Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIORSERTIFIKAAT*

GRADE/*GRAAD* 12

SEPTEMBER 2023

PHYSICAL SCIENCES P1/ *FISIESE WETENSKAPPE V1* MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/*PUNTE*: 150

This marking guideline consists of 16 pages./
Hierdie nasienriglyn bestaan uit 16 bladsye.

GENERAL GUIDELINES/*ALGEMENE RIGLYNE*

1. CALCULATIONS/*BEREKENINGE*

1.1 **Marks will be awarded for**: correct formula, correct substitution, correct answer with unit.
Punte sal toegeken word vir: *korrekte formule, korrekte substitusie, korrekte antwoord met eenheid.*

1.2 **No marks** will be awarded if an **incorrect or inappropriate formula is used**, even though there are many 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.*

1.3 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 substitusies toegeken word, maar* ***geen verdere punte*** *sal toegeken word nie.*

1.4 If **no formula** is given, but **all substitutions are correct**, a candidate will **forfeit one mark.**
Indien ***geen formule*** *gegee is nie, maar* ***al die substitusies is korrek***, ***verloor*** *die kandidaat* ***een punt****.*

1.5 **No penalisation** if **zero substitutions are omitted** in calculations where **correct formula**/**principle** is correctly given.
Geen penalisering *indien* ***nulwaardes nie getoon*** *word nie in berekeninge waar die* ***formule/beginsel korrek gegee is nie****.*

1.6 Mathematical manipulations and change of subject of appropriate formulae carry no marks, but if a candidate starts off with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and correct substitutions. The mark for the incorrect numerical answer is forfeited.
Wiskundige manipulasies en verandering van die onderwerp van toepaslike formules tel geen punte nie, maar indien 'n kandidaat met die korrekte formule begin en dan die onderwerp van die formule verkeerd verander, sal die punte vir die formule en korrekte substitusies toegeken word. Die punt vir die verkeerde numeriese antwoord word verbeur.

1.7 Marks are only awarded for a formula if a **calculation has been attempted**, i.e. substitutions have been made or a numerical answer given.
Punte word slegs vir 'n formule toegeken indien ***'n poging tot berekening aangewend*** *is, d.w.s. substitusies is gedoen of 'n numeriese antwoord is gegee.*

1.8 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 word en nie vir waardes wat voor 'n berekening gelys is nie.

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1.9 All calculations, when not specified in the question, must be done to a minimum of two decimal places.
Alle berekenings, wanneer nie in die vraag gespesifiseer word nie, moet tot 'n minimum van twee desimale plekke gedoen word.

1.10 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 van '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.

1.11 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-diagramvraag) hoef nie noodwendig dieselfde volgorde te hê nie. VOLPUNTE sal toegeken word op voorwaarde dat dit 'n geldige oplossing vir die probleem is. Enige berekening wat egter nie die kandidaat nader aan die antwoord as die oorspronklike data bring nie, sal geen punte tel nie.

2. UNITS/*EENHEDE*

2.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question**.
*Kandidate sal slegs een keer gepenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid **in 'n vraag**.*

2.2 Units are only required in the final answer to a calculation.
Eenhede word slegs in die finale antwoord op 'n vraag verlang.

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

- *Korrekte antwoord + verkeerde eenheid*
- *Verkeerde antwoord + korrekte eenheid*
- *Korrekte antwoord + geen eenheid*

2.4 SI units must be used except in certain cases, e.g. $V \cdot m^{-1}$ instead of $N \cdot C^{-1}$, and $cm \bullet s^{-1}$ or $km \bullet h^{-1}$ instead of $m \bullet s^{-1}$ where the question warrants this.
SI-eenhede moet gebruik word, behalwe in sekere gevalle, bv. $V \bullet m^{-1}$ in plaas van $N \bullet C^{-1}$, en $cm \bullet s^{-1}$ of $km \bullet h^{-1}$ in plaas van $m \bullet s^{-1}$ waar die vraag dit regverdig.

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3. GENERAL/*ALGEMEEN*

3.1 If one answer or calculation is required, but two are 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.

3.2 For marking purposes, alternative symbols (s, u, t, etc.) will also be accepted.
Vir nasiendoeleindes sal alternatiewe simbole (s, u, t, ens.) ook aanvaar word.

3.3 Separate compound units with a multiplication dot, not a full stop, for example, $m•s^{-1}$.
For marking purposes, $m•s^{-1}$ and m/s will also be accepted.
Skei saamgestelde eenhede met 'n vermenigvuldigingspunt en nie met 'n punt nie, byvoorbeeld $m•s^{-1}$. Vir nasiendoeleindes sal $m•s^{-1}$ en m/s ook aanvaar word.

4. POSITIVE 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:

4.1 **Subquestion to subquestion:** When a certain variable is calculated in one subquestion (e.g. 3.1) and needs to be substituted in another (3.2 of 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 subquestions.
***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** vir die daaropvolgende subvraag toegeken.*

4.2 **A multistep question in a subquestion**: If the candidate has to calculate, for example, current in die 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 bv. die stroom verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verloor die kandidaat die punt vir die substitusie sowel as die finale antwoord.*

5. NEGATIVE MARKING/*NEGATIEWE NASIEN*

Normally an incorrect answer cannot be correctly motivated if based on a conceptual mistake. If the candidate is therefore required to motivate in QUESTION 3.2 the answer given in QUESTION 3.1, and QUESTION 3.1 is incorrect, no marks can be awarded for QUESTION 3.2. However, if the answer for e.g. QUESTION 3.1 is based on a calculation, the motivation for the incorrect answer could be considered.
'n Verkeerde antwoord, indien dit op 'n konsepsuele fout gebaseer is, kan normaalweg nie korrek gemotiveer word nie. Indien 'n kandidaat gevra word om in VRAAG 3.2 die antwoord op VRAAG 3.1 te motiveer en VRAAG 3.1 is verkeerd, kan geen punte vir VRAAG 3.2 toegeken word nie. Indien die antwoord op bv. VRAAG 3.1 egter op 'n berekening gebaseer is, kan die motivering vir die verkeerde antwoord in VRAAG 3.2 oorweeg word.

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QUESTION 1/*VRAAG* 1: MULTIPLE-CHOICE QUESTIONS
MEERVOUDIGEKEUSE-VRAE

1.1	D ✓✓	(2)
1.2	C ✓✓	(2)
1.3	B ✓✓	(2)
1.4	C ✓✓	(2)
1.5	C ✓✓	(2)
1.6	A ✓✓	(2)
1.7	C ✓✓	(2)
1.8	D ✓✓	(2)
1.9	A ✓✓	(2)
1.10	C ✓✓	(2)

[20]



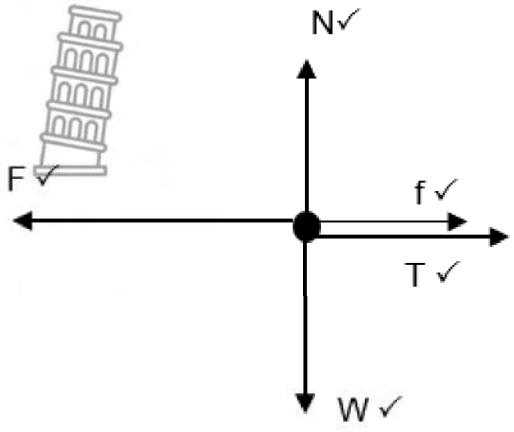


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QUESTION 2/*VRAAG 2*

2.1 Newton's third law ✓
Newton se derde wet (1)

2.2



Notes
Mark awarded for arrow and label.
Do not penalise for length of arrows since drawing is not drawn to scale,
Any other additional force(s). Max. $^4/_5$
If force(s) do not make contact with body. Max. $^4/_5$

Aantekeninge
Punt word toegeken vir byskrif en pyltjie.
Moenie vir die lengte van die pyltjie penaliseer nie
Enige addisionele krag(te). Maks. $^4/_5$
As krag(te) nie kontak maak met liggaam nie. Maks. $^4/_5$ (5)

2.3.1 $F_{net} = ma$ / $F - T - f = ma$ } Any one / *Enige een* ✓
$9\,000 - T - 3\,500 = 0$ ✓
$T = 5\,500$ N ✓ (3)

POSITIVE MARKING FROM / *POSITIEWE NASIEN VANAF* 2.3.1

2.3.2 $F_{net} = ma$
$T - f = ma$
$T - \mu_k N = ma$
$T - \mu_k mg = ma$ } Any one / *Enige een* ✓
$\underline{5\,500 - \mu_k \times 950 \times 9{,}8 = 0}$ ✓
$\therefore \mu_k = 0{,}59$ (0,591) ✓ (4)



2.4 $F_{net} = ma$
$-f = ma$
$-(\mu_k N) = ma$
$-(\mu_k mg) = ma$
Any one / *Enige een* ✓

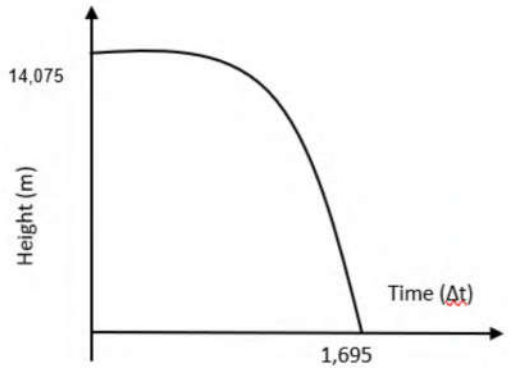
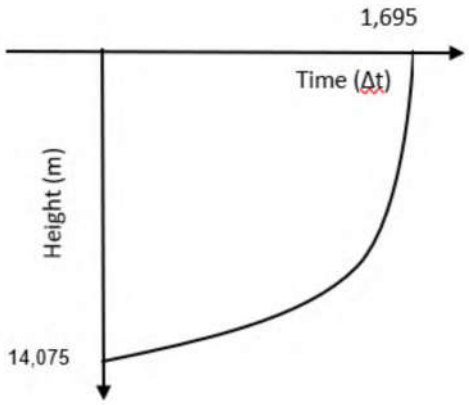
$\underline{-(0,59 \times 950 \times 9,8) = 950a}$ ✓
$\therefore a = -5,78\ m.s^{-2}$
$\therefore a = 5,78\ m.s^{-2}$ (to the right / *na regs*) ✓ (3)
[16]

QUESTION 3/*VRAAG 4*

3.1 $9,8\ m.s^{-2}$ ✓ (1)

3.2.1	**UPWARD POSITIVE/*OPWAARTS AS POSITIEF***	**UPWARD NEGATIVE/*OPWAARTS AS NEGATIEF***	
	$\Delta y = v_i\Delta t + ½\ a\Delta t^2$ ✓ $\underline{-2 = v_i \times 0,125 + ½ \times (-9,8)(0,125)^2}$ ✓ Any one/ *Enige een* ✓ $v_i = -15,388\ m.s^{-1}$ $v_f^2 = v_i^2 + 2a\Delta y$ $\underline{-15,388^2 = 0^2 + 2(-9,8)\ \Delta y}$ ✓ $\therefore \Delta y = 12,08\ m$ Height / *Hoogte* = 12,08 + 2 ✓ Height / *Hoogte* = 14,08 m ✓	$\Delta y = v_i\Delta t + ½\ a\Delta t^2$ ✓ $\underline{2 = v_i \times 0,125 + ½\ (9,8)(0,125)}$ ✓ Any one/ *Enige een* ✓ $v_i = 15,388\ m.s^{-1}$ $v_f^2 = v_i^2 + 2a\Delta y$ $\underline{15,388^2 = 0^2 + 2(9,8)\ \Delta y}$ ✓ $\therefore \Delta y = 12,08\ m$ Height / *Hoogte* = 12,08 + 2 ✓ Height / *Hoogte* = 14,08 m ✓	(5)
3.2.2	**UPWARD POSITIVE/*OPWAARTS AS POSITIEF***	**UPWARD NEGATIVE/*OPWAARTS AS NEGATIEF***	
	$v_f = v_i + a\Delta t$ ✓ $\underline{-15,388 = 0 + (-9,8)(\Delta t)}$ ✓ $\therefore \Delta t = 1,57\ s$ $\Delta t = 1,57 + 0,125$ ✓ $\Delta t = 1,70\ s$ ✓	$v_f = v_i + a\Delta t$ ✓ $\underline{15,388 = 0 + (9,8)(\Delta t)}$ ✓ $\therefore \Delta t = 1,57\ s$ $\Delta t = 1,57 + 0,125$ ✓ $\Delta t = 1,70\ s$ ✓	(4)
	OPTION 1/*OPSIE 1*		
3.2.3	**UPWARD POSITIVE/*OPWAARTS AS POSITIEF***	**UPWARD NEGATIVE/*OPWAARTS AS NEGATIEF***	
	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = \underline{-15,388^2 + 2(-9,8)(-2)}$ ✓ $\therefore v_f = 16,61\ m.s^{-1}$ downwards / *afwaarts* ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = \underline{15,388^2 + 2(9,8)(2)}$ ✓ $\therefore v_f = 16,61\ m.s^{-1}$ downwards/*afwaarts* ✓	
	OPTION 2/*OPSIE 2*		
	UPWARD POSITIVE/*OPWAARTS AS POSITIEF*	**UPWARD NEGATIVE/*OPWAARTS AS NEGATIEF***	
	$v_f = v_i + a\Delta t$ ✓ $v_f = \underline{-15,388 + (-9,8)(0,125)}$ ✓ $v_f = -16,61$ $\therefore v_f = 16,61\ m.s^{-1}$ downwards / *afwaarts* ✓	$v_f = v_i + a\Delta t$ ✓ $v_f = \underline{15,388 + (9,8)(0,125)}$ ✓ $\therefore v_f = 16,61\ m.s^{-1}$ downwards/*afwaarts* ✓	

	OPTION 3/*OPSIE 3*		
	UPWARD POSITIVE/*OPWAARTS AS POSITIEF*	**UPWARD NEGATIVE/*OPWAARTS AS NEGATIEF***	
	$\Delta x = \frac{v_f + v_i}{2} \Delta t$ ✓ $-2 = (\frac{v_f + (-15{,}388)}{2}) \times 0{,}125$ ✓ $\therefore v_f = 16{,}61$ m.s^{-1} downwards /*afwaarts* ✓	$\Delta x = \frac{v_f + v_i}{2} \Delta t$ ✓ $2 = (\frac{v_f + 15{,}388}{2}) \times 0{,}125$ ✓ $\therefore v_f = 16{,}61$ m.s^{-1} downwards /*afwaarts* ✓	(3)

	UPWARD POSITIVE/*OPWAARTS AS POSITIEF*	**UPWARD NEGATIVE/*OPWAARTS AS NEGATIEF***
		

CRITERIA FOR MARKING / *NASIENKRITERIA*	
Correct shape / *Korrekte vorm*	✓
Initial position indicated / Aanvanklike posisie aangedui	✓
Time when ball hits the ground / *Tyd wanneer bal die grond tref*	✓

(3)
[16]

QUESTION 4/*VRAAG 4*

4.1 A system on which the net external force is zero. ✓✓
'n Sisteem waar die netto eksterne krag nul is. (2)

4.2 $\sum p_i = \sum p_f$
$m_A v_i + m_B v_i = m_A v_f + m_B v_f$ ✓ Any one / *Enige een*
$(m_A + m_B)v_i = m_A v_f + m_B v_f$
$(2 + 1) \times 0$ ✓ $= 1 \times 5 + 2v_f$ ✓
$v_f = 2{,}5$ m.s^{-1} left / *links* (west / *wes*) ✓ (4)

OPTION 1 / *OPSIE 1*

4.3 $F_{net}\Delta t = \Delta p$
$F_{net}\Delta t = m\Delta v$
$F_{net}\Delta t = mv_f - mv_i$ ✓ Any one / *Enige een*
$-80 \times 0{,}05$ ✓ $= 1 \times v_f - 1 \times 5$ ✓
$v_f = 1$ m.s^{-1} left / *links* (west / *wes*) ✓

OPTION 2 / *OPSIE 2*

$F_{net} = ma$
$-80 = 1 \times a$ ✓
$a = -80$ m.s^{-2}
$v_f = v_i + a\Delta t$ ✓
$v_f = 5 + (-80) \times 0{,}05$ ✓
$v_f = 1$ m.s^{-1} left / *links* (west / *wes*) ✓ (4)

4.4 Collision in which kinetic energy is not conserved. ✓✓
Collision where total kinetic energy before the collision is not equal to the total kinetic energy after the collision. ✓✓
Botsing waarin die kinetiese energie nie behoue is nie.
Botsing waar die totale kinetiese energie voor die botsing nie gelyk is aan die totale kinetiese energie na die botsing nie. (2)
[12]

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QUESTION 5/*VRAAG 5*

5.1 The work done on an object by a net force is equal to the change in kinetic energy of the object. ✓✓
Die arbeid verrig op 'n voorwerp deur 'n netto krag is gelyk aan die verandering in die voorwerp se kinetiese energie. (2)

OPTION 1 / *OPSIE 1*

5.2 $W_{net} = \Delta E_k$
$W_{Fg} + W_f = \Delta E_k$
$-\Delta E_p + W_f = \Delta E_k$
$[-mg(h_2 - h_1)] + f.\Delta x\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
Any one / Enige een ✓

$\underline{-50 \times 9{,}8\,(0-5)}$ ✓ + $\underline{72\Delta x\cos 180^\circ}$ ✓ = $\underline{\frac{1}{2} \times 50 \times 8^2 - 0}$ ✓

$\Delta x = 11{,}81$ m
$\theta = \sin^{-1}\left(\frac{5}{11{,}81}\right)$ ✓
$\theta = 25{,}05^\circ$ ✓

OPTION 2 / *OPSIE 2*

$W_{nc} = \Delta E_p + \Delta E_k$
$W_{nc} = [mg(h_2 - h_1)] + \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
$W_f = [mg(h_2 - h_1)] + \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
Any one / *Enige een* ✓

$\underline{72\Delta x\cos 180^\circ}$ ✓ = $\underline{50 \times 9{,}8\,(0-5)}$ ✓ + $\underline{\frac{1}{2} \times 50 \times 8^2 - 0}$ ✓

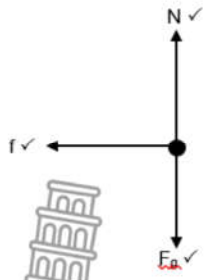
$\Delta x = 11{,}81$ m
$\theta = \sin^{-1}\frac{5}{11{,}81}$ ✓
$\theta = 25{,}05^\circ$ ✓

OPTION 3 / *OPSIE 3*

$W_{net} = \Delta E_k$
$(F_g - F_f).\Delta x.\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
Any one / *Enige een* ✓
$(mg\sin\theta - 72).\Delta x.(1) = \underline{\frac{1}{2}(50)(8^2 - 0^2)}$ ✓
$\frac{50(9{,}8)(5)\,\Delta x}{\Delta x}$ ✓ $- \underline{72\Delta x}$ ✓ $= 1\,600$

$\Delta x = 11{,}81$ m
$\theta = \sin^{-1}\frac{5}{11{,}81}$ ✓
$\theta = 25{,}05^\circ$ ✓ (6)

5.3



(3)

5.4 **OPTION 1 / *OPSIE 1***

$W_{net} = \Delta E_k$
$W_f = \Delta E_k$
$W_f = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
} Any one / *Enige een* ✓

$W_f = 0$ ✓ $- \frac{1}{2} \times 50 \times 8^2$ ✓
$W_f = 1\ 600$ J ✓

OPTION 2 / *OPSIE 2*

$W_{nc} = \Delta E_p + \Delta E_k$
$W_f = \Delta E_p + \Delta E_k$
} Any one / *Enige een* ✓

$W_f = 0$ ✓ $- \frac{1}{2} \times 50 \times 8^2$ ✓
$W_f = 1\ 600$ J ✓

OPTION 3 / *OPSIE 3*

$v_f^2 = v_f^2 + 2a\Delta x$
$0^2 = 8^2 + 2a(10)$ ✓
$\therefore a = -3{,}2\ m \cdot s^{-1}$

$F_{nett} = ma$
$= 50 \times (-3{,}2)$ ✓
$= -160$ N $(= F_f)$

(Any ONE / *Enige EEN* ✓)

$W_f = F_f \cdot \Delta x \cdot \cos\theta$
$= (160)(10)(\cos 180^\circ)$
$= 1\ 600$ J ✓

(4)
[15]

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QUESTION 6/*VRAAG 6*

6.1 The (apparent) change in frequency observed by a listener because the listener and source of sound have different velocities relative to the medium of sound propagation. ✓ ✓
Die verandering in frekwensie van die klank waargeneem deur 'n luisteraar omdat die klankbron en luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het.

The (apparent) change in frequency observed by a listener due to relative motion between the sound source and the listener. ✓ ✓

Die verandering in die (waargenome) frekwensie waargeneem deur 'n luisteraar omdat daar relatiewe beweging is tussen die luisteraar en die klankbron. (2)

6.2 Towards observer **B**. ✓ Frequency detected by observer B is higher than the frequency detected by observer **A**. ✓

*Na waarnemer **B**. Die frekwensie wat waargeneem word deur luisteraar **B** is hoër as die waargenome frekwensie deur luisteraar **A**.* (2)

6.3 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓

545 ✓ $= \frac{343}{343 + v_s}$ ✓ x f_s .....(1)

615 ✓ $= \frac{343}{343 - v_s}$ ✓ x f_s .....(2)

$v_s = 20{,}70\ m{\cdot}s^{-1}$ $(20{,}69827586\ m{\cdot}s^{-1})$

$f_s = \frac{545(343 + 27{,}70)}{343}$ ✓ **OR/OF** $f_s = \frac{615(343 - 27{,}70)}{343}$

$f_s = 577{,}91$ Hz ✓ (range / *gebied* 577,89 Hz to 577,91 Hz) (7)

6.4 The star is moving away. ✓
The spectral lines show a decrease in frequency (towards red). ✓

OR/OF

The spectral lines show an increase in wavelength (towards red). ✓

Die ster beweeg weg.
Die spektralelyne toon 'n afname in frekwensie (na rooi).

OR/OF

Die spektralelyne toon 'n toename in golflengte (na rooi). (2)

[13]

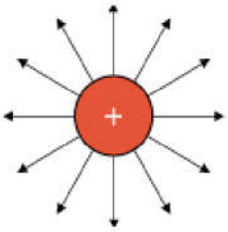
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QUESTION 7/*VRAAG 7*

7.1 The electrostatic force exerted by one point charge on another is directly proportional to the product of the charges and inversely proportional to the square of the distance between them. ✓✓

Die elektrostatiese krag wat een puntlading op 'n ander puntlading uitoefen is direk eweredig aan die produk van die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. (2)

7.2



Marking criteria / *Nasienkriteria*
- ✓ Direction / *Rigting*
- ✓ Straight lines / *Reguitlyne*
- ✓ Touching and vertically from charge./ *Raak en is loodreg vanaf die lading*

(3)

7.3 $F = \frac{kQ_1Q_2}{r^2}$ ✓

$F = \frac{(9 \times 10^9)(36 \times 10^{-6})(16 \times 10^{-6})}{(0,03)^2}$ ✓

$F = 5\,760$ N ✓ (3)

7.4 Negative. ✓ For the test charge to experience a net force of zero, the electric field due to **P** and **T** should be in opposite (directions). ✓ The electric field of **P** is to the right, for the electric field of **T** to move to the left, (away) from point **X**, it must be a negative charge. ✓

*Negatief. Vir die puntlading om 'n netto krag van nul te ervaar moet die elektrieseveld a.g.v. **P** en **T** in teenoorgestelde (rigtings) wees. Die elektrieseveld van **P** is regs sodat die elektrieseveld van **T** na links beweeg (weg) vanaf punt **X**. so dit moet 'n negatiewe lading wees.* (3)

7.5 $E = \frac{kQ}{r^2}$ ✓

$E_1 = \frac{(9 \times 10^9)(36 \times 10^{-6})}{(0,03 + r)^2}$ ✓ right / *regs* (Note distance to be correct / *Let wel die afstand moet korrek wees*)

(Any 1 of Top substitutions / *Enige van die vervangings*)

$E_2 = \frac{(9 \times 10^9)(16 \times 10^{-6})}{r^2}$ ✓ left/*links*

$E_{net} = E_1 + E_2$

$0 = \frac{(9 \times 10^9)(36 \times 10^{-6})}{(0,03 + r)^2} + \frac{(-(0,03 + r)^2)}{r^2}$ ✓ (Correct addition / *Korrekte addisie*)

$r = 0,06$ m ✓ (5)

[16]

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QUESTION 8/*VRAAG 8*

8.1 The total energy per coulomb of charge that a battery can supply. ✓✓
Die totale energie per coulomb lading wat 'n battery kan verskaf. (2)

8.2.1 $P = I^2 R$ ✓
$16 = 2^2 \times R$ ✓
$R = 4\ \Omega$ ✓ (3)

8.2.2 **Positive marking from / *Positiewe nasien vanaf* 8.2.1**

OPTION 1 / *OPSIE 1*

$R = \frac{V}{I}$ ✓
$12 = \frac{V_p}{2}$ ✓
$V = 24$ V
$I_{10} = \frac{24}{10}$ ✓
$I_{10} = 2,4$ A
$I = I_{10} + I_2$
$I = 2,4 + 2$ ✓
$I = 4,4$ A ✓

OPTION 2 / *OPSIE 2*

$I_{10} = \frac{12}{10} \times 2$ ✓✓✓
$I_{10} = 2,4$ A
$I = I_{10} + I_2$
$I = 2,4 + 2$ ✓
$I = 4,4$ A ✓

(5)

8.2.3 **Positive marking from 8.2.1 and 8.2.2. / *Positiewe nasien vanaf 8.2.1 en 8.2.2***

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓
$\frac{1}{R_p} = \frac{1}{10} + \frac{1}{12}$ ✓
$R_p = 5,4545\ \Omega$
$R_{ext} = 7,4545\ \Omega$
Emf / *Emk*= $I(R_{ext} + r)$ ✓
[36 = 4,4 (7,4545 ✓+ r)] ✓
$R = 0,73\ \Omega$ ✓

$R_p = \frac{R_1 R_2}{R_1 + R_2}$ ✓
$R_p = \frac{10 \times 12}{10 + 12}$ ✓
$R_p = 5,4545\ \Omega$

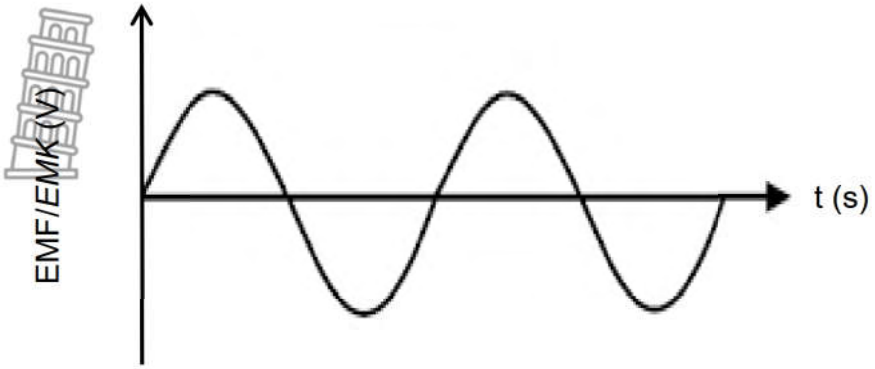
(6)

8.3 Decrease. ✓ The total external resistance will increase, and the current will decrease. ✓
Afneem. Die totale eksterne weerstand sal toeneem en die stroom sal afneem. (2)
[18]

QUESTION 9/*VRAAG 9*

9.1 Mechanical energy ✓ to electrical energy. ✓
Meganiese energie na elektriese energie. (2)

9.2



Marking criteria / N*asienkriteria*	
Correct shape/ *Korrekte vorm*	✓
Two complete waves / *Twee volledige golwe*	✓

(2)

9.3 AC can be transmitted over long-distances because it causes minor energy loss. ✓

OR/*OF*

The potential difference can be increased or decreased.
WS kan oor lang afstande met minimale energie verlies oorgedra word.

OR/*OF*

Die potensiaalverskil can verhoog of verlaag word. (1)

9.4 $V_{rms/\ wgk}$ **OR** Root mean square voltage/*wortel gemiddelde kwadraat spanning* (1)

9.5.1 $I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ✓

$I_{rms} = \frac{6,25}{\sqrt{2}}$ ✓

I_{rms} = 4,42 A ✓ (3)

9.5.2 **Positive marking from / *Positiewe nasien vanaf* 9.3.1**
OPTION 1 / *OPSIE 1*
$P_{average\ /\ gemiddeld} = I_{rms}^2 R$ ✓
= $4,42^2$ x 45 ✓
= 879,14 W ✓ (3)
[12]

QUESTION 10/*VRAAG 10*

10.1 The process whereby electrons are ejected from a (metal) surface, when light of suitable frequency is incident on that surface. ✓✓
Die proses waardeur elektrone uit 'n (metaal)oppervlakte vrygestel word, wanneer lig van geskikte frekwensie invallend op die oppervlak is. (2)

10.2 Increasing the power rating of the light bulb increases the intensity of the photons. ✓ Increase in intensity does not affect the maximum kinetic energy or maximum speed of the photo-electrons. ✓
Toename in die drywinggradering van die gloeilampies verhoog die intensiteit van die fotone. Toename in die intensiteit affekteer nie die maksimum kinetiese energie nie of maksimum spoed van die fotoëlektrone nie. (2)

10.3 Light **B**. ✓ It has the higher intensity. More photo-electrons will be ejected and therefore more current. ✓ (Ammeter reading will be higher.)

*Lig **B**. Dit het 'n hoër intensiteit. Meer foto-elektrone word vrygestel en daarom meer stroom. (Ammeterlesing sal hoër wees).* (2)

10.4.1

OPTION 1 / *OPSIE 1*	**OPTION 2 / *OPSIE 2***
$E = \frac{hc}{\lambda}$ ✓ $E = \frac{6{,}63\times10^{-34}\times3\times10^{8}}{490\times10^{-9}}$ ✓ $E = 4{,}06 \times 10^{-19}$ J ✓	$c = f\lambda$ $f = \frac{3\times10^{8}}{490\times10^{-9}}$ $f = 6{,}12244898$ Hz $E = hf$ ✓ $E = 6{,}63 \times 10^{-34} \times 6{,}12244898 \times 10^{14}$ ✓ $E = 4{,}06 \times 10^{-19}$ J ✓

(3)

10.4.2 **Positive marking from / *Positiewe nasien vanaf* 10.4.1.**
$E = W_0 + E_{k(max/\ maks.)}$ ✓
$4{,}06 \times 10^{-19}$ ✓ $= W_o + \frac{1}{2} \times 9{,}11 \times 10^{-31} \times (7{,}5 \times 10^{5})^2$ ✓
$W_0 = 1{,}50 \times 10^{-19}$ J ✓ (4)
[13]

TOTAL / *TOTAAL*: 150

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