



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE/
NASIONALE SENIOR
SERTIFIKAAT**

GRADE/GRAAD 12

SEPTEMBER 2018

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

MARKS/PUNTE: 150

This marking guideline consists of 20 pages./
Hierdie nasienriglyn bestaan uit 20 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.
- 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 $cm \cdot s^{-1}$ or $km \cdot h^{-1}$ instead of $m \cdot s^{-1}$ where the question warrants this.
SI-eenhede moet gebruik word, behalwe in sekere gevalle, bv. $V \cdot m^{-1}$ in plaas van $N \cdot C^{-1}$, en $cm \cdot s^{-1}$ of $km \cdot h^{-1}$ in plaas van $m \cdot s^{-1}$ waar die vraag dit regverdig.

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, $m \cdot s^{-1}$.
For marking purposes, $m \cdot s^{-1}$ and m/s will also be accepted.
Skei saamgestelde eenhede met 'n vermenigvuldigingspunt en nie met 'n punt nie, byvoorbeeld $m \cdot s^{-1}$. Vir nasiendoeleindes sal $m \cdot s^{-1}$ 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 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 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 the 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.

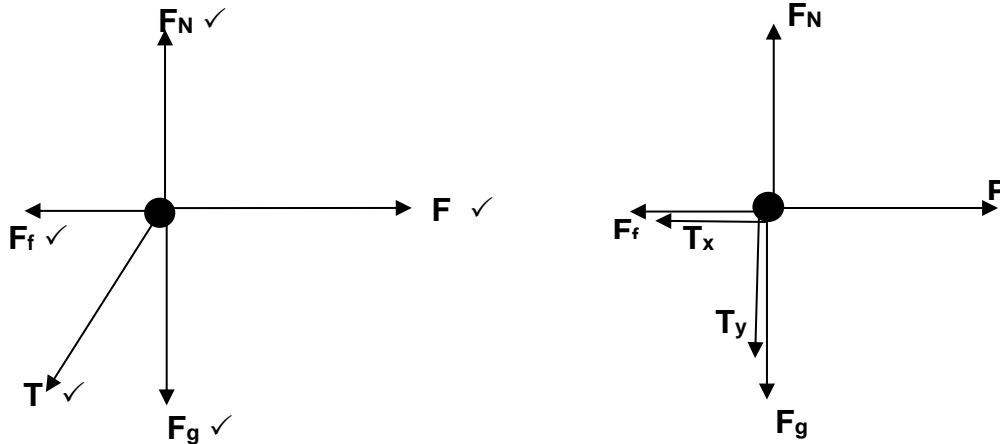
'n Verkeerde antwoord, indien dit op 'n konsepsuele fout gebaseer is, kan normaalweg nie korrek gemotiveer word nie. Indien 'n kandidaat gevra word om in VRAAG 3.2 die antwoord op VRAAG 3.1 te motiveer en VRAAG 3.1 is verkeerd, kan geen punte vir VRAAG 3.2 toegeken word nie. Indien die antwoord op bv. VRAAG 3.1 egter op 'n berekening gebaseer is, kan die motivering vir die verkeerde antwoord in VRAAG 3.2 oorweeg word.

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

- | | | |
|------|------|-------------|
| 1.1 | C ✓✓ | (2) |
| 1.2 | A ✓✓ | (2) |
| 1.3 | D ✓✓ | (2) |
| 1.4 | A ✓✓ | (2) |
| 1.5 | D ✓✓ | (2) |
| 1.6 | C ✓✓ | (2) |
| 1.7 | A ✓✓ | (2) |
| 1.8 | D ✓✓ | (2) |
| 1.9 | C ✓✓ | (2) |
| 1.10 | D ✓✓ | (2) |
| | | [20] |

QUESTION/VRAAG 2

2.1.1



Mark awarded for arrow and label./Punt toegeken vir pyl en byskrif
 Do not penalise for length of arrows since drawing is not drawn to scale/
 Moenie penaliseer vir lengte van pyle want skets nie volgens skaal nie.
 Any other additional force(s)/Enige addisionele krag(te) ⁴/₅
 If force(s) do not make contact with body./Indien krag(te) nie kontak maak met
 liggaam nie Max/Maks. ⁴/₅

(5)

2.1.2 If the resultant/net force acts on an object, the object will accelerate in the direction of the resultant/net force with an acceleration that is directly proportional to the resultant/net force ✓ and inversely proportional to the mass ✓ of the object.

Indien 'n resulterende/netto krag op 'n voorwerp uitgeoefen word sal die voorwerp versnel in die rigting van die resulterende/netto krag met 'n versnelling wat direk eweredig is aan die resulterende/netto krag ✓ en omgekeerd eweredig aan die massa van die voorwerp. ✓

(2)

2.1.3 **OPTION/OPSIE 1**

OPTION/OPSIE 2

$$\begin{aligned}
 F_{net} &= ma \\
 F_{net} &= F_{app} - T_x - f \\
 ma &= F_{app} - T_x - f \\
 5,2a &= 46,5 - T_x - 12 \checkmark \\
 5,2a &= 34,5 - T_x \dots \dots \dots (1) \\
 2a &= T_x - 5,1 \checkmark \dots \dots \dots (2) \\
 a &= 4,08m.s^{-2} \\
 2 \times (4,08) \checkmark &= T_x - 5,1 \\
 T_x &= 13,26 \\
 T &= \frac{T_x}{\cos 25^\circ} \\
 T &= \frac{13,26}{\cos 25^\circ} \checkmark \\
 T &= 14,63 \text{ N } \checkmark
 \end{aligned}$$

any one
enige een

$$\begin{aligned}
 -5,2a &= -46,5 + T_x + 12 \checkmark \\
 -5,2a &= -34,5 + T_x \dots \dots (1) \\
 -2a &= T_x + 51 \checkmark \dots \dots (2) \\
 a &= -4,08m.s^{-2} \\
 a &= 4,08 \text{ m.s}^{-2}
 \end{aligned}$$

(6)

2.2

$$g = \frac{GM}{R^2} \checkmark$$

$$g = \frac{6,67 \cdot 10^{-11} \times 6,39 \cdot 10^{23}}{(3,39 \cdot 10^6)^2} \checkmark$$

$$g = 3,71 \text{ m}\cdot\text{s}^{-2} \checkmark$$

(3)
[16]

QUESTION/VRAAG 3

3.1.1 UPWARD POSITIVE /
OPWAARTS POSITIEF

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$-(48) \checkmark = v_i \times 2,8 + \frac{1}{2} \times (-9,8) \times 2,8^2 \checkmark$$

$$v_i = -3,42$$

$$v_i = 3,42 \text{ m.s}^{-1} \checkmark$$

DOWNWARD POSITIVE /
AFWAARTS POSITIEF

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$(48) \checkmark = v_i \times 2,8 + \frac{1}{2} \times 9,8 \times 2,8^2 \checkmark$$

$$v_i = 3,42 \text{ m.s}^{-1} \checkmark$$

(4)

3.1.2 UPWARD POSITIVE /
OPWAARTS POSITIEF

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

$$v_f = -3,42 + (-9,8) (2,8) \checkmark$$

$$v_f = -30,86 \text{ m.s}^{-1}$$

$$v_f = 30,86 \text{ m.s}^{-1} \checkmark$$

OPTION/OPSIE 1

DOWNWARD POSITIVE /
AFWAARTS POSITIEF

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

$$v_f = 3,42 + (9,8) (2,8) \checkmark$$

$$v_f = 30,86 \text{ m.s}^{-1} \checkmark$$

(3)

OPTION/OPSIE 2

UPWARD POSITIVE /
OPWAARTS POSITIEF

$$v_f^2 = v_i^2 + 2a \Delta x \checkmark$$

$$v_f^2 = -3,42^2 + 2 (-9,8) (-48) \checkmark$$

$$v_f = 30,86 \text{ m.s}^{-1} \checkmark$$

DOWNWARD POSITIVE /
AFWAARTS POSITIEF

$$v_f^2 = v_i^2 + 2a \Delta x \checkmark$$

$$v_f^2 = 3,42^2 + 2 (9,8) (48) \checkmark$$

$$v_f = 30,86 \text{ m.s}^{-1} \checkmark$$

OPTION/OPSIE 3

UPWARD POSITIVE /
OPWAARTS POSITIEF

$$\Delta x = \frac{v_f + v_i}{2} \Delta t \checkmark$$

$$-(48) = \frac{v_f - 3,42}{2} \times 2,8 \checkmark$$

$$v_f = -30,87$$

$$v_f = 30,87 \text{ m.s}^{-1} \checkmark$$

DOWNWARD POSITIVE /
AFWAARTS POSITIEF

$$\Delta x = \frac{v_f + v_i}{2} \Delta t \checkmark$$

$$48 = \frac{v_f + 3,42}{2} \times 2,8 \checkmark$$

$$v_f = 30,87 \text{ m.s}^{-1} \checkmark$$

OPTION/OPSIE 4

$$E_{Mi} = E_{Mf}$$

$$mgh_1 + \frac{1}{2} m v_i^2 = mgh_2 + \frac{1}{2} m v_f^2 \quad \left. \vphantom{mgh_1 + \frac{1}{2} m v_i^2} \right\} \begin{array}{l} \text{Any one} \checkmark \\ \text{Enige een} \end{array}$$

$$gh_1 + \frac{1}{2} v_i^2 = gh_2 + \frac{1}{2} v_f^2$$

$$9,8 \times 48 + \frac{1}{2} \times 3,42^2 = 0 + \frac{1}{2} v_f^2 \checkmark$$

$$v_f = 30,86 \text{ m.s}^{-1} \checkmark$$

OPTION/OPSIE 5

$$F_{\text{net}} \Delta t = \Delta p$$

$$F_{\text{net}} \Delta t = m (v_f - v_i) \quad \left. \vphantom{F_{\text{net}} \Delta t = m (v_f - v_i)} \right\} \begin{array}{l} \text{Any one} \\ \text{Enige een} \checkmark \end{array}$$

$$mg \Delta t = m (v_f - v_i)$$

$$g \Delta t = v_f - v_i$$

$$9,8 \times 2,8 = v_f - 3,42 \checkmark$$

$$v_f = 30,86 \text{ m.s}^{-1} \checkmark$$

3.1.3 **UPWARD POSITIVE /
OPWAARTS POSITIEF**

$$V_f^2 = V_i^2 + 2a\Delta X \checkmark$$

$$0 = V_i^2 + 2(-9,8)(8) \checkmark$$

$$V_i = 12,52 \text{ m.s}^{-1} \text{ upwards.} \checkmark$$

**DOWNWARD POSITIVE /
AFWAARTS POSITIEF**

$$V_f^2 = V_i^2 + 2a\Delta x \checkmark$$

$$0 = V_i^2 + 2(9,8)(-8) \checkmark$$

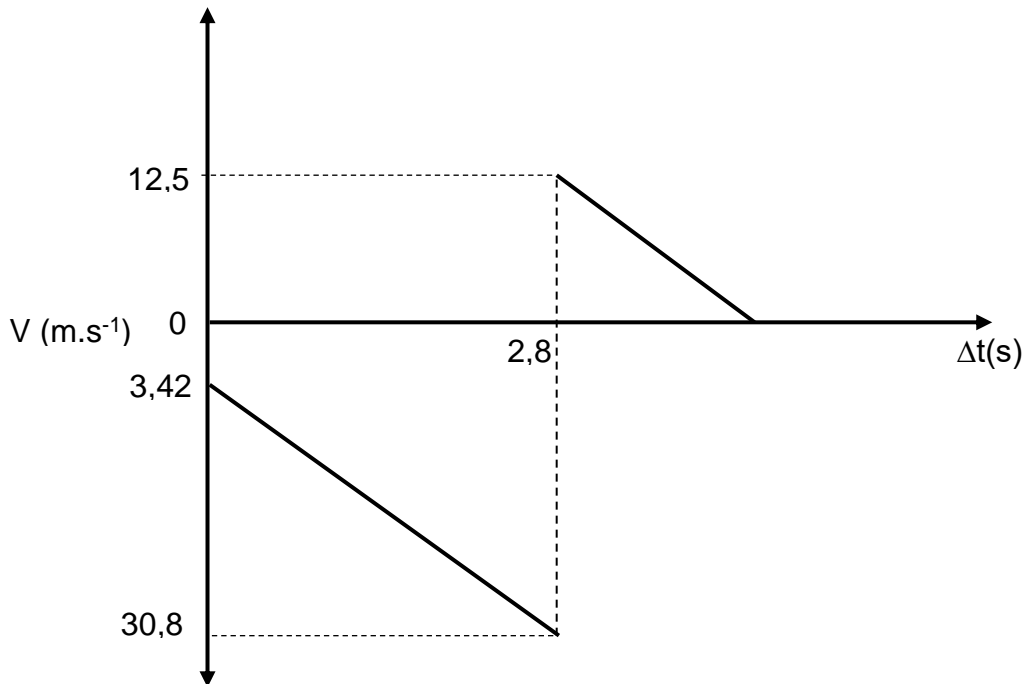
$$V_i = 12,52 \text{ m.s}^{-1}$$

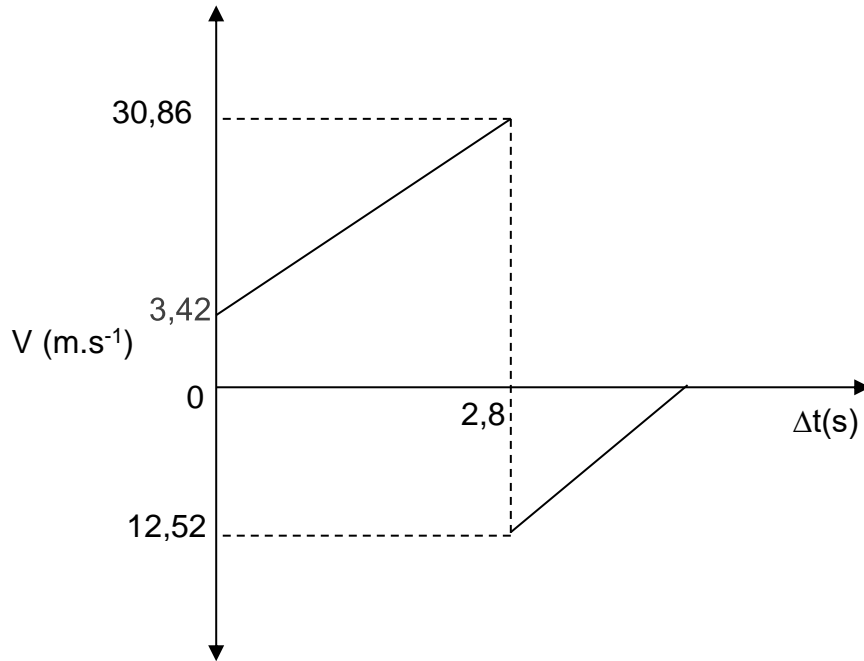
$$V_i = 12,52 \text{ m.s}^{-1} \text{ upwards.} \checkmark$$

(3)

3.2 **Positive marking from/Positiewe merk vanaf 3.1.1, 3.1.2, 3.1.3
CRITERIA FOR MARKING/KRITERIA VIR MERK**

- (i) Initial velocity with which the ball was thrown. \checkmark
Beginsnelheid waarmee bal gegooi is.
- (ii) Final velocity with which the ball hit the ground. \checkmark
Eindsnelheid waarmee die bal die grond tref.
- (iii) Time taken to hit the ground. \checkmark
Tyd om die grond te tref.
- (iv) The velocity with which the ball bounces off the ground. \checkmark
Die snelheid waarmee die bal van die grond af bons.



(4)
[14]**QUESTION/VRAAG 4**

4.1 $(m_A + m_B) v_i = m_A v_{fA} + m_B v_{fB} \checkmark$
 $(1100 + 800) \times \left(\frac{45 \times 1000}{3600}\right) \checkmark = 1100 v_{fA} + 800 \times 9,06 \checkmark$
 $v_{fA} = 15,00 \text{ m.s}^{-1} \checkmark$

(4)

- 4.2 4.2.1 The product of the net force acting on an object and the time the net force acts on the object. $\checkmark\checkmark$
Die produk van die netto krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk. $\checkmark\checkmark$

(2)

Positive marking from QUESTION 4.1 / Positiewe merk vanaf VRAAG 4.1

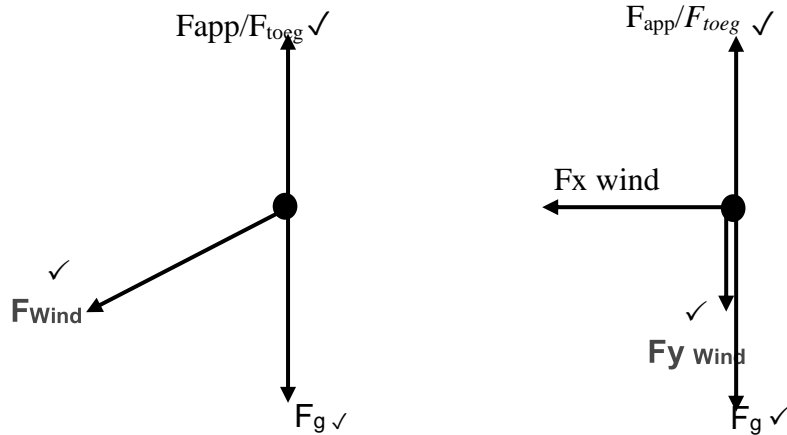
4.2.2 **OPTION/OPSIE 1**
 $F_{net} \Delta t = m (v_f - v_i) \checkmark$
 $F_{net} \times 0,2 \checkmark = 1100 (0 - (-15)) \checkmark$
 $F_{net} = 1,65 \times 10^4 \text{ N left/links} \checkmark$

OPTION/OPSIE 2
 $F_{net} \Delta t = m (v_f - v_i) \checkmark$
 $F_{net} \times 0,2 \checkmark = 1100 (0 - (15)) \checkmark$
 $F_{net} = -1,65 \times 10^4$
 $F_{net} = 1,65 \times 10^4 \text{ N left/links} \checkmark$

(4)
[10]

QUESTION/VRAAG 5

5.1



(3)

Mark awarded for arrow and label./Punt toegeken vir pyl en byskrif

Do not penalise for length of arrows since drawing is not drawn to scale/

Moenie penaliseer vir lengte van pyle nie want skets is nie volgens skaal nie.

Any other additional force(s)/Enige addisionele krag(te) $2/3$

If force(s) do not make contact with body./Indien krag(te) nie kontak maak met liggaam nie Max/Maks. $2/3$

5.2

5.2.1 **OPTION/OPSIE 1**

$$W_{Fg} = F_g \Delta X \cos\theta \checkmark$$

$$W_{Fg} = 245 \times 9,8 \times 12 \cos 180^\circ \checkmark$$

$$W_{Fg} = -28812 \text{ J} \checkmark$$

OPTION 2/OPSIE 2

$$W_{Fg} = -\Delta E_p$$

$$W_{Fg} = -mg(h_2 - h_1) \left. \begin{array}{l} \text{Any one } \checkmark / \\ \text{Enige een} \end{array} \right\}$$

$$W_{Fg} = -245 \times 9,8(12 - 0) \checkmark$$

$$W_{Fg} = -28812 \text{ J} \checkmark$$

(3)

5.2.2 **OPTION/OPSIE 1**

$$F_{\text{net}} = F_{\text{wind}Y} + F_g + F_{\text{app}} \leftarrow$$

$$F_{\text{net}} = -(1870 \cos 50^\circ) - (245 \times 9,8) + 3000 \checkmark$$

$$F_{\text{net}} = -603,01 \text{ N}$$

$$W_{\text{net}} = F_{\text{net}} \cdot \Delta X \cos\theta \leftarrow$$

$$W_{\text{net}} = 603,01 \times 12 \cos 180^\circ \checkmark$$

$$W_{\text{net}} = -7236,12 \text{ J} \checkmark$$

Any one \checkmark /

Enige een

Positive marking from QUESTION 5.2.1/

Positiewe merk vanaf VRAAG 5.2.1

OPTION/OPSIE 2

$$W_{\text{nc}} = \Delta E_k + \Delta E_p \left. \begin{array}{l} \text{Any one } \checkmark / \\ \text{Enige een} \end{array} \right\}$$

$$W_F + W_{\text{wind}} = \Delta E_k + \Delta E_p$$

$$3000 \times 12 \cos 0^\circ + 1870 \times 12 \cos 130^\circ \checkmark = 28812 \checkmark + \Delta E_k$$

$$\Delta E_k = -7236,15 \text{ J}$$

$$W_{\text{net}} = -7236,12 \text{ J} \checkmark$$

**Positive marking from QUESTION 5.2.1/
Positiewe merk vanaf VRAAG 5.2.1**

OPTION/OPSIE 3

$$W_{\text{net}} = W_{\text{wind}} + W_{\text{Fg}} + W_{\text{app}} \checkmark$$

$$W_{\text{net}} = (1870 \times 12 \cos 130^\circ) \checkmark - 28812 + (3000 \times 12 \cos 0^\circ) \checkmark$$

$$W_{\text{net}} = -7236,15 \text{ J} \checkmark \quad (4)$$

- 5.3 The net work done on an object is equal to the change in kinetic energy $\checkmark\checkmark$
Die netto arbeid verrig op 'n voorwerp is gelyk aan die verandering in kinetiese energie $\checkmark\checkmark$ (2)

5.4
$$\left. \begin{aligned} W_{\text{net}} &= \Delta E_k \\ W_{\text{net}} &= \frac{1}{2} m V_f^2 - \frac{1}{2} m V_i^2 \end{aligned} \right\} \text{Any one/Enige een } \checkmark$$

$$-7236,15 = \frac{1}{2} \times 245 V_f^2 - \frac{1}{2} \times 245 \times 15^2 \checkmark$$

$$V_f = 12,88 \text{ m}\cdot\text{s}^{-1} \checkmark$$

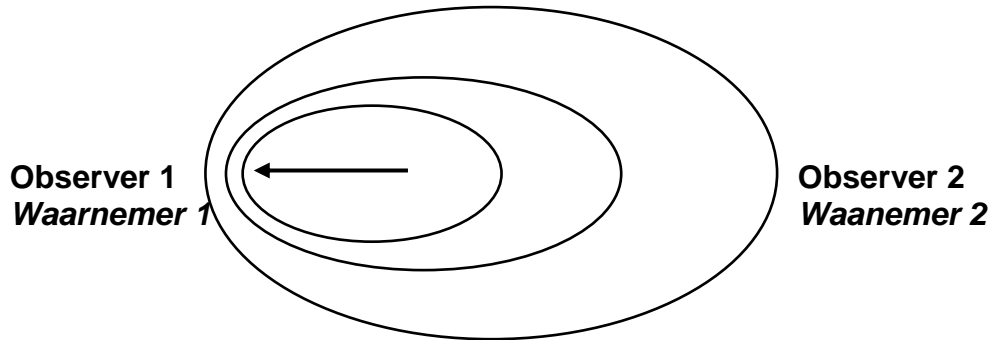
(3)
[15]

QUESTION/VRAAG 6

6.1 6.1.1 EQUAL TO. ✓ There is no relative motion between the observers and the source of sound. ✓
GELYK AAN. ✓ *Daar is geen relatiewe beweging tussen die waarnemers en die bron van die klank nie.* ✓ (2)

6.1.2 GREATER THAN / GROTER AS ✓ (1)

6.1.3



Criteria/Kriteria	Mark/Punt
Wave compressed towards observer 1 <i>Golf saamgepers na waarnemer 1</i>	✓
Wave stretched away from observer 2 <i>Golf saamgepers weg van waarnemer 2</i>	✓
Direction of motion indicated <i>Rigting van beweging aangedui</i>	✓

(3)

6.1.4 Doppler effect / Doppler effek ✓ (1)

6.1.5 $f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓
 $1730 \checkmark = \frac{340 \checkmark}{340 - 25} \checkmark f_S$
 $f_S = 1602,79 \text{ Hz}$ ✓ (5)

6.1.6 Star C, ✓ it shows a greater red shift. ✓
Ster C, ✓ dit toon 'n groter rooi verskuiwing ✓ (2)
[14]

QUESTION/VRAAG 7

7.1 The electrostatic force between two point charges is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance between them. ✓

Die elektrostatische krag tussen twee puntladings is direk eweredig aan die produk van die ladings ✓ en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. ✓

(2)

7.2.1 OPTION/OPSIE 1

$$\text{Factor/Faktor} = \frac{1920}{120} \checkmark = 16$$

OR/OF

$$\text{Factor/Faktor} = \frac{120}{1920} = \frac{1}{16}$$

Factor decreases by 16. /Faktor verminder met 16 ✓

Factor by which r increased/Faktor waarmee r toeneem = $\sqrt{16} = 4$ ✓

$$X + 6 = 4X \checkmark$$

$$X = 2 \text{ m } \checkmark$$

OPTION/OPSIE 2

$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$1920 \checkmark = \frac{9 \times 10^9 \times Q^2}{X^2} \checkmark$$

$$Q^2 = \frac{1920 \times X^2}{9 \times 10^9} \dots\dots\dots (1)$$

$$120 = \frac{9 \times 10^9 \times Q^2}{(X+6)^2} \checkmark$$

$$Q^2 = \frac{120 \times (X+6)^2}{9 \times 10^9} \dots\dots\dots (2)$$

$$\frac{1920 \times X^2}{9 \times 10^9} = \frac{120 \times (X+6)^2}{9 \times 10^9}$$

$$x = 2 \text{ m } \checkmark$$

(5)

**Positive marking from QUESTION 7.2.1/
Positiewe merk vanaf VRAAG 7.2.1**

7.2.2 OPTION/OPSIE 1

$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$1920 \checkmark = \frac{9 \times 10^9 \times Q^2}{2^2} \checkmark$$

$$Q = 9,24 \times 10^{-4} \text{ C } \checkmark$$

OPTION/OPSIE 2

$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$120 \checkmark = \frac{9 \times 10^9 \times Q^2}{8^2} \checkmark$$

$$Q = 9,24 \times 10^{-4} \text{ C } \checkmark$$

(4)

**Positive marking from QUESTION 7.2.1/
Positiewe merk vanaf VRAAG 7.2.1**

$$7.3.1 \quad E = \frac{kQ}{r^2} \checkmark$$

$$E_1 = \frac{9 \times 10^2 \times 9,24 \times 10^{-4}}{2.2^2} \checkmark$$

$$E_1 = 1718181,818 \text{ N.C}^{-1} \quad (1,72 \times 10^6 \text{ N.C}^{-1}) \text{ Right/Regs}$$

$$E_2 = \frac{9 \times 10^2 \times 9,24 \times 10^{-4}}{0.2^2} \checkmark$$

$$E_2 = 207900000 \text{ N.C}^{-1} \quad (2,08 \times 10^8 \text{ N.C}^{-1}) \text{ Right/Regs}$$

$$E_{\text{net}} = 1718181,818 + 207900000 \\ (1,72 \times 10^6 \text{ N.C}^{-1} + 2,08 \times 10^8 \text{ N.C}^{-1}) \checkmark$$

$$E_{\text{net}} = 2,10 \times 10^8 \text{ N.C}^{-1} \checkmark$$

(5)

**Positive marking from QUESTION 7.3.1/
Positiewe merk vanaf VRAAG 7.3.1**

7.3.2 OPTION/OPSIE 1

$$E = \frac{F}{q} \checkmark$$

$$2,10 \times 10^8 = \frac{F}{1,6 \times 10^{-19}} \checkmark$$

$$F = 3,36 \times 10^{-11} \text{ N} \checkmark$$

OPTION/OPSIE 2

$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$F = \frac{9 \times 10^9 \times 9,24 \times 10^{-4} \times 1,6 \times 10^{-19}}{2.2^2} + \frac{9 \times 10^9 \times 9,24 \times 10^{-4} \times 1,6 \times 10^{-19}}{0.2^2} \checkmark$$

$$F = 3,35 \times 10^{-11} \text{ N} \checkmark$$

(3)
[19]

QUESTION/VRAAG 8

8.1.1 Diagram **A** represents **Exp 2**/*Diagram A verteenwoordig Eksp 2.* ✓ (1)

8.1.2 $\epsilon = I(R+r)$ ✓
 $= 14,4 + 4,8r$ ✓ (1)
 $= 20,58 + 1,71r$ ✓ (2)
 $3,09 r = 6,18$
 $\therefore r = 2 \Omega$ ✓

(4)

8.1.3 **OPTION/OPSIE 1**

$\epsilon = I(R+r)$
 $= 4,8 \times 2 + 14,4$ ✓
 $= 24 \text{ V}$ ✓

OPTION/OPSIE 2

$\epsilon = I(R+r)$
 $= 1,71 \times 2 + 20,5$ ✓
 $= 24 \text{ V}$ ✓

(2)

**Positive marking from QUESTION 8.2.1 and 8.2.2 /
Positiewe merk vanaf VRAAG 8.2.1 en 8.2.2**

8.1.4 **OPTION/OPSIE 1**

$R = \frac{V}{I}$ ✓
 $R = \frac{20,58}{1,71}$ ✓
 $R = 12$
 $R = R_1 + R_2$
 $12 = 2R_1$ ✓
 $R = 6 \Omega$ ✓

OPTION/OPSIE 2

$R = \frac{V}{I}$ ✓
 $R = \frac{14,4}{4,8}$ ✓
 $R = 3 \Omega$
 $\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2}$
 $\frac{1}{3} = \frac{1}{R} + \frac{1}{R}$ ✓ ($R_1=R_2 = R$)
 $R = 6 \Omega$ ✓

OPTION/OPSIE 3

$\epsilon = I (R + r)$ ✓
 $24 = 4,8 (R + 2)$ ✓
 $R = 3 \Omega$
 $\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2}$
 $\frac{1}{3} = \frac{1}{R} + \frac{1}{R}$ ✓ ($R_1 = R_2 = R$)
 $R = 6 \Omega$ ✓

OPTION/OPSIE 4

$\epsilon = I (R + r)$ ✓
 $24 = 1,71(R + 2)$ ✓
 $R = 12,04 \Omega$
 $R = R_1 + R_2$
 $12,04 = 2R$ ✓
 $R = 6,02 \Omega$ ✓

(4)

8.1.5 **OPTION/OPSIE 1**

DECREASE, ✓ total external resistance will increase, the current will decrease ✓

$P \propto I^2$ ✓ therefore power decreases.

AFNEEM, totale eksterne weerstand sal afneem, die stroom sal afneem

$P \propto I^2$ ✓ dus sal drywing verminder.

OPTION/OPSIE 2

DECREASE, ✓ total external resistance will increase, the current will decrease, the lost volt will decrease. ✓

$P \propto V_{lost}^2$ ✓ therefore power decreases.

AFNEEM, totale eksterne weerstand sal afneem, die stroom sal afneem, die verlore volt sal verminder.

$P \propto V_{verlore}^2$ ✓ dus sal drywing verminder.

(3)

8.2 $P = I^2 R$ ✓

$P = 16^5 \times 52$ ✓

$P = 13\,312\text{ W}$

$\text{kWh} = 13,312 \times 6$

$\text{kWh} = 79,872$

$\text{Cost/Koste} = 79,872 \times 1,20$ ✓

$= \text{R}95,85$ ✓

(4)

[18]

QUESTION/VRAAG 9

9.1 9.1.1 Mechanical energy to Electrical energy. ✓✓
Meganiese energie na Elektriese energie (2)

9.1.2 P to Q. / P na Q ✓ (1)

9.2 9.2.1 $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ $V_{wgk} = \frac{V_{maks}}{\sqrt{2}}$ ✓
 $230 = \frac{V_{max}}{\sqrt{2}}$ ✓
 $V_{max}/maks = 325,27 V$ ✓ (3)

9.2.2 $\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓
 $\frac{1}{R_{//}} = \frac{1}{12} + \frac{1}{24}$ ✓
 $R_{//} = 8 \Omega$

OPTION/OPSIE 1

$P_{average} = \frac{V_{rms}^2}{R}$ ✓ / $P_{gem} = V_{wgk}/R$

$P_{average} = \frac{(230)^2}{8}$ ✓

$P_{average} / P_{gem} = 6612,5 W (6,61 kW)$ ✓

(5)

OPTION/OPSIE 2

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

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

$I_{rms} = \frac{230}{8}$
 $= 28,75 A$

$P_{avg} = V_{rms}.I_{rms}$ ✓ / $P_{gem} = V_{wgk}.I_{wgk}$
 $= (230)(28,75)$ ✓
 $= 6612,5 W (6,61 kW)$ ✓

OPTION/OPSIE 3

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

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

$I_{rms} = \frac{230}{8}$
 $= 28,75 A$

$P_{average} = I_{rms}^2 R$ / $P_{gem} = I_{wgk}^2 . R$
 $= (28,75)^2(8)$ ✓
 $= 6612,5 W (6,61 kW)$ ✓

✓ Any one/
Enige een

✓ Any one/
Enige een

(5)
[11]

QUESTION/VRAAG 10

10.1 The minimum energy (of incident photons) that can eject electrons from a metal (surface). ✓✓
Die minimum energie (van invallende fotone) wat elektrone kan vrystel vanuit 'n metaal (oppervlakte) ✓✓ (2)

10.2 $W_0 = 3,51 \times 10^{-19} \text{ J}$ ✓ (1)

10.3 EQUAL to ✓ The gradient is Planck's constant. ✓
GELYK AAN ✓ Die gradiënt (helling) is Plank se konstante ✓ (2)

**Positive marking from QUESTION 10.1.2/
 Positiewe merk vanaf VRAAG 10.1.2**

10.4 $W_0 = hf_0$ ✓
 $3,51 \times 10^{-19} = 6,63 \times 10^{-34} f_0$ ✓
 $f_0 = 5,29 \times 10^{14} \text{ Hz}$ ✓ (3)

**Positive marking from QUESTION 10.1.2/
 Positiewe merk vanaf VRAAG 10.1.2**

10.5 $E = W_0 + E_k$ } Any one ✓/
 $\frac{hc}{\lambda} = W_0 + \frac{1}{2} mv^2$ } *Enige een*

$\frac{6,63 \times 10^{-34} \times 3 \times 10^8}{\lambda} \checkmark = 3,51 \times 10^{-19} \checkmark + \frac{1}{2} \times 3,83 \times 10^{-19} \checkmark$

$\lambda = 2,71 \times 10^{-7} \text{ m}$ ✓ (5)

[13]

TOTAL/TOTAAL: 150