



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE/
NASIONALE SENIOR
SERTIFIKAAT**

GRADE/GRAAD 12

SEPTEMBER 2021

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

MARKS/PUNTE: 150

This marking guideline consists of 17 pages./
Hierdie nasienriglyn bestaan uit 17 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 gepeenaliseer 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 **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** vir die daaropvolgende subvraag toegeken.*
- 4.2 **A multistep question of a sub-question:** 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 B ✓✓ (2)
- 1.4 D ✓✓ (2)
- 1.5 D ✓✓ (2)
- 1.6 C ✓✓ (2)
- 1.7 A ✓✓ (2)
- 1.8 C ✓✓ (2)
- 1.9 D ✓✓ (2)
- 1.10 B ✓✓ (2)
- [20]**

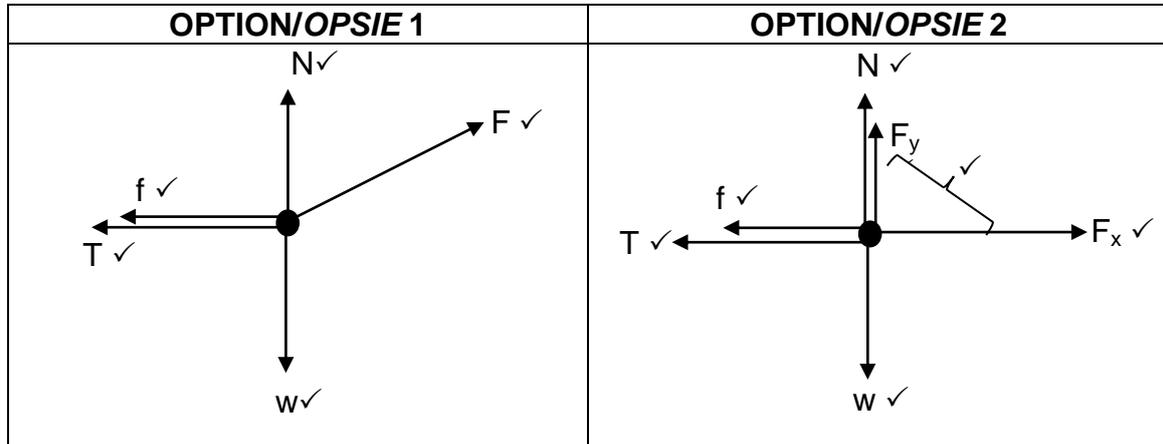
QUESTION/VRAAG 2

2.1.1 When a (non-zero) resultant/net force acts on an object, it accelerates in the direction of the force. The acceleration is directly proportional to the force and inversely proportional to the mass of the object. ✓✓

Indien 'n (nie-nul) resultante/netto krag op 'n voorwerp inwerk, versnel dit in die rigting van die krag. Die versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp. ✓✓

(2)

2.1.2



(5)

Accept the following symbols./Aanvaar die volgende simbole:	
N ✓	F_N /Normal/Normaal/Normal force/Normaalkrag
f ✓	F_f / f_k / f_r / frictional force/wrywingskrag/kinetic frictional force / kinetiese wrywingskrag
w ✓	F_g , mg/weight/ $F_{\text{Earth on block}}$ /49 N/gravitational force/gewig/ $F_{\text{aarde op blok}}$ / gravitasiekrag
T ✓	Tension / Spanning / F_T / F_s
$F_{\text{applied/toegepas}}$ ✓	F / F_A / Applied force / Toegepaste krag

Marks awarded for arrow and label/Punte toegeken vir pyltjie en byskrif.

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

Moenie penaliseer vir pyltjie-lengtes nie (diagram is nie volgens skaal nie).

Any other additional force(s)/Enige addisionele krag(te) $\frac{3}{4}$

If force(s) do not make contact with body. Max./Maks. $\frac{3}{4}$

Indien krag(te) nie kontak maak met voorwerp nie.

2.1.3

OPTION/OPSIE 1 (To the right is positive) (Na regs positief)	OPTION/OPSIE 2 (To the right is negative) (Na regs negatief)
$F_{\text{net}} = ma$ $T - f = ma$ $F \cos \theta - T - f = ma$ $T - 10 = 2(2) \checkmark$ $T = 14 \text{ N}$ $F \cos \theta - T - f = ma$ $F \cos 20^\circ - 14 - 15 \checkmark = 5(2) \checkmark$ $F = 41,50 \text{ N} \checkmark$	$F_{\text{net}} = ma$ $f - T = -ma$ $T + f - F \cos \theta = -ma$ $10 - T = 2(-2) \checkmark$ $T = 14 \text{ N}$ $T + f - F \cos \theta = -ma$ $14 + 15 - F \cos 20^\circ \checkmark = 5(-2) \checkmark$ $F = 41,50 \text{ N} \checkmark$

(5)

2.2

$$F = \frac{Gm_1m_2}{d^2} \checkmark$$

$$1\,842,50 \checkmark = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(200)}{d^2} \checkmark$$

$$d = 6\,579\,982,80 \text{ m}$$

distance above earth surface/afstand bo die aardoppervlak =

$$6\,579\,982,80 - 6,38 \times 10^6 \checkmark$$

$$= 199\,982,80 \text{ m} (1,9998280 \times 10^5 \text{ m} / 2,00 \times 10^5 \text{ m}) \checkmark$$

(5)
[17]**QUESTION/VRAAG 3**3.1.1 **OPTION/OPSIE 1**

UPWARDS POSITIVE OPWAARTS POSITIEF	UPWARDS NEGATIVE OPWAARTS NEGATIEF
$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(-25)^2 = (-20)^2 + 2(-9,8)\Delta y \checkmark$ $\Delta y = -11,48$ $\Delta y = 11,48 \text{ m} \checkmark$	$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(25)^2 = (20)^2 + 2(9,8)\Delta y \checkmark$ $\Delta y = 11,48 \text{ m} \checkmark$

OPTION/OPSIE 2

UPWARDS POSITIVE OPWAARTS POSITIEF	UPWARDS NEGATIVE OPWAARTS NEGATIEF
$v_f = v_i + a\Delta t$ $-25 = -20 + (-9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2 \checkmark$ $\Delta y = (-20)(0,51) + \frac{1}{2}(-9,8)(0,51)^2 \checkmark$ $\Delta y = -11,47$ $\Delta y = 11,47 \text{ m} \checkmark$	$v_f = v_i + a\Delta t$ $25 = 20 + (9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2 \checkmark$ $\Delta y = (20)(0,51) + \frac{1}{2}(9,8)(0,51)^2 \checkmark$ $\Delta y = 11,47 \text{ m} \checkmark$

OPTION/OPSIE 3	
UPWARDS POSITIVE OPWAARTS POSITIEF	UPWARDS NEGATIVE OPWAARTS NEGATIEF
$v_f = v_i + a\Delta t$ $-25 = -20 + (-9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $\Delta y = \frac{-25 + (-20)}{2} \times 0,51 \checkmark$ $\Delta y = -11,48 \text{ m}$ $\Delta y = 11,48 \text{ m} \checkmark$	$v_f = v_i + a\Delta t$ $25 = 20 + (9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $\Delta y = \frac{25 + 20}{2} \times 0,51 \checkmark$ $\Delta y = 11,48 \text{ m} \checkmark$

OPTION/OPSIE 4 (ACCEPT/AANVAAR)

UPWARDS POSITIVE OPWAARTS POSITIEF	UPWARDS NEGATIVE OPWAARTS NEGATIEF
$v_f = v_i + a\Delta t$ $-25 = -20 + (-9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = lb + \frac{1}{2}bh \checkmark$ $\Delta y = 20 \times 0,51 + \frac{1}{2}(5)0,51 \checkmark$ $\Delta y = 11,48 \text{ m} \checkmark$	$v_f = v_i + a\Delta t$ $25 = 20 + (-9,8)(\Delta t)$ $\Delta t = 0,51 \text{ s}$ $\Delta y = lb + \frac{1}{2}bh \checkmark$ $\Delta y = 20 \times 0,51 + \frac{1}{2}(5)0,51 \checkmark$ $\Delta y = 11,48 \text{ m} \checkmark$

(3)

3.1.2

UPWARDS POSITIVE OPWAARTS POSITIEF	UPWARDS NEGATIVE OPWAARTS NEGATIEF
$v_f = v_i + a\Delta t \checkmark$ $-25 = -20 + (-9,8)(\Delta t) \checkmark$ $\Delta t = 0,51 \text{ s}$ (time to reach to ground) <i>(tyd om die grond te bereik)</i> $v_f = v_i + a\Delta t$ $0 = 12 + (-9,8)(\Delta t) \checkmark$ $\Delta t = 1,22 \text{ s}$ (time to reach maximum height) <i>(tyd om maks hoogte te bereik)</i> $t = 1,22 + 0,51 \checkmark$ $t = 1,73 \text{ s} \checkmark$	$v_f = v_i + a\Delta t \checkmark$ $25 = 20 + (-9,8)(\Delta t) \checkmark$ $\Delta t = 0,51 \text{ s}$ (time to reach to ground) <i>(tyd om die grond te bereik)</i> $v_f = v_i + a\Delta t$ $0 = -12 + (9,8)(\Delta t) \checkmark$ $\Delta t = 1,22 \text{ s}$ (time to reach maximum height) <i>(tyd om maks hoogte te bereik)</i> $t = 1,22 + 0,51 \checkmark$ $t = 1,73 \text{ s} \checkmark$

(5)

3.1.3

OPTION/OPSIE 1	
Positive marking from 3.1.1/Positiewe merk vanaf 3.1.1	
UPWARDS POSITIVE OPWAARTS POSITIEF	UPWARDS NEGATIVE OPWAARTS NEGATIEF
$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $0^2 = 12^2 + 2(-9,8) \Delta y \checkmark$ $\Delta y = 7,35 \text{ m}$ Displacement = $\frac{-11,48}{2} + 7,35 \checkmark$ Verplasing = $-4,13$ = $4,13 \text{ m}$ (downwards/afwaarts) \checkmark	$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $0^2 = -12^2 + 2(9,8) \Delta y \checkmark$ $\Delta y = -7,35 \text{ m}$ Displacement = $\frac{11,48}{2} + (-7,35) \checkmark$ Verplasing = $4,13 \text{ m}$ (downwards/afwaarts) \checkmark

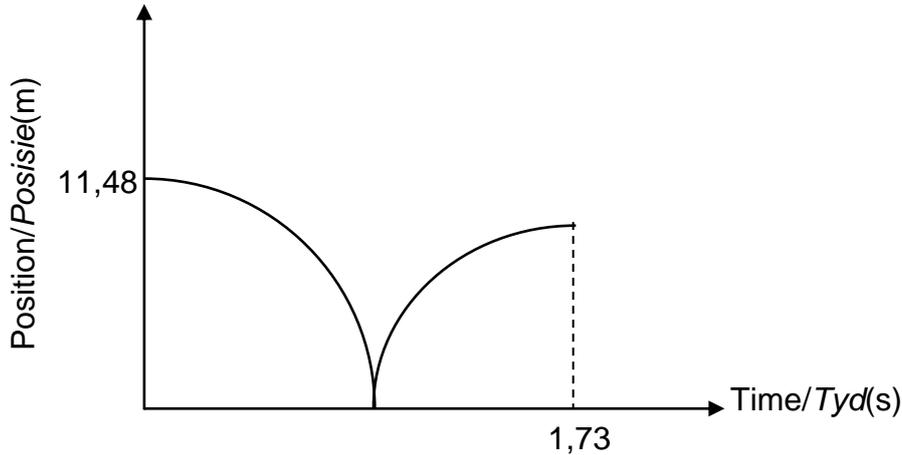
OPTION/OPSIE 2	
Positive marking from 3.1.1/Positiewe merk vanaf 3.1.1	
UPWARDS POSITIVE OPWAARTS POSITIEF	UPWARDS NEGATIVE OPWAARTS NEGATIEF
$v_f = v_i + a\Delta t$ $0 = 12 + (-9,8)(\Delta t)$ $\Delta t = 1,22 \text{ s}$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$ $\Delta y = 12 \times 1,22 + \frac{1}{2}(-9,8)(1,22)^2 \checkmark$ $\Delta y = 7,35 \text{ m}$ Displacement = $\frac{-11,48}{+7,35} \checkmark$ Verplasing = $-4,13$ = $4,13 \text{ m}$ (downwards/afwaarts) \checkmark	$v_f = v_i + a\Delta t$ $0 = -12 + (9,8)(\Delta t)$ $\Delta t = 1,22 \text{ s}$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$ $\Delta y = (-12)(1,22) + \frac{1}{2}(9,8)(1,22)^2 \checkmark$ $\Delta y = -7,35$ Displacement = $\frac{11,48}{+(-7,35)} \checkmark$ Verplasing = $4,13 \text{ m}$ (downwards/afwaarts) \checkmark

OPTION/OPSIE 3	
Positive marking from 3.1.1 / Positiewe merk vanaf 3.1.1	
UPWARDS POSITIVE OPWAARTS POSITIEF	UPWARDS NEGATIVE OPWAARTS NEGATIEF
$v_f = v_i + a\Delta t$ $0 = 12 + (-9,8)(\Delta t)$ $\Delta t = 1,22 \text{ s}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $\Delta y = \frac{0 + (12)}{2} \times 1,22 \checkmark$ $\Delta y = 7,32 \text{ m}$ Displacement = $\frac{-11,48}{+7,32} \checkmark$ Verplasing = $-4,16$ = $4,16 \text{ m}$ (downwards/afwaarts) \checkmark	$v_f = v_i + a\Delta t$ $0 = -12 + (9,8)(\Delta t)$ $\Delta t = 1,22 \text{ s}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $\Delta y = \frac{0 + (-12)}{2} \times 1,22 \checkmark$ $\Delta y = -7,32 \text{ m}$ Displacement = $\frac{11,48}{+(-7,32)} \checkmark$ Verplasing = $4,16 \text{ m}$ (downwards/afwaarts) \checkmark

OPTION/OPSIE 4	
Positive marking from 3.1.1 / Positiewe merk vanaf 3.1.1	
UPWARDS POSITIVE OPWAARTS POSITIEF	UPWARDS NEGATIVE OPWAARTS NEGATIEF
$v_f = v_i + a\Delta t$ $0 = 12 + (-9,8)\Delta t$ $\Delta t = 1,22 \text{ s}$ Area/oppervlakte = $\frac{1}{2}bh \checkmark$ = $\frac{1}{2}(1,22)(12) \checkmark$ = $7,32 \text{ m}$ Displacement = $\frac{-11,48}{+7,32} \checkmark$ Verplasing = $-4,16$ = $4,16 \text{ m}$ (downwards/afwaarts) \checkmark	$v_f = v_i + a\Delta t$ $0 = -12 + (9,8)\Delta t$ $\Delta t = 1,22 \text{ s}$ Area/oppervlakte = $\frac{1}{2}bh \checkmark$ = $\frac{1}{2}(1,22)(-12) \checkmark$ = $-7,32 \text{ m}$ Displacement = $\frac{11,48}{+(-7,32)} \checkmark$ Verplasing = $4,16 \text{ m}$ (downwards/afwaarts) \checkmark

(4)

3.2 Positive marking from 3.1.1 and 3.1.2 / *Positiewe merk vanaf 3.1.1 en 3.1.2*



CRITERIA FOR MARKING/MERK KRITERIA	
Correct shape/Korrekte vorm	✓
Height indicated/Hoogte aangedui (11,48 m)	✓
Time t indicated/Tyd t aangedui (1,73 s)	✓

(3)
[15]

QUESTION/VRAAG 4

4.1 In an isolated system total linear momentum is conserved. ✓✓
Die totale lineêre momentum bly behoue in 'n geïsoleerde/geslote sisteem. (2)

4.2.1 $\sum p_i = \sum p_f$
 $m_A v_{iA} + m_B v_{iB} = (m_A + m_B) v_f$ } Any one/Enige een ✓
 $(2 \times v_{iA}) + (4 \times -5) \checkmark = (2+4)(-1,67) \checkmark$
 $v_{iA} = 4,99 \text{ m}\cdot\text{s}^{-1}$ (East/Ooswaarts) ✓ (4)

4.2.2	POSITIVE MARKING FROM 4.2.1/Positiewe merk vanaf 4.2.1	POSITIVE MARKING FROM 4.2.1/Positiewe merk vanaf 4.2.1
	OPTION/OPSIE 1	OPTION/OPSIE 2
	$F_{net} \cdot \Delta t = \Delta p$ $F_{net} \cdot \Delta t = m(v_f - v_i)$ } Any one /Enige een ✓ $F_{net} \times 0,01 \checkmark = 2 (-1,67 - 4,99) \checkmark$ $F_{net} = -1\,332 \text{ N}$ $F_{net} = \underline{1\,332 \text{ N west/left/Wes/links}} \checkmark$	$F_{net} \cdot \Delta t = \Delta p$ $F_{net} \cdot \Delta t = m(v_f - v_i)$ } Any one /Enige een ✓ $F_{net} \times 0,01 \checkmark = 2 [1,67 - (-4,99)] \checkmark$ $F_{net} = -1\,332 \text{ N}$ $F_{net} = \underline{1\,332 \text{ N west/left/Wes/links}} \checkmark$

OPTION/OPSIE 3	OPTION/OPSIE 4
$F_{\text{net}} = ma$ $F_{\text{net}} = m \left(\frac{v_f - v_i}{\Delta t} \right)$ $F_{\text{net}} = 2 \times \left(\frac{-1,67 - 4,99}{0,01} \right)$ $F_{\text{net}} = -1\ 332$ $F_{\text{net}} = \underline{1\ 332\ \text{N west/left/Wes/links}}$	$F_{\text{net}} = ma$ $F_{\text{net}} = m \left(\frac{v_f - v_i}{\Delta t} \right)$ $F_{\text{net}} = 2 \times \left(\frac{1,67 - (-4,99)}{0,01} \right)$ $F_{\text{net}} = \underline{1\ 332\ \text{N west/left/Wes/links}}$

OPTION 5/OPSIE 5	OPTION 6/OPSIE 5
$F_{\text{net}} \cdot \Delta t = \Delta p$ $F_{\text{net}} \cdot \Delta t = m(v_f - v_i)$ $F_{\text{net}}(0,01) \checkmark = 4(-1,67 - -5) \checkmark$ $F_{\text{net}} = 1\ 332$ $F_{AB} = -F_{BA}$ $F_{\text{net}(BA)} = \underline{1\ 332\ \text{N west/left}}$	$F_{\text{net}} \cdot \Delta t = \Delta p$ $F_{\text{net}} \cdot \Delta t = m(v_f - v_i)$ $F_{\text{net}}(0,01) \checkmark = 4(1,67 - 5) \checkmark$ $F_{\text{net}} = -1\ 332$ $F_{AB} = -F_{BA}$ $F_{\text{net}(BA)} = \underline{1\ 332\ \text{N west/left}}$

(4)
[10]**QUESTION/VRAAG 5**5.1 Gravitational force / *Gravitasiekrag* ✓

(1)

5.2
$$\Delta x = \frac{12}{\sin 30^\circ} \checkmark = 24\ \text{m}$$

$$W_f = f \cdot \Delta x \cos \theta \checkmark$$

$$W_f = 35,5 \times 24 \cos 180^\circ \checkmark$$

$$W_f = -852\ \text{J} \checkmark$$

(4)

5.3 Zero/0 J ✓

(1)

5.4 Positive marking from 5.2/Positiewe merk vanaf 5.2

OPTION/OPSIE 1

$$W_{\text{net}} = \Delta E_k$$

$$W_f + W_F + W_{Fg} = \Delta E_k$$

$$f \times \Delta x \cos \theta + F \Delta x \cos \theta + mg(h_2 - h_1) = \Delta E_k$$

$$-852 \checkmark + (62,5 \times 24 \cos 180^\circ) \checkmark + m(9,8)(12-0) \checkmark = 0$$

$$m = 20 \text{ kg} \checkmark$$

Any one/Enige een ✓

OPTION/OPSIE 2

$$W_{\text{nc}} = \Delta E_p + \Delta E_k$$

$$W_f + W_F = \Delta E_p + \Delta E_k$$

$$f \Delta x \cos \theta + F \Delta x \cos \theta = mg(h_2 - h_1) + \Delta E_k$$

$$-852 \checkmark + (62,5)(24)\cos 180^\circ \checkmark = m(9,8)(0 - 12) \checkmark + 0$$

$$m = 20 \text{ kg} \checkmark$$

Any one/Enige een ✓

OPTION 3/OPSIE 3

$$W_{\text{net}} = \Delta E_k$$

$$W_f + W_F + W_w = \Delta E_k$$

$$f \Delta x \cos \theta + F \Delta x \cos \theta + mg \Delta x \cos \theta = \Delta E_k$$

$$-852 \checkmark + (62,5)(24)\cos 180^\circ \checkmark + m(9,8)(24)\cos 60^\circ \checkmark = 0$$

$$m = 20 \text{ kg} \checkmark$$

Any one/Enige een ✓

(5)
[11]**QUESTION/VRAAG 6**6.1.1 520 Hz / 520 waves per second (waves.s⁻¹)/golwe per sekondes (golwe.s⁻¹) ✓ (1)6.1.2 The change in frequency ✓ (or pitch) observed/detected by a listener because the listener and the sound source have different velocities relative to the medium of sound propagation. ✓Die verandering in frekwensie ✓ (of toonhoogte) waargeneem deur 'n luisteraar want die luisteraar en die klankbron het verskillende snelhede relatief tot die medium wat klank voortplant. ✓**OR/OF**The (apparent) changed in observed/detected frequency (pitch) as a result of relative motion between the sound source and the listener. ✓ ✓Die waarskynlike verandering in die waargenome frekwensie (toonhoogte) as gevolg van die relatiewe beweging tussen die klankbron en die luisteraar. ✓ ✓ (2)6.1.3 TOWARDS ✓ Detected frequency is higher than the source frequency ✓
NA. ✓ Waargenome frekwensie is hoër as die bron se frekwensie ✓ (2)

6.1.4
$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark$$

$$520 \checkmark = \frac{343}{343 - v_s} \checkmark (480) \checkmark$$

$$v_s = 26,38 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(5)

6.1.5 Decreases/Neem af ✓

For a constant velocity/speed of sound, if the frequency increases, λ decreases. ✓
Vir 'n konstante snelheid/spoed van klank, indien die frekwensie toeneem, neem λ af.

OR/OF

$\lambda \propto \frac{1}{f}$ at constant velocity/speed/by konstante snelheid/spoed ✓

OR/OF

$f \propto \frac{1}{\lambda}$ at constant velocity/speed/by konstante snelheid/spoed ✓ (2)

6.2 Light from the star is shifted towards longer wavelength (towards the red end of the spectrum) ✓ which indicated that the star is moving away from the earth. ✓

*Lig van die ster skuif na 'n langer golflengte (na die rooi kant van die spektrum) ✓
 wat aandui dat die ster wegbeweeg van die aarde af. ✓*

(2)

6.3 Used to measure the direction and speed of blood flow in arteries and veins. ✓

Word gebruik om die rigting en spoed waarteen bloed in are en slagare vloei, te meet.

OR/OF

Used to measure the heartbeat of a foetus in the womb.

Word gebruik om die hartklop van 'n fetus in die baarmoeder te meet.

(1)

[15]**QUESTION/VRAAG 7**

7.1.1 GAIN/BYGEKRY ✓

(1)

$$7.1.2 \quad n = \frac{Q}{q_e} \quad \checkmark$$

$$n = \frac{5 \times 10^{-6}}{1,6 \times 10^{-19}} \quad \checkmark$$

$$n = 3,125 \times 10^{13} \text{ (electrons/elektrone)} \quad \checkmark \quad (3)$$

$$7.1.3 \quad E = \frac{kQ}{r^2} \quad \checkmark$$

$$E = \frac{9 \times 10^9 \times 5 \times 10^{-5}}{0,1^2} \quad \checkmark$$

$$E = 4,5 \times 10^6 \text{ N.C}^{-1} \quad \checkmark \text{ left/links} \quad \checkmark \quad (5)$$

7.2.1 Negative/Negatief ✓

Like charges repel each other/Gelyksoortige ladings stoot mekaar af. ✓

OR/OF

The charges repel each other. If sphere **A** is negative, then sphere **B** must also be negative. ✓

*Die ladings stoot mekaar af. Indien sfeer **A** negatief is, dan moet sfeer **B** ook negatief wees.*

(2)

$$7.2.2 \quad F_E = T \sin 30^\circ$$

$$F_E = 25 \sin 30^\circ \checkmark$$

$$F_E = 12,5 \text{ N}$$

$$F_E = \frac{kQ_1 Q_2}{r^2} \checkmark$$

$$12,5 \checkmark = \frac{(9 \times 10^9)(5 \times 10^{-6}) Q}{0,05^2} \checkmark$$

$$Q = 6,94 \times 10^{-7} \text{ C} \checkmark$$

(6)
[17]**QUESTION/VRAAG 8**

- 8.1.1 Temperature/*temperatuur* ✓
 Length of the conductors/*Lengte van die geleiers* ✓
 Thickness of the conductors/*Dikte van die geleiers* } (Any two/*Enige twee*)
 ACCEPT: Type of material
 AANVAAR: *Tipe materiaal* (2)

- 8.1.2 Gradient is the inverse of the resistance. ✓/
Gradiënt is die inverse van die weerstand ✓
OR/OF

$$\text{Gradient} = \frac{1}{R} \checkmark \quad (1)$$

- 8.1.3 Conductor C./*Geleier C.* ✓

It has the highest resistance. The higher the resistance of a conductor, the more heat is produced in the conductor if the current is constant. ✓
Dit het die hoogste weerstand. Hoe hoër die weerstand, hoe meer hitte geproduseer word in die geleier indien die stroom konstant is. (2)

8.2.1 $R = \frac{V}{I} \checkmark$
 $R = \frac{12}{1,5} \checkmark$
 $R = 8 \Omega \checkmark$ (3)

- 8.2.2 **OPTION/OPSIE 1**

$$R_{\text{total}} = R + r \checkmark$$

$$[8 = (4 + 3) \checkmark + r] \checkmark$$

$$r = 1 \Omega \checkmark$$

- OPTION/OPSIE 2**

$$\varepsilon = I(R + r) \checkmark$$

$$12 = 1,5 [(4 + 3) \checkmark + r] \checkmark$$

$$r = 1 \Omega \checkmark \quad (4)$$

8.2.3 $W = I^2 R \Delta t \checkmark$
 $W = (1,5)^2 (3) (180) \checkmark$
 $W = 1\,215 \text{ J} \checkmark$ (3)

- 8.3.1 Decrease/*Neem af.* ✓ (1)

- 8.3.2 Increase/*Neem toe.* ✓ (1)

8.4 Increase/Neem toe. ✓

R_{ext} decreases. Current through battery increases. ✓

$W = I^2 r \Delta t$ / Energy transfer to the battery/work done by battery increases. ✓

R_{eks} neem af. Stroom deur die battery neem toe. ✓

$W = I^2 r \Delta t$ / Energie oorgedra aan die battery/arbeid verrig deur die battery neem toe. ✓

(3)
[20]

QUESTION/VRAAG 9

9.1 Mechanical energy to electrical energy.

Meganiese energie na elektriese energie ✓✓

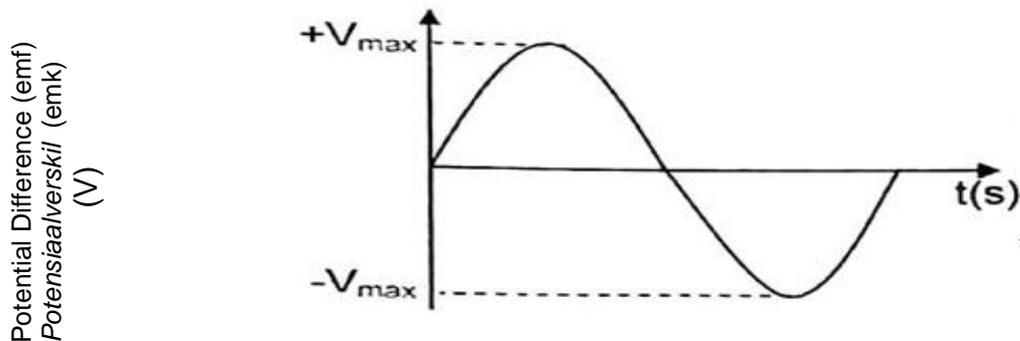
(2)

9.2 AC generator has slip rings and DC generator has a split ring / commutator ✓

WS-generator het sleepringe en GS-generator het 'n splitring / kommutator

(1)

9.3



CRITERIA FOR MARKING/MERK KRITERIA

Correct shape/Korrekte vorm	✓
Axes labelled correct/Asse korrek	✓
V_{max} indicated on graph/ V_{maks} aangedui op grafiek	✓

(2)

9.4 $P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}}$ ✓

$$2000 = I_{\text{rms}} \times 230 \quad \checkmark$$

$$I_{\text{rms}} = 8,70 \text{ A}$$

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

$$8,70 = \frac{I_{\text{max}}}{\sqrt{2}} \quad \checkmark$$

$$I_{\text{max}} = 12,30 \text{ A} \quad \checkmark$$

$P_{\text{gem}} = V_{\text{wgk}} I_{\text{wgk}}$ ✓

$$2000 = I_{\text{wgk}} \times 230 \quad \checkmark$$

$$\therefore I_{\text{wgk}} = 8,70 \text{ A}$$

$$I_{\text{wgk}} = \frac{I_{\text{max}}}{\sqrt{2}}$$

$$8,70 = \frac{I_{\text{max}}}{\sqrt{2}} \quad \checkmark$$

$$\therefore I_{\text{maks}} = 12,30 \text{ A} \quad \checkmark$$

(4)

9.5

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

$$230 = \frac{V_{\text{max}}}{\sqrt{2}} \quad \checkmark$$

$$V_{\text{max}}/V_{\text{maks}} = 325,27 \text{ V} \quad \checkmark$$

(3)
[12]

QUESTION/VRAAG 10

10.1 Work function (of the metal) / Werksfunksie (van die metaal) ✓

$$E_{k(max)} = \frac{hc}{\lambda} - W_0 \checkmark$$

The intercept on the vertical axis = W_0 .

Die afsnit op die vertikale-as = W_0 ✓

OR/OF

$$\frac{hc}{\lambda} = W_0 + E_{k(max)} \checkmark$$

The intercept on the vertical axis is equal to the W_0

Die afsnit op die vertikale-as is gelyk aan die W_0 ✓

(3)

10.2 $E = W_0 + E_{k(max)}$
 $hf = W_0 + E_{k(max)}$
 $hf = hf_0 + E_{k(max)}$ } Any one/Enige een ✓

$$\frac{6,63 \times 10^{-34} \times 6,16 \times 10^{14} \checkmark}{f_0 = 5,32 \times 10^{14} \text{ Hz} \checkmark} = \frac{6,63 \times 10^{-34} f_0 \checkmark + 5,6 \times 10^{-20} \checkmark}{f_0 = 5,32 \times 10^{14} \text{ Hz} \checkmark}$$

(5)

10.3.1 Remain the same/Bly dieselfde ✓

The gradient is equal to the product of Planck's constant and the speed of light in vacuum which are constants. ✓

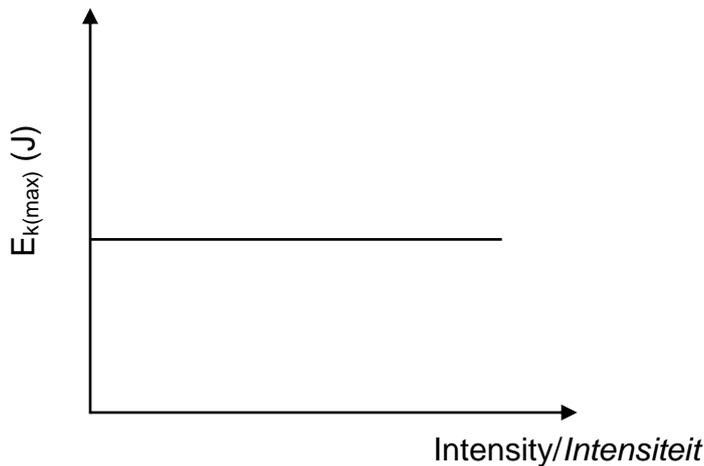
Die gradiënt is gelyk aan die produk van Planck se konstante en die spoed van lig in 'n vakuum wat konstantes is.

OR/OF

Gradient = hc , which are constants/Gradiënt = hc , wat konstantes is.

(2)

10.3.2 Remains the same/Bly dieselfde ✓



CRITERIA FOR MARKING/MERK KRITERIA	
Axes labelled/Asse benoem	✓
Correct shape/Korrekte vorm	✓

(3)
[13]

TOTAL/TOTAAL: 150