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**NATIONAL
SENIOR CERTIFICATE**

GRADE/*GRAAD* 12

SEPTEMBER 2012

**PHYSICAL SCIENCES P1
*FISIESE WETENSKAPPE V1***

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 14 pages.
Hierdie memorandum bestaan uit 14 bladsye.

LEARNING OUTCOMES AND ASSESSMENT STANDARDS LEERUITKOMSTE EN ASSESSERINGSTANDAARDE		
LO/LU1	LO/LU2	LO/LU3
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. <i>Beplan en voer 'n wetenskaplike ondersoek uit om data sistematies te versamel ten opsigte van akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.</i>	AS 12.2.1 Define and discuss basic prescribed and scientific knowledge. <i>Definieer en bespreek basiese voorgeskrewe wetenskaplike kennis.</i>	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. <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>
AS 12.1.2 Seek pattern and trends, represent them in different forms to draw conclusions, and formulate simple generalisations. <i>Soek patrone en tendense, stel dit in verskillende vorms voor om gevolgtrekkings te maak en om eenvoudige veralgemenings te formuleer.</i>	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. <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>	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. <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>
AS 12.1.3 Apply known problem-solving strategies to solve multi-step problems. <i>Pas bekende probleemoplossingstrategieë toe om veelvuldige-stapprobleme op te los.</i>	AS 12.2.3 Apply scientific knowledge in everyday life contexts. <i>Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.</i>	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. <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>
AS 12.1.4 Communicate and present scientific arguments with clarity and precision. <i>Kommunikeer en verdedig wetenskaplike argument duidelik en presies.</i>		

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 manipulerings 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. $\text{V}\cdot\text{m}^{-1}$ instead of $\text{N}\cdot\text{C}^{-1}$, and $\text{cm}\cdot\text{s}^{-1}$ or $\text{km}\cdot\text{h}^{-1}$ instead of $\text{m}\cdot\text{s}^{-1}$ where the question warrants this. (This instruction only applies to Paper 1).

SI-eenhede moet gebruik word behalwe in sekere gevalle, bv. $\text{V}\cdot\text{m}^{-1}$ in plaas van of $\text{N}\cdot\text{C}^{-1}$, en $\text{cm}\cdot\text{s}^{-1}$ of $\text{km}\cdot\text{h}^{-1}$ in plaas van $\text{m}\cdot\text{s}^{-1}$ 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
$I = \frac{V}{R} \checkmark$ $= \frac{200}{25} \checkmark$ $= 8 \text{ A} \checkmark$	$R = \frac{V}{I} \checkmark$ $= \frac{200}{25} \times$ $= 8 \text{ A} \times$	$R = \frac{V}{I}$ $= \frac{200}{25}$ $= 8 \text{ A}$	$R = \frac{V}{I} \checkmark$ $I = \frac{R}{V} \times$ $= \frac{25}{200}$ $= 0,125 \text{ A} \times$	$I = \frac{V}{R} \checkmark$ $= 8 \text{ A} \checkmark$

SECTION/AFDELING A

QUESTION/VRAAG 1: ONE WORD ITEMS/EENWOORD-ITEMS

- | | | | |
|-----|--|----------|-----|
| 1.1 | Isolated system/Geïsoleerde sisteem ✓ | [12.2.1] | (1) |
| 1.2 | Power/Drywing ✓ | [12.2.1] | (1) |
| 1.3 | Alternator ✓ | [12.2.1] | (1) |
| 1.4 | Destructive interference/Destruktiwe interferensie ✓ | [12.2.1] | (1) |
| 1.5 | Ultraviolet light/Ultravioletlig ✓ | [12.2.1] | (1) |

[5]

QUESTION/VRAAG 2: MULTIPLE CHOICE QUESTIONS/MEERVOUDIGEKEUSE-VRAE

- | | | | | |
|------|---|----|----------|-----|
| 2.1 | C | ✓✓ | [12.2.3] | (2) |
| 2.2 | C | ✓✓ | [12.2.3] | (2) |
| 2.3 | D | ✓✓ | [12.2.3] | (2) |
| 2.4 | C | ✓✓ | [12.2.3] | (2) |
| 2.5 | B | ✓✓ | [12.2.3] | (2) |
| 2.6 | A | ✓✓ | [12.2.3] | (2) |
| 2.7 | B | ✓✓ | [12.2.3] | (2) |
| 2.8 | D | ✓✓ | [12.2.3] | (2) |
| 2.9 | C | ✓✓ | [12.2.3] | (2) |
| 2.10 | A | ✓✓ | [12.2.3] | (2) |

[20]

TOTAL SECTION/TOTAAL AFDELING A: 25

SECTION B/AFDELING B**QUESTION 3/VRAAG 3**

3.1 8 m ✓ [12.2.1] (1)

3.2 0,8 s ✓ – the time taken by the ball to rise is equal to the time it takes to fall to the same position where it was projected ✓ [12.2.3] (2)
tyd op = tyd af vanaf 'n gegewe punt

3.3 **take upward motion as positive [FOR QUESTION 3.3 to 3.7]**
neem opwaarts as positief [VIR VRAE 3.3 tot 3.7]
 $v_f = v_i + g \Delta t$ ✓
 $0 = v_i + (-9,8) (0,4)$ ✓
 $= v_i - 3,92$
 $v_i = 3,92 \text{ m} \cdot \text{s}^{-1}$ up/op ✓ [12.2.2] (3)

3.4 **POSITIVE MARKING FROM 3.3**
POSITIEWE NASIEN VAN 3.3

$$\begin{aligned} \Delta y &= v_i \Delta t + \frac{1}{2} g \Delta t^2 \checkmark \\ &= (3,92) (0,4) + \frac{1}{2} (-9,8) (0,4)^2 \checkmark \\ &= 0,784 \text{ m} \checkmark \end{aligned}$$

$$\begin{aligned} \text{The maximum height/maksimum hoogte} &= 8 \text{ m} + 0,78 \\ &= 8,78 \text{ m} \checkmark \end{aligned} \quad [12.2.1]$$

OR/OF

$$\begin{aligned} v_f^2 &= v_i^2 + 2g \Delta y \checkmark \\ (0)^2 &= (3,92)^2 + 2 (-9,8) \Delta y \checkmark \\ \Delta y &= 0,784 \text{ m} \checkmark \\ \text{Maximum height/maksimum hoogte} &= 8 \text{ m} + 0,78 = 8,78 \text{ m} \checkmark \end{aligned}$$

OR/OF

$$\begin{aligned} \Delta y &= \frac{(v_i + v_f) t}{2} \checkmark \\ &= \frac{(3,92 + 0) 0,4}{2} \checkmark \\ &= 0,78 \text{ m} \checkmark \\ \text{Maximum height/maksimum hoogte} &= 8 \text{ m} + 0,78 \text{ m} \\ &= 8,78 \text{ m} \checkmark \end{aligned} \quad (4)$$

3.5 **POSITIVE MARKING FROM 3.3 and 3.4**
POSITIEWE NASIEN VAN 3.3 en 3.4

from maximum height downwards/van maksimum hoogte afwaarts

$$\begin{aligned} v_f^2 &= v_i^2 + 2g \Delta y \checkmark \\ &= (0)^2 + 2 (-9,8) (-8,78) \checkmark \\ v_f &= 13,12 \text{ m} \cdot \text{s}^{-1} \checkmark \end{aligned} \quad [12.1.2]$$

OR/OF

From the balcony upwards/van die balkon afwaarts

$$\begin{aligned} v_f^2 &= v_i^2 + 2a \Delta y \checkmark \\ &= 3,92^2 + 2 (-9,8) (-8) \checkmark \\ v_f &= 13,12 \text{ m} \cdot \text{s}^{-1} \checkmark \end{aligned} \quad (4)$$

3.6 POSITIVE MARKING FROM 3.3 - 3.5

POSITIEWE NASIEN VAN 3.3 - 3.5From maximum height/*van maksimum hoogte*

$$\Delta y = v_i \Delta t + \frac{1}{2} g \Delta t^2 \checkmark$$

$$-8,78 = 0 \times \Delta t + \frac{1}{2} (-9,8) \Delta t^2 \checkmark$$

$$t = 1,34 \text{ s}$$

$$\text{therefore total time/} \textit{totale tyd} = 0,4 + 1,34 = 1,74 \text{ s} \checkmark$$

[12.1.2] (3)

OR/OFFrom maximum height/
van maksimum hoogte

$$v_f = v_i + a \Delta t \checkmark$$

$$13,12 = 0 + 9,8 t \checkmark$$

$$t = 1,34 \text{ s}$$

$$\text{total } t = 0,4 + 1,34 = 1,74 \text{ s} \checkmark$$

OR/OFFrom balcony/
Van balkon

$$\Delta y = \left(\frac{v_f + v_i}{2} \right) t \checkmark$$

$$-8 = \left(\frac{-13,12 + 3,92}{2} \right) t \checkmark$$

$$t = 1,74 \text{ s} \checkmark$$

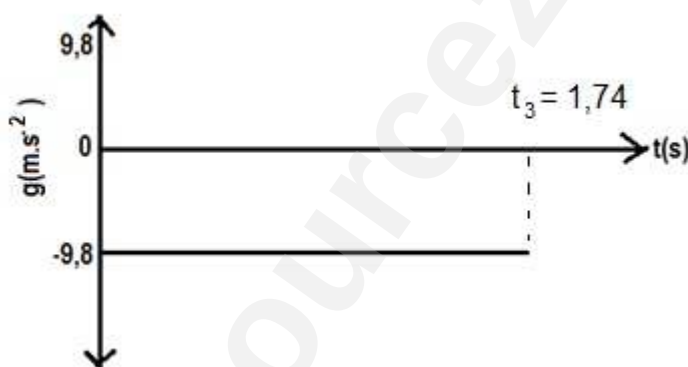
OR/OFFrom balcony/
Van balkon

$$v_f = v_i + a \Delta t \checkmark$$

$$-13,12 = +3,92 +$$

$$(-9,8)t \checkmark$$

$$t = 1,74 \text{ s} \checkmark$$

3.7 The graph of acceleration vs. time/*Die grafiek van versnelling vs. tyd*One mark for labelling both axes/*een punt vir byskrifte van beide asse*One mark for the shape of the graph/*een punt vir die vorm van grafiek*

[12.1.2]

(2)

[19]

QUESTION 4/VRAAG 44.1 mechanical energy/*meganiese energie* ✓

[12.1.2] (1)

4.2 4.2.1 The speed of the ball at A & B is the same ✓ because there is no external force acting on the ball, the surface is frictionless ✓ **or** Newton's first law of motion. [12.3.1]

*Die spoed van die bal by A & B is gelyk ✓ want daar is geen eksterne krag wat op die bal inwerk nie, die oppervlak is wrywingloos ✓ **or** Newton se eerste wet*

(2)

4.2.2 The ball is moving at a lower speed at B than at A ✓ because the rough surface has an external force which is frictional force ✓ acting on the ball [12.3.2]

Die bal se spoed is laer by B as by A ✓ want die oppervlak is grof en 'n eksterne krag, wrywing, ✓ werk op die bal in

(2)

4.3 Investigation 1/Ondersoek 1

Since/Omdat $v_A = v_B$

which implies that/daarom $E_{KA} = E_{KB}$ and since/en omdat $E_{PA} = E_{PB}$ ✓

Mechanical energy at A = Mechanical energy at B ✓

Meganiese energie by A = Meganiese energie by B

Investigation 2/ondersoek 2

$v_A > v_B$

therefore/daarom $E_{KA} \neq E_{KB}$ ✓ but $E_{PA} = E_{PB}$

Mechanical energy at A is not equal to mechanical at B ✓ because there is friction and mechanical energy is not conserved. [12.3.2]

Meganiese energie by B is nie gelyk aan meganiese energie by A want daar is wrywing (4)

4.4 The principle of conservation of mechanical ✓ energy states that in an isolated system total mechanical energy is conserved ✓ [12.2.1]

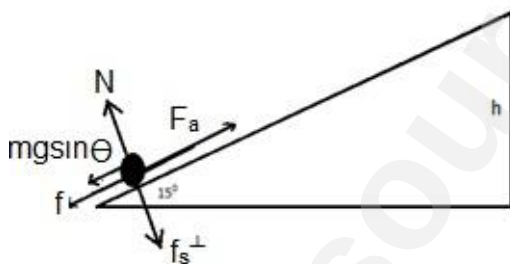
Beginsel van behoud van meganiese energie stel dat in 'n geslote sisteem totale meganiese energie behoue sal bly (2)

[11]

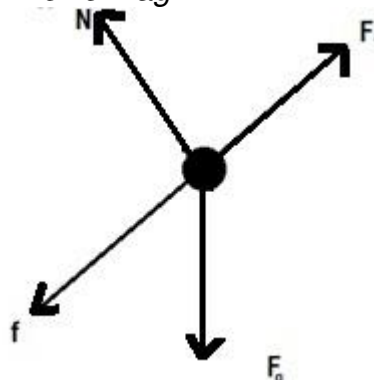
QUESTION 5/VRAAG 5

5.1 The free body diagram/Vryeliggaamdiagram

One mark for each force indicated/Een punt vir elke krag



or



F_a - force applied/toegepaste krag

f - frictional force/wrywing

N - normal force/normaalkrag

$f_{g\perp}$ - $\perp$ component of gravitational force

$f_{g\parallel}$ - $mg \sin \theta$ component of gravitational force OR

F_g - gravitational force/gravitasiekrag

[12.2.3] (4)

$$\begin{aligned} 5.2 \quad W_{\text{net}} &= \Delta E_k \quad \checkmark \\ &= \frac{1}{2} m (2^2 - 2^2) \\ &= 0 \text{ J} \quad \checkmark \end{aligned}$$

[12.2.3] (2)

$$\begin{aligned} 5.3 \quad F_{\text{NET}} &= ma = 0 \quad \checkmark \\ F_{\text{net}} &= F_a + mg \sin \theta + f = 0 \\ F_a &= 400 \times 9,8 \sin 15^\circ \quad \checkmark + 1400 \quad \checkmark \\ &= 2414,57 \text{ N} \quad \checkmark \end{aligned}$$

[12.1.3] (4)

5.4 $P = F v$ ✓
 $= 2\,414,57 \times 2$ ✓
 $= 4\,829,14 \text{ W}$ ✓ [12.1.3] (3)

5.5 $\sin 15^\circ = h/6$ ✓
 $h = 1,55 \text{ m}$ ✓ [12.2.3] (2)

5.6 5.6.1 $W_{\text{climber}} = W_{\text{hiker}} \checkmark / W_{\text{klimmer}} = W_{\text{stapper}}$
 The magnitude of their mass is the same, the vertical height of the mountain they are climbing is the same ✓
Die grootte van hul massas is gelyk, die vertikale hoogte van die berg is dieselfde
 $E = mgh = W$ [12.3.2] (2)

5.6.2 The hiker has more power / *Die stapper het meer drywing* ✓
 The time taken by the hiker is less than the time taken by the climber and / *die stapper neem korter tyd as die klimmer en*
 $P = W/t$
 Therefore power is inversely proportional to time. ✓
Daarom is drywing omgekeerd eweredig aan tyd [12.3.2] (2)

[19]

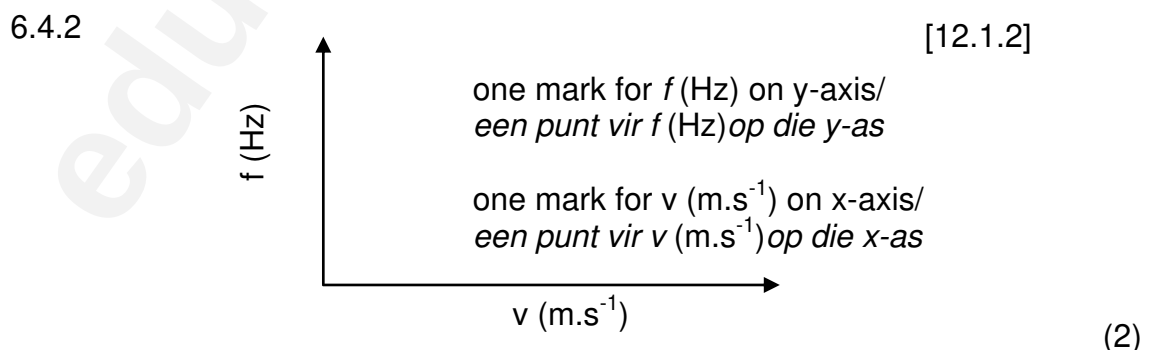
QUESTION 6 / VRAAG 6

6.1 moving away / *beweeg weg* ✓ [12.2.2] (1)

6.2 Doppler effect ✓ [12.2.3] (1)

6.3 $f_L = f_S (v \pm v_L / v \pm v_S)$ ✓
 $700 \checkmark = 900 (343/343 + v_s)$ ✓
 $v_s = 98 \text{ m} \cdot \text{s}^{-1}$ ✓ [12.2.3] (4)

6.4 6.4.1 **Controlled variables** (any two) /
Beheerbare veranderlikes (enige twee)
 - direction the sound source moves / *rigting waarin klankbron beweeg* ✓
 - frequency of the sound source / *frekwensie van die klankbron* ✓
 - speed of the listener (stationary) / *spoed van die luisteraar (stilstaande)*
 - speed of sound or air temperature / *spoed van klank of lug temp.* [12.1.2] (2)



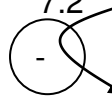
6.4.3 Reject the hypothesis, the **higher** the frequency the stationary observer hears ✓ because the source moves towards the stationary observe [12.3.2]
Verwerp die hipotese, hoe hoër die frekwensie wat 'n stilstaande luisteraar hoor want die klankbron beweeg na die luisteraar (1)

[11]

QUESTION 7/VRAAG 7

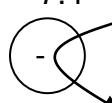
- 7.1 **Huygen's principle** states that every point in a wave front acts as a secondary wavelet that spreads out in all directions with the same speed as the wave. ✓✓ [12.2.1]

Huygens se beginsel verklaar dat elke punt op 'n golffront reageer soos 'n bron van sekondêre golfies wat in alle rigtings met dieselfde spoed as die golf uitsprei. (2)

- 7.2  Diffraction pattern B/Diffraksiepatroon B ✓
Because yellow light has a longer wavelength therefore the longer the wavelength the wider the diffraction pattern. ✓✓ Diffraction pattern B is more spread out than diffraction pattern A. [12.2.3]
Geel lig het 'n langer golflengte en daarom 'n breër diffraksie patroon. Diffraksiepatroon B is meer uitgesprei as diffraksiepatroon A

OR diffraction is directly proportional to wavelength
OF diffraksie is direk eweredig aan golflengte (3)

- 7.3 $\sin \theta = m \frac{\lambda}{a}$ ✓
 $= \frac{1 \times 460 \times 10^{-9}}{5 \times 10^{-6}}$ ✓
 $\theta = 5,28^\circ$ ✓ [12.1.3] (3)

- 7.4  The smaller the width of the slit, the wider the diffraction pattern ✓/the dark bands will be further from the centre of the screen
Smaller spleet, breër die diffraksiepatroon/die donker bande sal verder van die uitmekaar wees
because diffraction is inversely proportional to slit width. ✓
want diffraksie is omgekeerd eweredig aan spleetwydte [12.2.2] (2)
[10]

QUESTION 8/VRAAG 8

- 8.1 –By preventing the harmful UV-rays of the sun from penetrating the skin ✓
Deur te voorkom dat die skadelike UV-strale van die son die vel binnedring
–To prevent sunburn ✓/Voorkom sonbrand
and permanent damage to the skin/skin cancer *en permanente velskade/velkanker* ✓ [12.3.2] (3)

- 8.2 Gamma rays/Gammastrale ✓ [12.2.1] (1)

- 8.3 X-rays have a higher penetrating ability than radio waves because of their higher frequency. ✓ ($E \propto f$)
X-strale het 'n hoër indringingsvermoë as radiogolwe as gevolg van hul hoër frekwensie ($E \propto f$)
X-rays do not penetrate through lead ✓ so the radiologist will be safe from harmful effects of x-rays that cause cancer.
X-strale kan nie deur lood beweeg nie daarom is die radioloog veilig van die skadelike effek van x-strale wat kanker kan veroorsaak [12.3.2] (2)

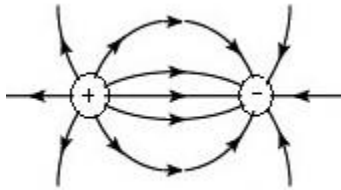
- 8.4 $c = f \lambda$ ✓
 $3 \times 10^8 = 10^8 \lambda$ ✓
 $\lambda = 3 \text{ m}$ ✓ [12.2.3] (3)
[9]

QUESTION 9/VRAAG 9

- 9.1 **Coulomb's law** of electrostatics states that the electrostatic force between two charges is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance between the charges. ✓

Die elektrostatische krag tussen twee ladings is direk eweredig aan die produk van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen die ladings [12.2.1] (2)

- 9.2 one mark for the pattern/een punt vir die patroon
one mark for the direction of field lines/een punt vir die rigting van die veldlyne



[12.1.2] (2)

9.3 $F_1 = \frac{k q_1 q}{r^2}$ ✓
 $= \frac{9 \times 10^9 \times 5 \times 10^{-9} \times q}{(0,8)^2}$ ✓

$$F_2 = \frac{k q q_2}{r^2}$$

$$= \frac{9 \times 10^9 \times q \times 3 \times 10^{-9}}{(0,2)^2}$$
 ✓

$$F_{\text{net}} = F_1 + F_2$$

$$\checkmark 12 \times 10^{-4} = \frac{9 \times 10^9 \times 5 \times 10^{-9} \times q}{(0,8)^2} + \frac{9 \times 10^9 \times q \times 3 \times 10^{-9}}{(0,2)^2}$$
 ✓
$$12 \times 10^{-4} = \frac{(45 q) (0,2)^2 + (27 q) (0,8)^2}{0,0256}$$

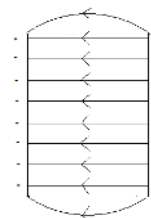
$$12 \times 10^{-4} = \frac{1,8 q + 17,28 q}{0,0256}$$

$$30,72 \times 10^{-6} = 19,08 q$$

$$q = 1,61 \times 10^{-6} \text{ C } \checkmark \text{ (positive/positief)}$$

[12.1.3] (6)
[10]**QUESTION 10/VRAAG 10**

- 10.1 one mark for the direction of field lines/een punt vir die rigting van die veldlyne
one mark for the uniform field between the plates/een punt vir die uniforme veld tussen die plate
one mark for non-uniform field near the ends/een punt vir die nie-uniforme veld naby die kante



(3)

$$\begin{aligned}
 10.2 \quad 10.2.1 \quad C &= Q/V \checkmark \\
 &= \frac{3 \times 10^{-6}}{1,5} \checkmark \\
 &= 2 \times 10^{-6} \text{ F} \checkmark
 \end{aligned}
 \quad [12.2.3] \quad (3)$$

$$\begin{aligned}
 10.2.2 \quad &[\text{POSITIVE MARKING FROM 10.2.1}] \\
 &[\text{POSITIEWE NASIEN VAN 10.2.1}] \\
 C &= \frac{\epsilon_0 A}{d} \checkmark \\
 2 \times 10^{-6} &= \frac{8,85 \times 10^{-12} (0,2 \times 3)}{d} \checkmark \\
 d &= 2,66 \times 10^{-6} \text{ m} \checkmark
 \end{aligned}
 \quad [12.2.3] \quad (3)$$

[9]

QUESTION 11/VRAAG 11

$$\begin{aligned}
 11.1 \quad 1/R_{\parallel} &= 1/r_1 + 1/(r_2 + r_3) \checkmark \\
 &= 1/4 + 1/(10 + 6) \checkmark \\
 R &= 3,2 \, \Omega
 \end{aligned}
 \quad [12.1.3] \quad (2)$$

$$\begin{aligned}
 11.2 \quad 11.2.1 \quad V_1 = V_{\parallel} &= IR_{\parallel} \quad \text{OR/OF} \quad \text{Current through } 6 \, \Omega \text{ resistor/} \\
 &= 6 \times 3,2 \quad \text{Stroom deur } 6 \, \Omega \text{ resistor} \\
 &= 19,2 \text{ V} \\
 I = V/R &= 19,2/16 \checkmark \\
 &= 1,2 \text{ A} \quad = 1/5 \text{ of/van } 6 \text{ A} \checkmark \\
 &= 1,2 \text{ A}
 \end{aligned}$$

$$\begin{aligned}
 \text{Which implies that/Wat impliseer dat } V_2 &= I_{6\Omega} \times R_{6\Omega} \checkmark \\
 &= 1,2 \times 6 \checkmark \\
 &= 7,2 \text{ V} \checkmark
 \end{aligned}
 \quad [12.1.3] \quad (4)$$

$$\begin{aligned}
 11.2.2 \quad V_{\text{lost}} &= 24 - 19,2 = 4,8 \text{ V} \checkmark \\
 r &= V_{\text{lost}}/I_{\text{tot}} \checkmark \\
 &= 4,8/6 \\
 &= 0,8 \, \Omega \checkmark
 \end{aligned}$$

OR/OF

$$\begin{aligned}
 \text{emf} &= I (R + r) \checkmark \\
 24 &= 6 (3,2 + r) \checkmark \\
 r &= 0,8 \, \Omega \checkmark
 \end{aligned}
 \quad [12.1.3] \quad (3)$$

[9]

QUESTION 12/VRAAG 12

12.1 $V_{\text{rms}} = V_{\text{max}} / \sqrt{2} \checkmark$

$172 = V_{\text{max}} / \sqrt{2} \checkmark$

$V_{\text{max}} = 243,24 \text{ V} \checkmark$

[12.2.3] (3)

12.2 $V_{\text{max}} = I_{\text{max}} R \checkmark$

$243,24 = 20 I \checkmark$

$I_{\text{max}} = 12,16 \text{ A} \checkmark$

[12.1.3]

(3)

12.3 $P_{\text{ave}} = V_{\text{rms}}^2 / R \checkmark$

$= (172)^2 / 20 \checkmark$

$= 1479,2 \text{ W} \checkmark$

[12.1.3]

OR/OF $P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}} \checkmark$

$= 172 \times 8,60$

$= 1479,2 \text{ W}$

OR/OF

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

$= (8,60)^2 \times 20$

$= 1479,2 \text{ W}$

$I_{\text{rms}} = I_{\text{max}} / \sqrt{2}$

$= 12,16 / \sqrt{2}$

$= 8,60 \text{ A}$

(3)

[9]**QUESTION 13/VRAAG 13**13.1 Photoelectric effect/*fotoëlektriese effek* $\checkmark$

[12.2.1]

(1)

13.2 Intensity/*intensiteit* $\checkmark$

[12.2.2]

(1)

13.3 Increase/*toeneem* $\checkmark$

because when intensity is increased more electrons are ejected per second $\checkmark$ causing the flow of current to increase as well as the reading on the ammeter increases. ($I = Q/t$)

wanneer intensiteit verhoog word meer elektrone per sekonde vrygestel, wat veroorsaak dat die stroom vergroot en ook die lesing op die ammeter ($I = Q/t$)

[12.2.2]

(2)

13.4 $E = W_0 + E_k \checkmark$

$h c / \lambda = W_0 + E_k$

$6,63 \times 10^{-34} \times \frac{3 \times 10^8}{60 \times 10^{-9}} \checkmark = 6,63 \times 10^{-34} \times f_0 + 2,8 \times 10^{-18} \checkmark$

$f_0 = 7,77 \times 10^{14} \text{ Hz} \checkmark$

OR/OF

$E = W_0 + E_k \checkmark$

$6,63 \times 10^{-34} \times \frac{3 \times 10^8}{60 \times 10^{-9}} \checkmark = W_0 + 2,8 \times 10^{-18} \checkmark$

$W_0 = 5,15 \times 10^{-19} \text{ J}$

But/Maar $W_0 = h f_0$

$5,15 \times 10^{-19} = 6,63 \times 10^{-34} f_0$

$f_0 = 7,77 \times 10^{14} \text{ Hz} \checkmark$

[12.2.3]

(4)

13.5 Learners should use solar cells/photo cells to make solar $\checkmark$ panels./*Leerders kan**sonsel/fotoselle gebruik om sonpanele te maak***OR/OF**

The photon of light from the sun will knock off electrons on the surface of silicon metal in the solar cell and electricity will be produced./

Fotone lig van die son sal elektrone van die oppervlak van silikon in die sonsel vrystel en elektrisiteit word opgewek

[12.3.2]

(1)

[9]**TOTAL SECTION B/TOTAAL AFDELING B: 125****GRAND TOTAL/GROOTTOTAAL: 150**