.2 FORMULAE AND SUBSTITUTIONS/FORMULES EN SUBSTITUSIE

1.2.1 Mathematical manipulations and change of subjects of appropriate formulae carry no marks, but if a candidate starts with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and the correct substitutions. The mark for the incorrect numerical answer is forfeited.

Wiskundige manipulering en verandering van die voorwerp van toepaslike formules dra geen punte nie, maar as 'n kandidaat begin met die korrekte formule en dan die voorwerp van die formule verkeerd uitwerk, sal punte vir die formule en korrekte substitusie toegeken word.

1.2.2 When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.

*Wanneer 'n fout gedurende **substitusie in 'n korrekte formule** begaan word, sal 'n punt vir die korrekte formule en vir korrekte substitusie toegeken word, maar **geen verdere punte** sal toegeken word nie.*

1.2.3 Marks are only awarded for a formula if a calculation had been **attempted**, i.e. substitutions have been made or a numerical answer given.

*Punte sal slegs toegeken word vir 'n formule as 'n **poging aangewend was** om 'n berekening te doen d.w.s. substitusie was gedoen of 'n numeriese antwoord word verskaf.*

- 1.2.4 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.

Punte kan slegs toegeken word vir substitusies wanneer waardes in formules ingestel is en nie vir waardes wat voor 'n berekening gelys is nie.

- 1.2.5 All calculations, when not specified in the question, must be done to two decimal places.

Alle berekenings, wanneer nie in die vraag gespesifiseer word nie, moet tot twee desimale plekke gedoen word.

1.3 UNITS/EENHEDE

- 1.3.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question or sub-question**.

'n Kandidaat sal slegs een keer gepenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid in 'n vraag of subvraag.

- 1.3.2 Units are only required in the final answer to a calculation.

Eenhede word slegs in die finale antwoord tot 'n vraag verlang.

- 1.3.3 Marks are only awarded for an answer, and not for a unit per se. Candidates will therefore forfeit the mark allocated for the answer in each of the following situations:

- correct answer + wrong unit
- wrong answer + correct unit
- correct answer + no unit.

Punte word slegs vir 'n antwoord en vir 'n eenheid per se toegeken nie. Kandidate sal derhalwe die punt vir die antwoord in die volgende gevalle verbeur:

- korrekte antwoord + verkeerde eenheid
- verkeerde antwoord + korrekte eenheid
- korrekte antwoord + geen eenheid

- 1.3.4 SI units must be used except in certain cases, e.g. $V \cdot m^{-1}$ instead of $N \cdot C^{-1}$, and $cm \cdot s^{-1}$ or $km \cdot h^{-1}$ instead of $m \cdot s^{-1}$ where the question warrants this. (This instruction only applies to Paper 1).

SI-eenhede moet gebruik word behalwe in sekere gevalle, bv. $V \cdot m^{-1}$ in plaas van of $N \cdot C^{-1}$, en $cm \cdot s^{-1}$ of $km \cdot h^{-1}$ in plaas van $m \cdot s^{-1}$ waar die vraag dit verlang. (Hierdie instruksie geld slegs by Vraestel 1).

1.4 POSTIVE MARKING/POSITIEWE NASIEN

Positive marking regarding calculations will be followed in the following cases:

Positiewe nasien met betrekking tot berekeninge sal in die volgende gevalle geld:

- 1.4.1 **Sub-question to sub-question:** When a certain variable is calculated in one sub-question (e.g. 3.1) and needs to be substituted in another (3.2 or 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks** are to be awarded for the subsequent sub-questions.

Subvraag na subvraag: Wanneer 'n sekere veranderlike in een subvraag (bv. 3.1) bereken word en dan in 'n ander vervang moet word (3.2 of 3.3), bv. Indien die antwoord vir 3.1 verkeerd is en word korrek in 3.2 of 3.3 vervang, word volpunte aan die daaropvolgende subvraag toegeken.

- 1.4.2 **A multi-step question in a sub-question:** If the candidate has to calculate, for example, current in the first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.
'n Vraag met veelvuldige stappe in 'n subvraag: Indien 'n kandidaat byvoorbeeld, die aantal mol verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verloor die kandidaat die punt vir die substitusie sowel as die finale antwoord.
- 1.4.3 If a final answer to a calculation is correct, full marks will not automatically be awarded. Markers will always ensure that the correct/appropriate formula is used and that workings, including substitutions, are correct.
Indien 'n finale antwoord tot 'n berekening korrek is, sal volpunte nie outomaties toegeken word nie. Nasieners sal altyd verseker dat die korrekte toepaslike formule gebruik word en dat bewerkings, insluitende substitusies korrek is.
- 1.4.4 Questions where a series of calculations have to be made (e.g. a circuit diagram question) do not necessarily always have to follow the same order. FULL MARKS will be awarded provided it is a valid solution to the problem. However, any calculation that will not bring the candidate closer to the answer than the original data, will not count any marks.
Vrae waar 'n reeks berekeninge gedoen moet word (bv. 'n stroombaan diagram vraag) hoef nie noodwendig altyd dieselfde orde te volg nie. VOLPUNTE sal toegeken word mits dit 'n geldige oplossing tot die probleem is. Maar, enige berekening wat nie die kandidaat nader aan die antwoord bring as die oorspronklike data, sal geen punte tel nie.
- 1.4.5 If one answer or calculation is required, but two given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.
Indien een antwoord of berekening verlang word, maar twee word deur die kandidaat gegee, sal slegs die eerste een nagesien word, ongeag watter een korrek is. Indien twee antwoorde verlang word, sal slegs die eerste twee nagesien word, ens.
- 1.4.6 Normally, if based on a conceptual mistake, an incorrect answer cannot be correctly motivated. If the candidate is therefore required to motivate in question 3.2 the answer given to question 3.1, and 3.1 is incorrect, no marks can be awarded for question 3.2. However, if the answer for e.g. 3.1 is based on a calculation, the motivation for the incorrect answer for 3.2 could be considered.
Normaalweg, as dit gebaseer is op 'n voorstellingsfout, kan 'n verkeerde antwoord nie korrek gemotiveer word nie. As die kandidaat derhalwe gevra word met 'n vraag in 3.2 om die antwoord in vraag 3.1 te motiveer, en 3.1 is verkeerd, sal geen punte vir vraag 3.2 toegeken word nie. Maar, as die antwoord in bv. 3.1 gebaseer is op 'n berekening, kan die motivering vir die verkeerde antwoord oorweeg word.

- 1.4.7 If instructions regarding method of answering are not followed, e.g. the candidate does a calculation when the instruction was to **solve by construction and measurement**, a candidate may forfeit all the marks for the specific question.

*Indien instruksies aangaande metode van beantwoording nie gevolg word nie, bv. die kandidaat doen 'n berekening wanneer die instruksie **los op deur konstruksie en meting** was, mag die kandidaat al die punte vir die spesifieke vraag verbeur.*

- 1.4.8 For an **error of principle, no marks** are awarded (Rule 1) e.g. if the potential difference is 200 V and resistance is 25 Ω , calculate the current.

*Vir 'n **foutdraendebeginsel**, sal **geen punte** toegeken word nie (Reël 1) bv. as die potensiaalverskil 200 V en die weerstand 25 Ω is, bereken die stroom.*

CORRECT/ KORREK	ANSWER (1) ANTW (1)	POSSIBLE MOONTLIK	ANSWER (2) ANTW (2)	POSSIBLE MOONTLIK
$I = \frac{V}{R} \checkmark$ $= \frac{200}{25} \checkmark$ $= 8 \text{ A} \checkmark$	$R = \frac{V}{I} \checkmark$ $= \frac{200}{25} x$ $= 8 \text{ A } x$	$R = \frac{V}{I}$ $= \frac{200}{25}$ $= 8 \text{ A}$	$R = \frac{V}{I} \checkmark$ $I = \frac{R}{V} x$ $= \frac{25}{200}$ $= 0,125 \text{ A } x$	$I = \frac{V}{R} \checkmark$ $= 8 \text{ A} \checkmark$

SECTION/AFDELING A**QUESTION/VRAAG 1**

1.1	watt ✓	[12.2.1]	(1)
1.2	potential difference / <i>potensiaalverskil</i> ✓	[12.2.1]	(1)
1.3	diffraction / <i>diffraksie</i> ✓	[12.2.1]	(1)
1.4	(line) absorption spectrum / (<i>lyn</i>) <i>absorpsiespektrum</i> ✓	[12.2.1]	(1)
1.5	photoelectric effect / <i>fotoëlektriese effek</i> ✓	[12.2.1]	(1)
			[5]

QUESTION/VRAAG 2

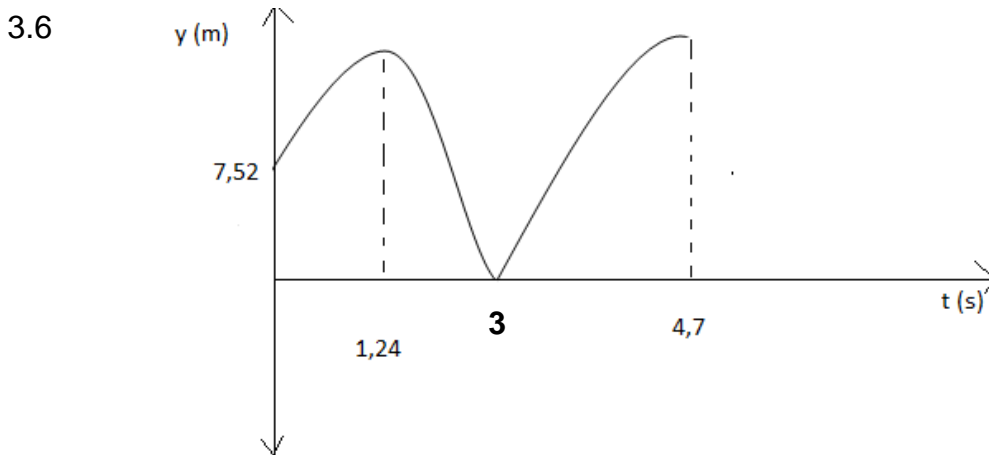
2.1	B ✓✓	[12.1.2]	(2)
2.2	D ✓✓	[12.2.3]	(2)
2.3	C ✓✓	[12.2.3]	(2)
2.4	D ✓✓	[12.1.2]	(2)
2.5	B ✓✓	[12.2.3]	(2)
2.6	C ✓✓	[12.2.1]	(2)
2.7	D ✓✓	[12.2.3]	(2)
2.8	B ✓✓	[12.1.2]	(2)
2.9	C ✓✓	[12.1.2]	(2)
2.10	C ✓✓	[12.1.2]	(2)
			[20]

TOTAL SECTION / TOTAAL AFDELING A: 25

SECTION/AFDELING B

QUESTION/VRAAG 3

- 3.1 Gravitational acceleration (g)/*gravitasieversnelling* (g) ✓ [12.2.1] (1)
- 3.2 12 m.s⁻¹ up / *op* ✓ [12.1.3] (1)
- 3.3 3.3.1 It is at its highest position/*by sy hoogste punt* ✓ [12.1.3] (1)
- 3.3.2 on the ground/*op die grond* ✓ [12.1.3] (1)
- 3.3.3 maximum height after it has bounced/*maksimum hoogte na die bons* ✓ [12.2.2] (1)
- 3.4 3.4.1 Area under the graph/*Area onder grafiek* = $\frac{1}{2} b \times h$ ✓
 $= \frac{1}{2} (3 - 1,24)(17)$ ✓ - $\frac{1}{2} (1,24)(12)$ ✓
 $= 14,96 - 7,44$
 $= 7,52 \text{ m}$ ✓ [12.1.3] (4)
- 3.4.2 Area under the graph/*Area onder grafiek* = $\frac{1}{2} b \times h$
 $= \frac{1}{2} (4,7 - 3) \times (17)$ ✓
 $= 14,45 \text{ m}$ ✓ [12.1.3] (3)
- 3.5 $F_{\text{net}} \Delta t = \Delta p$ ✓
 $= m (v_f - v_i)$
 $= 150 \times 10^{-3} (17 - (-17))$ ✓
 $= 150 \times 10^{-3} (34)$
 $= 5,1 \text{ kg.m.s}^{-1}$ ✓ up / *op* [12.1.3] (3)



1 mark for the shape of the graph (going up then bouncing back up)/*1 punt vir die vorm van die grafiek (gaan op, bons dan terug op)*

1 mark for the height of the bounce equal the height of throw/
1 punt vir die hoogte van die bons gelyk aan die hoogte van die gooi

1 mark for **not** starting at $y = 0$ ($y = 7,52$)
 1 punt in die **nie** begin by $y = 0$ ($y = 7,52$)

(-1 mark if both axes are not labelled)
 (-1 punt indien beide asse nie benoem nie)

[12.1.3] (3)
[18]

QUESTION/VRAAG 4

4.1 Its velocity decreases \checkmark (from $12 \text{ m}\cdot\text{s}^{-1}$ to $0 \text{ m}\cdot\text{s}^{-1}$) as it moves up \checkmark /uniform deceleration as it moves up.
 Sy snelheid neem af \checkmark (van $12 \text{ m}\cdot\text{s}^{-1}$ tot $0 \text{ m}\cdot\text{s}^{-1}$) terwyl dit op beweeg \checkmark /uniforme vertraging terwyl dit op beweeg. [12.2.1] (2)

4.2 $\Delta E_k = E_{kf} - E_{ki} \checkmark$
 $= \frac{1}{2} (5)(0)^2 - \frac{1}{2} (5)(12)^2 \checkmark$
 $= -360 \text{ J} \checkmark$ [12.1.3] (3)

4.3 POSITIVE MARKING FROM 4.2/POSITIEWE NASIEN VAN 4.2

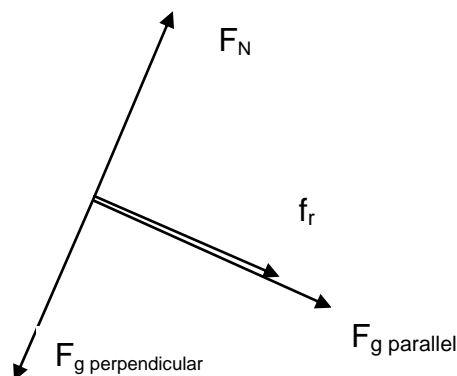
$-360 \text{ J} \checkmark$ [12.1.3] (1)

4.4 The work done by a net force (on an object) is equal to \checkmark the change in kinetic energy (of that particular object). \checkmark
 Die arbeid verrig deur 'n netto/resultante krag is gelyk aan \checkmark die verandering in kinetiese energie (van die voorwerp). \checkmark

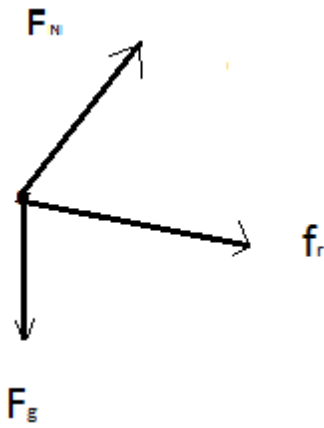
OR/OF

The net/total work (done on an object) is equal to \checkmark the change in kinetic energy (of the object). \checkmark
 Die netto/totale arbeid verrig (op 'n voorwerp) is gelyk aan \checkmark die verandering in kinetiese energie (van die voorwerp). \checkmark [12.12.1] (2)

4.5



4.5



One mark for F_N → Normal force/
normaalkrag
 One mark for F_{fr} → frictional
 force/*wrywing*
 One mark for $F_{g\perp}$ and $F_{g\parallel}$
 (components of gravitational force)
 / *komponente van gravitasiekr*

OR/OF

one mark for F_g gravitational force/
gravitasiekr

[12.1.3] (3)

4.6

$$\begin{aligned} W_{F_g} &= F_g \cos \Theta \Delta x \checkmark \\ &= mg \cos \Theta \Delta x \\ &= 5 \times 9,8 \cos (16^\circ + 90^\circ)(8,4) \checkmark \\ &= -113,45 \text{ J } \checkmark \end{aligned}$$

OR/OF

$$\begin{aligned} W_{F_g} &= mg \Delta h \checkmark \\ &= 5 (9,8) (0 - 8,4 \sin 16^\circ) \checkmark \\ &= -113,45 \text{ J } \checkmark \end{aligned}$$

[12.1.3] (3)

4.7

POSITIVE MARKING FROM/POSITIEWE NASIEN VAN
 QUESTION/VRAAG 4.2 AND/EN QUESTION/VRAAG 4.6

$$\begin{aligned} W_{NET} &= \Delta E_k \checkmark \\ W_{fr} + W_{F_{g\parallel}} \checkmark &= \Delta E_k \quad (W_N = 0 \text{ J and/en } W_{F_{g\perp}} = 0 \text{ J) since/omdat } \cos 90^\circ = 0 \\ W_{fr} + (-113,45) \checkmark &= -360 \checkmark \\ W_{fr} &= -246,55 \text{ J } \checkmark \end{aligned}$$

OR/OF

$$\begin{aligned} W_{NET} &= \Delta E_k \checkmark \\ F_{NET} \Delta x \cos \Theta \checkmark &= \Delta E_k \\ F_{NET} (8,4) \cos 180^\circ &= -360 \checkmark \\ (F_{fr} + F_{g\parallel}) (8,4) \cos 180^\circ &= -360 \\ F_{fr} (8,4) \cos 180^\circ + f_{g\parallel} (8,4) \cos 180^\circ &= -360 \\ W_{fr} + 13,506 (-1) 8,4 \checkmark &= -360 \\ W_{fr} &= -246,55 \text{ J } \checkmark \end{aligned}$$

[12.1.3] (5)
[19]

QUESTION/VRAAG 5

- 5.1 Higher, \checkmark B is moving towards A, the wavelengths will thus be less at A. \checkmark
Hoër, \checkmark B beweeg nader aan A, dus sal die golflengtes minder wees by A. \checkmark [12.2.1] (2)
- 5.2 $f_L = (v \pm v_L / v \pm v_s) f_s \checkmark$
 $= (343 + 0 / 343 - 8,33) \checkmark 13 \times 10^3 \checkmark$
 $= 13\,323,57 \text{ Hz} \checkmark$ [12.1.3] (4)
- 5.3 When the truck is next to her/*Wanneer die trok langs haar is.* \checkmark [12.2.1] (1)
- 5.4 Doppler effect, \checkmark the apparent change in frequency \checkmark when a listener and source move with respect to one another. \checkmark
Doppler-effek \checkmark die skynbare verandering in frekwensie \checkmark indien die luisteraar en bron ten opsigte van mekaar beweeg. \checkmark [12.2.1] (3)
- 5.5 Remain the same/*dieselfde* $\checkmark\checkmark$ (2)
[12]

QUESTION/VRAAG 6

- 6.1 Nodal lines are dark lines caused by destructive interference. ✓✓/
Nodale lyne is donker lyne wat vorm as gevolg van destruktiewe interferensie. ✓✓ [12.3.1] (2)

- 6.2 bright band where waves meet in phase ✓ (resulting in constructive interference)/
helder bande waar golwe in fase ontmoet ✓ (konstruktiewe interferensie)



Dark band where waves meet out of phase ✓ (resulting in destructive interference)/
Donker bande waar golwe uit fase ontmoet ✓ (destruktiewe interferensie)

One mark for broad central band/een punt vir breë sentrale strook. ✓

One mark for alternate dark and bright bands/een punt vir afwisselende donker en ligte bande. ✓

[12.1.3] (4)

6.3 6.3.1 $\sin \Theta = m\lambda / a$ ✓

$$= 3 \sqrt{\frac{664 \times 10^{-9}}{1,20 \times 10^{-4}}} \checkmark$$

$$= 1,66 \times 10^{-2}$$

$$\Theta = 0,95^\circ \checkmark$$

[12.1.3] (4)

6.3.2 POSITIVE MARKING FROM/POSITIEWE NASIEN VAN QUESTION/VRAAG 6.3

$$\tan \Theta = \frac{y}{2,75}$$

$$\tan 0,95^\circ = \frac{y}{2,75} \quad \checkmark$$

$$y = 0,046 \text{ m } \checkmark$$

[12.1.3] (2)
[12]

QUESTION/VRAAG 7

- 7.1 Electric field is a region (space) in which a charge will experience an electrostatic force. $\checkmark\checkmark$
Elektriese veld is 'n gebied (ruimte) waarin 'n lading 'n elektrostatische krag sal ondervind. $\checkmark\checkmark$ [12.2.3] (2)

$$7.2 \quad E_1 = kq/r^2 \checkmark$$

$$= \frac{9 \times 10^9 (15 \times 10^{-9})}{(2 \times 10^{-2})^2} \checkmark$$

$$= 337\,500 \text{ N.C}^{-1} \text{ left/links}$$

$$E_2 = kq / r^2$$

$$= \frac{9 \times 10^9 X}{(8 \times 10^{-2})^2} \checkmark$$

$$= 1,40625 \times 10^{12} X \text{ N.C}^{-1} \text{ left/links}$$

$$E_{\text{net}} = E_1 + E_2 \checkmark$$

$$3,943 \times 10^5 = 337\,500 + 1,40625 \times 10^{12} X \checkmark$$

$$\frac{3,943 \times 10^5 - 337\,500}{1,40625 \times 10^{12}} = \frac{1,40625 \times 10^{12} X}{1,40625 \times 10^{12}}$$

$$X = 4,04 \times 10^{-8} \text{ C} \checkmark \quad [12.3.1] \quad (6)$$

- 7.3 POSITIVE MARKING FROM QUESTION/POSITIEWE NASIEN VANAF VRAAG 7.2

$$Q \text{ on each sphere} = \frac{Q_1 + Q_2}{2} \checkmark$$

$$= \frac{4,04 \times 10^{-8} + (-15 \times 10^{-9})}{2} \checkmark$$

$$= 1,27 \times 10^{-8} \text{ C}$$

$$F_{\text{NEW/NUUT}} = \frac{k Q_1 Q_2}{r^2} \checkmark$$

$$= \frac{9 \times 10^9 \times (1,27 \times 10^{-8})^2}{(10 \times 10^{-2})^2} \checkmark$$

$$= 1,45 \times 10^{-4} \text{ N} \checkmark \quad \text{attraction/aantrekkend} \checkmark \quad [12.1.3] \quad (6)$$

7.4 Any TWO of the following:

- Avoid being the highest point out in an open area like fields, golf courses or parking lots/*Moenie die hoogste punt in 'n oop area soos 'n veld, gholfbaan of parkeerarea wees nie.*
- The safest place is inside a car/*Die veiligste plek is binne-in 'n kar.*
- Stay away from any form of metal e.g. umbrellas and golf clubs./*Bly weg van enige vorm van metaal bv. sambrele en gholfstokke.*
- Get away from water/*Bly weg van water.*
- Do not stand under tall objects like trees and towers./*Moenie onder hoë voorwerpe soos bome of torings staan nie.*
- Do not fly any kites/*Moenie vlieërs vlieg nie.*
- Any relevant answer/*Enige relevante antwoord.*

[12.3.1] (2)
[16]

QUESTION/VRAAG 8

8.1 capacitance will increase ✓

$$C = \frac{\epsilon_0 A}{d} \quad \text{OR } C = Q/Ed, \quad C \text{ and } d \text{ are inversely proportional } \checkmark$$

kapasitansie sal vermeerder ✓

$$C = \frac{\epsilon_0 A}{d} \quad \text{OF } C = Q/Ed, \quad C \text{ en } d \text{ is omgekeerd eweredig } \checkmark$$

[12.2.1] (2)

8.2 $C = \frac{\epsilon_0 A}{d} \quad \checkmark$

$$= \frac{8,85 \times 10^{-12} \times 33,25 \times 10^{-5}}{0,015 \times 10^{-3}} \quad \checkmark$$

$$= 1,96 \times 10^{-10} \text{ F } \quad \checkmark$$

[12.1.3] (3)

8.3 decrease ✓ ($V = Ed$, E_{NET} is smaller therefore V is also smaller) ✓/
verminder ✓ ($V = Ed$, E_{NET} is minder dus sal V ook verminder) ✓

[12.2.1] (2)
[7]

QUESTION/VRAAG 9

9.1 The maximum work done per unit charge. ✓✓/
Die maksimum arbeid verrig per eenheid lading. ✓✓ [12.2.2] (2)

9.2 $\frac{1}{R_p} = \frac{1}{4} + \frac{1}{6}$ ✓
 $R_p = 2,4 \Omega$ ✓
 $R \text{ (total)} = 2,4 + 6 + 10 + 2$ ✓
 $= 20,4 \Omega$
 $I = \frac{V}{R} = \frac{30}{20,4} = 1,47 \text{ A}$ ✓

OR / OF

$R_{ex} = 2,4 + 6 + 10 = 18,4 \Omega$ ✓
 $\text{emf} = I (R + r)$ ✓
 $30 = I (18,4 + 2)$ ✓
 $I = 1,47 \text{ A}$ ✓

9.3 $V_p = IR_p = (1,47)(2,4) = 3,53 \text{ V}$ ✓ [12.3.1] (6)
 (3)
[11]

QUESTION/VRAAG 10

10.1 10.1.1 Electrical energy ✓ is converted to mechanical energy ✓/
Elektriese energie ✓ is omgesit in meganiese energie ✓ [12.2.2] (2)

10.1.2 DC motor uses permanent magnets ✓ whereas AC motor uses electromagnets. ✓
GS-motors gebruik permanente magnete ✓ en WS-motors gebruik elektromagnete. ✓

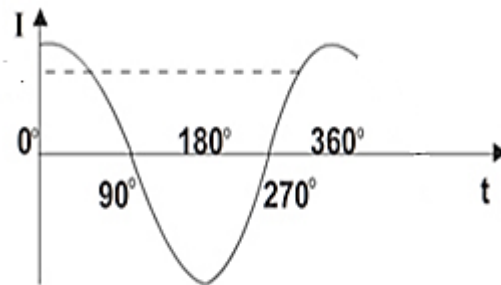
OR/OF

DC motor depends on brushes for contact making to reverse current through the rotating coil ✓ whereas AC motor depends on reversing magnetic field produced by AC through a stationary coil. ✓
GS-motors maak gebruik van borsels om kontak te maak en draai die stroom in die anker om ✓ waar WS-motors gebruik maak van 'n omkeerbare magneetveld wat veroorsaak word deur WS in 'n stilstaande anker. ✓ [12.2.2] (2)

10.1.3 A car battery produces direct current. ✓ (The speed of the windscreen wiper can easily be changed without losing too much torque). ✓
'n Motorbattery verskaf gelykstroom ✓ (Die spoed van die ruitveër kan verander word sonder om te veel wringrag te verloor.) [12.3.1] (1)

- 10.2 10.2.1 1 – Magnets/magnete ✓
2 – Coil of conducting wire/spoel geleidingsdraad ✓ [12.2.2] (2)
- 10.2.2 Anticlockwise/antikloksgewys ✓ [12.2.2] (1)
- 10.2.3 Right hand dynamo rule/regterhand dinamoreël ✓ [12.2.2] (1)

10.2.4



One mark for the shape of the graph/Een punt vir die vorm van die grafiek.

One mark for axes labelled/een punt vir die benoeming van asse

One mark for at least one angle indicated/Een punt vir die aantoon van ten minste een hoek.

[12.1.3] (3)

- 10.2.5 In phase. ✓ When the *emf* is a maximum, ✓ it produces a current which is also a maximum. ✓
In fase. ✓ As die emk 'n maksimum is produseer dit 'n maksimum stroom. ✓

[12.2.2] (3)

- 10.2.6 The slip rings remain in contact with the rotating coil ✓ and conduct the AC induced in the armature to the external circuit via the brushes. ✓
Die sleepringe bly in kontak met die draaiende spoel ✓ en gelei wisselstroom wat in die anker geïnduseer word na die eksterne stroombaan d.m.v. die borsels. ✓

[12.2.2] (2)

- 10.2.7 The slip rings must be replaced by a split ring commutator. ✓
Vervang die sleepringe met 'n splitringkommutator ✓

[12.2.2] (1)

[18]

QUESTION/VRAAG 11

- 11.1 11.1.1 Used in security checks at airports and to image bone structures. ✓/Gebruik in sekuriteitskontrole by lughawens en beeldskepping van beenstrukture. ✓ [12.2.3] (1)
- 11.1.2 Used in optical fibres/in remote controls/night vision/heat sensors ✓/Gebruik in optiese vesel / afstandbeheer/nagvisie/hitte sensors. ✓ [12.2.3] (1)
- 11.1.3 Used to sterilise food and equipment/treat cancer. ✓ (or any other relevant answer)/Steriliseer kos en toerusting/behandeling van kanker. ✓ (enige relevante antwoord) [12.2.3] (1)
- 11.2 Frequency/frekwensie ✓ [12.2.3] (1)
- 11.3 Constant variable/gekontroleerde veranderlike ✓ ($c = f\lambda$) [12.2.1] (1)
- 11.4 Both hypotheses are wrong ✓ because the higher the frequency, the higher the energy resulting in higher penetrating ability (E directly proportional to f) ✓/Beide hipoteses is verkeerd, ✓ want hoe hoër die frekwensie hoe hoër die energie wat 'n hoër indringingsvermoë veroorsaak (E is direk eweredig aan f) ✓ [12.2.2] (2)

[7]

QUESTION/VRAAG 12

12.1	12.1.1	(Photo) electrons/(foto) elektrone ✓	[12.2.2]	(1)
	12.1.2	Electrons/ elektrone ✓	[12.2.2]	(1)
12.2		Photons/fotone ✓	[12.2.2]	(1)
12.3	12.3.1	Reading increases/lesing neem toe ✓	[12.2.2]	(1)
	12.3.2	The higher the light intensity, the more photons reach the cathode per second. <u>More photo-electrons are then liberated per second</u> and move through the ammeter. ✓ <i>Hoe hoër die ligintensiteit, hoe meer fotone sal die katode per sekonde tref. <u>Meer foto-elektrone sal per sekonde vrygestel word en deur die ammeter beweeg.</u> ✓</i>	[12.2.2]	(1) [5]

TOTAL SECTION/ TOTAAL AFDELING B: 125
GRAND TOTAL/GROOTTOTAAL: 150