



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE/
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

JUNE/JUNIE 2019

**PHYSICAL SCIENCES P1
MARKING GUIDELINE/
FISIESE WETENSKAPPE V1
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 began 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 verkeerde 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 'n 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 formule 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 no 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 berekening 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 in a subquestion:** 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 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 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 could be considered.

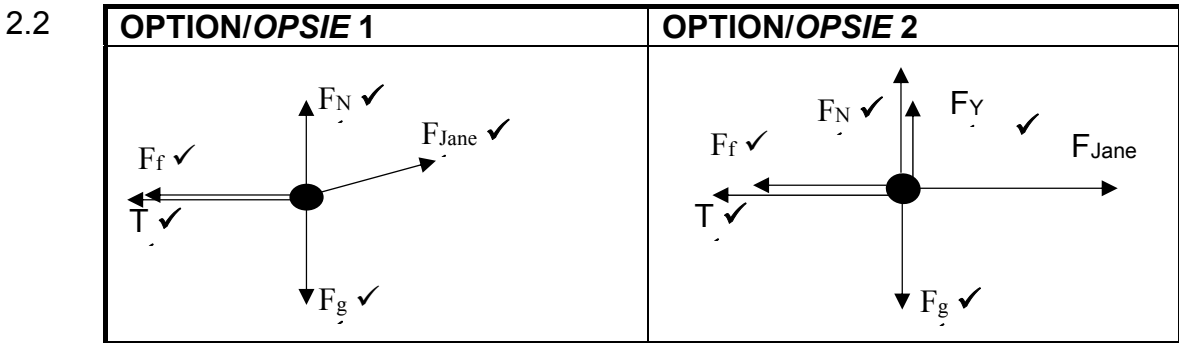
'n Verkeerde antwoord, indien dit op 'n konsepsuele fout gebaseer is, kan normaalweg nie korrek gemotiveer word nie. Indien 'n kandidaat gevra word om in VRAAG 3.2 die antwoord op VRAAG 3.1 te motiveer en 3.1 is verkeerd, kan geen punte vir VRAAG 3.2 toegeken word nie. Indien die antwoord op bv. 3.1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

QUESTION/VRAAG 1

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

QUESTION /VRAAG 2

2.1 When a net force/resultant force acts on an object, it produces the acceleration of the object in the direction of the net force/resultant force. This acceleration is directly proportional to the net/resultant force ✓ and inversely proportional to the mass of the object. ✓
Indien 'n netto/resulterende krag op 'n voorwerp inwerk, veroorsaak dit 'n versnelling van die voorwerp in die rigting van die netto/resulterende krag. Hierdie versnelling is direk eweredig aan die netto/resultante krag ✓ *en omgekeerd eweredig aan die massa van die voorwerp.* ✓ (2)



Mark awarded for both arrow and label./Punt toegeken vir beide pypunt en byskrif.

Do not penalise for length of forces since drawing is not drawn to scale. Moenie penaliseer vir lengte van kragte want diagram is 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 voorwerp nie. Max./Maks. ^{4/5}

(5)

2.3 Choose East (Right) to be positive/*Kies Oos (regs) as positief.*

4 kg box/houer

$$F_{\text{net}} = ma$$

$$F_x + f_k + T = ma$$

$$F_x - f_k - T = ma$$

$$F_{\text{Jane}} \cos 30^\circ + f_k + T = ma$$

✓ Any one / *Enige een*

$$80 \times 0,866 + (-8,14) + (-T) \checkmark = 4a$$

$$69,28 - 8,14 - T = 4a$$

$$61,14 - T = 4a \text{ ----- (1)}$$

5 kg box/houer

$$F_{\text{net}} = ma$$

$$T + W = ma$$

$$T + (-9,8 \times 5) \checkmark = 5a$$

$$T - 49 = 5a$$

$$a = \frac{T - 49}{5} \text{ ----- (2)}$$

Subst (2) in (1): / *Stel (2) in (1):*

$$61,14 - T = 4 \left(\frac{T - 49}{5} \right) \checkmark$$

$$305,7 - 5T = 4T - 196$$

$$9T = 501,7$$

$$T = 55,74 \text{ N } \checkmark$$

(5)
[12]

QUESTION/VRAAG 3

3.1 Each body in the universe attracts every other body with a force that is directly proportional to the product of their masses ✓ and inversely proportional to the square of the distance between their centres. ✓
Elke liggaam in die heelal trek elke ander liggaam aan met 'n krag wat direk eweredig is aan die produk van hulle massas ✓ *en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle middelpunte.* ✓

(2)

3.2

OPTION/OPSIE 1	OPTION/OPSIE 2
$F = \frac{Gm_1m_2}{r^2} \checkmark$ $126,30 \checkmark = \frac{6,67 \times 10^{-11} \times 7,35 \times 10^{22} m_2 \checkmark}{(1,74 \times 10^6)^2}$ $m_2 = 78,00 \text{ kg } \checkmark$	$g_m = \frac{GM_m}{R_m} \checkmark$ $= \frac{6,67 \times 10^{-11} \times 7,35 \times 10^{22}}{(1,74 \times 10^4)^2} \checkmark$ $= 1,619252874$ $w = mg$ $126,30 = m \times 1,619252874 \checkmark$ $m = 78,00 \text{ kg } \checkmark$

(4)
[6]

QUESTION/VRAAG 4

- 4.1 Projectile motion is the motion of an object upon which the only force acting is the force of gravity. ✓✓

Projektielbeweging is die beweging van 'n voorwerp waarop die enigste krag wat daarop inwerk, gravitasiekrag is. ✓✓

OR/OF

Projectile motion is the motion of an object that experiences only gravitational force. ✓✓

Projektielbeweging is die beweging van 'n voorwerp wat slegs gravitasiekrag ondervind. ✓✓

(2)

4.2

OPTION/OPSIE 1	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$v_f = v_i + g\Delta t$ ✓ $0 = (13) + (-9,8) \cdot \Delta t$ ✓ $\therefore \Delta t = 1,33 \text{ s}$ ✓	$v_f = v_i + g\Delta t$ ✓ $0 = (-13) + (9,8) \cdot \Delta t$ ✓ $\therefore \Delta t = 1,33 \text{ s}$ ✓

(3)

OPTION/OPSIE 2	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = 13^2 + 2(-9,8)\Delta y$ $\Delta y = 8,62244898 \text{ m}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t$ $8,62244898 = \frac{0+13}{2} \Delta t$ ✓ $\therefore \Delta t = 1,33 \text{ s}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = -13^2 + 2(9,8)\Delta y$ $\Delta y = -8,62244898 \text{ m}$ $\Delta y = \frac{v_f + v_i}{2} \Delta t$ $-8,62244898 = \frac{0-13}{2} \Delta t$ ✓ $\therefore \Delta t = 1,33 \text{ s}$ ✓

(3)

OPTION/OPSIE 3	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$v_f^2 = v_i^2 + 2g\Delta y$ ✓ $0^2 = 13^2 + 2(-9,8)\Delta y$ $\Delta y = 8,62244898 \text{ m}$ $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ $8,62 = 13\Delta t + \frac{1}{2}(-9,8)\Delta t^2$ ✓ $\therefore \Delta t = 1,33 \text{ s}$ ✓	$v_f^2 = v_i^2 + 2g\Delta y$ ✓ $0^2 = -13^2 + 2(9,8)\Delta y$ $\Delta y = 8,62244898 \text{ m}$ $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ $-8,62 = -13\Delta t + \frac{1}{2}(9,8)\Delta t^2$ ✓ $\therefore \Delta t = 1,33 \text{ s}$ ✓

(3)

4.3

OPTION/OPSIE 1	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$v_f^2 = v_i^2 + 2 g \Delta y \checkmark$ $0^2 \checkmark = (13)^2 + 2 (-9,8) \Delta y \checkmark$ $\Delta y = 8,62 \text{ m} \checkmark$	$v_f^2 = v_i^2 + 2 g \Delta y \checkmark$ $0^2 \checkmark = (-13)^2 + 2 (9,8) \Delta y \checkmark$ $\Delta y = 8,62 \text{ m} \checkmark$

OPTION/OPSIE 2	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$\Delta y = v_i \Delta t + \frac{1}{2} g \Delta t^2 \checkmark$ $= 13(1,33) \checkmark + \frac{1}{2} (-9,8)(1,33)^2 \checkmark$ $= 8,62 \text{ m} \checkmark$	$\Delta y = v_i \Delta t + \frac{1}{2} g \Delta t^2 \checkmark$ $= -13(1,33) \checkmark + \frac{1}{2} (9,8)(1,33)^2 \checkmark$ $= -8,62 \text{ m}$ $= 8,62 \text{ m, (upwards/opwaarts)} \checkmark$

OPTION/OPSIE 3	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $= \frac{0 + 13}{2} \checkmark \times 1,33 \checkmark$ $= 8,65 \text{ m} \checkmark$	$\Delta y = \frac{v_f + v_i}{2} \Delta t \checkmark$ $= \frac{0 - 13}{2} \checkmark \times 1,33 \checkmark$ $= -8,65 \text{ m}$ $= 8,65 \text{ m} \checkmark$

(4)

4.4 4.4.1

OPTION/OPSIE 1	
Taking top of building as starting point / Neem toppunt van gebou as beginpunt	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$v_f = v_i + a\Delta t \checkmark$ $v_f = 0 + (-9,8)(3,28 - 1,33) \checkmark$ $v_f = -19,11 \text{ m}\cdot\text{s}^{-1}$ $v_f = 19,11 \text{ m}\cdot\text{s}^{-1} \checkmark$	$v_f = v_i + a\Delta t \checkmark$ $v_f = 0 + (9,8)(3,28 - 1,33) \checkmark$ $v_f = 19,11 \text{ m}\cdot\text{s}^{-1} \checkmark$

OPTION/OPSIE 2	
Taking balcony as a starting point Neem balkon as beginpunt	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$v_f = v_i + a\Delta t \checkmark$ $v_f = -13 + (-9,8)(3,28 - 1,66) \checkmark$ $v_f = -19,08 \text{ m}\cdot\text{s}^{-1}$ $v_f = 19,08 \text{ m}\cdot\text{s}^{-1} \checkmark$	$v_f = v_i + a\Delta t \checkmark$ $v_f = 13 + (9,8)(3,28 - 2,66) \checkmark$ $v_f = 19,08 \text{ m}\cdot\text{s}^{-1} \checkmark$

(3)

4.4.2

OPTION/OPSIE 1	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$\Delta y = h = v_i\Delta t + \frac{1}{2} a\Delta t^2 \checkmark$ $h = -13(0,62) \checkmark + \frac{1}{2} (-9,8)(0,62)^2 \checkmark$ $h = -9,94 \text{ m} \checkmark$ Height of building/ <i>Hoogte van gebou</i> $= h + \Delta y$ $= 8,62 + 9,94 \checkmark$ $= 18,56 \text{ m} \checkmark$	$\Delta y = h = v_i\Delta t + \frac{1}{2} a\Delta t^2 \checkmark$ $h = 13(0,62) \checkmark + \frac{1}{2} (9,8)(0,62)^2 \checkmark$ $= 9,94 \text{ m} \checkmark$ Height of building/ <i>Hoogte van gebou</i> $= h + \Delta y$ $= 8,62 + 9,94 \checkmark$ $= 18,56 \text{ m} \checkmark$

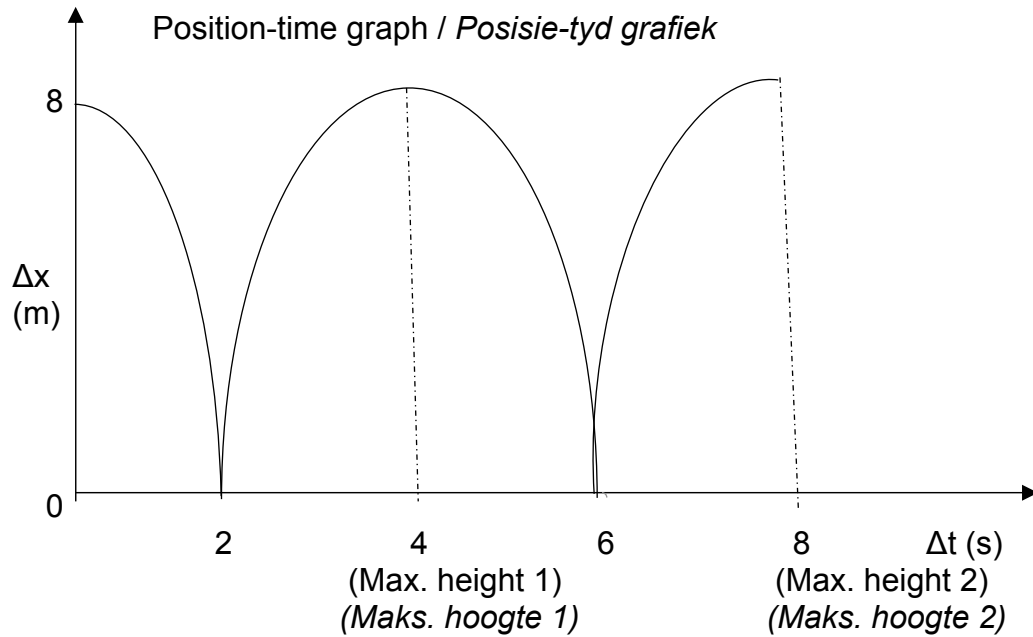
OPTION/OPSIE 2	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(-19,11)^2 \checkmark = (-13)^2 + 2(-9,8)(\Delta y_1) \checkmark$ $h = \Delta y = 10,01 \text{ m} \checkmark$ Height of building/Hoogte van gebou $= \Delta y + h$ $= 8,62 + 10,01 \checkmark$ $= 18,62 \text{ m} \checkmark$	$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(-19,11)^2 = (-13)^2 \checkmark + 2(-9,8)(\Delta y_1) \checkmark$ $h = \Delta y = 10,01 \text{ m} \checkmark$ Height of building/Hoogte van gebou $= \Delta y + h$ $= 8,62 + 10,01 \checkmark$ $= 18,62 \text{ m} \checkmark$

OPTION/OPSIE 3	
(upwards positive) (opwaarts positief)	(downwards positive) (afwaarts positief)
$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(-19,08)^2 = (-13)^2 + 2(-9,8)\Delta y \checkmark$ $h = \Delta y = 9,95 \text{ m} \checkmark$ Height of building/Hoogte van gebou $= \Delta y + h$ $= 8,62 + 9,95 \checkmark$ $= 18,57 \text{ m} \checkmark$	$v_f^2 = v_i^2 + 2a\Delta y \checkmark$ $(-19,08)^2 = (-13)^2 + 2(-9,8)\Delta y \checkmark$ $h = \Delta y = 9,95 \text{ m} \checkmark$ Height of building/Hoogte van gebou $= \Delta y + h$ $= 8,62 + 9,95 \checkmark$ $= 18,57 \text{ m} \checkmark$

(6)
[18]**QUESTION/VRAAG 5**

- 5.1 Downwards / Afwaarts \checkmark (1)
- 5.2 Two (times) **OR** 2 (times)
Twee (keer) **OF** 2 (keer) \checkmark (1)
- 5.3 Elastic / Elasties \checkmark (1)
- 5.4 4 s \checkmark and / en 8 s \checkmark (2)

5.5 Positive marking from QUESTION 5.4 / *Positiewe merk vanaf VRAAG 5.4*



Criteria for graph / <i>Kriteria vir die grafiek</i>	Marks/Punte
The height from which the ball was dropped <i>Hoogte van waar bal laat val is</i>	✓
The times when the ball was at its maximum height – 4 s and 8 s <i>Die tye wanneer die bal sy maksimum hoogte bereik – 4 s en 8 s</i>	✓
Shape of the graph/ <i>Vorm van die grafiek</i>	✓

(3)
[8]

QUESTION/VRAAG 6

- 6.1 The total linear momentum of an isolated system is conserved. ✓✓
Die totale lineêre momentum van 'n geïsoleerde sisteem bly behoue. ✓✓

OR/OF

In an isolated system the total linear momentum before collision is equal to the total linear momentum after collision. ✓✓

In 'n geïsoleerde sisteem is die totale lineêre momentum voor 'n botsing gelyk aan die totale lineêre momentum na 'n botsing. ✓✓ (2)

- 6.2 $\Sigma p_i = \Sigma p_f$
 $m_v v_{iv} + m_c v_{ic} = m_v v_{fv} + m_c v_{fc}$ } ✓
 $\frac{1500 \times 30 + 1200 \times 80000}{3600} \checkmark = \frac{1500 v_{fv} + 1200 \times 25}{3600} \checkmark$
 $v_{fv} = 27,78 \text{ m.s}^{-1} \checkmark$ in the same direction / *in dieselfde rigting.* ✓ (5)

- 6.3
- | OPTION/OPSIE 1 | OPTION/OPSIE 2 |
|---|--|
| $\Delta p = mv_f - mv_i \checkmark$ | $\Delta p = mv_f - mv_i \checkmark$ |
| $\Delta p = 1200 \times 25 - 1200 \times \frac{80000}{3600} \checkmark$ | $\Delta p = 1500 \times 27,78 - 1500 \times 30 \checkmark$ |
| $\Delta p = 3333,33 \text{ kg.m.s}^{-1}$ | $\Delta p = -3330 \text{ kg.m.s}^{-1}$ |
| In the direction of the motion | In the direction of the motion |
| <i>In dieselfde rigting as beweging</i> ✓ | <i>In dieselfde rigting as beweging</i> ✓ |
- (3)

- 6.4 $\Sigma E_{ki} = \frac{1}{2} m v_{ic}^2 + \frac{1}{2} m v_{iv}^2 \checkmark$
 $\Sigma E_{ki} = \frac{1}{2} \times 1200 \times \left(\frac{80000}{3600}\right)^2 + \frac{1}{2} \times 1500 \times 30^2 \checkmark$
 $\Sigma E_{ki} = 971296,30 \text{ J}$
 $\Sigma E_{kf} = \frac{1}{2} m v_{fc}^2 + \frac{1}{2} m v_{fv}^2$
 $\Sigma E_{kf} = \frac{1}{2} \times 1200 \times (25)^2 + \frac{1}{2} \times 1500 \times 27,78^2 \checkmark$
 $\Sigma E_{kf} = 953796,30 \text{ J}$
 $\Sigma E_{ki} \neq \Sigma E_{kf} \checkmark$

Collision is inelastic / *Botsing is onelasties* ✓

(5)
[15]

QUESTION/VRAAG 7

7.1 To the right / *na regs* ✓

For momentum to be conserved:

- momentum of trolley B = momentum of trolley **A**.
- momentum of **B** must be in an opposite direction to the momentum of trolley **A** ✓✓

Vir momentum om behoue te bly:

- *momentum van trollie B = momentum van trollie A.*
- *momentum van trollie B is in die teenoorgestelde rigting as die momentum van trollie A.* ✓✓

(3)

7.2 Let right/East be positive/Laat regs/Oos positief wees

$$\Sigma p_i = \Sigma p_f$$

$$m_{AV_i} + m_{BV_i} = m_{AV_f} + m_{BV_f}$$

$$(m_A + m_B) v_i = m_{AV_f} + m_{BV_f}$$

✓ Any one / *Enige een*

$$(0,5 + 0,75) \times 0 \checkmark = 0,5 \times (-2,5) + 0,75v_{Bf} \checkmark$$

$$v_{Bf} = 1,66 \text{ m}\cdot\text{s}^{-1} \text{ (to the right/East)/(na regs/oos)} \checkmark$$

(4)

7.3.1 21,5 N ✓

According Newton's Third law of motion, ✓ when the wall exerts a force on the trolley, the trolley simultaneously exerts a force (of 21,5 N) on the wall but in an opposite direction. ✓

Volgens Newton se Derde Bewegingswet, ✓ indien die muur 'n krag op die trollie uitoefen, oefen die trollie gelyktydig 'n krag (van 21,5 N) op die muur maar in die teenoorgestelde rigting. ✓

NOTE: *If learners just state Newton's third law without using it to explain, no marks will be awarded*

LET WEL: *As leerders net Newton's se derde wet sê sonder om teverduidelik, sal geen punte toegeken word.*

(3)

7.3.2 $F_{net} \Delta t = m \Delta v$

$$F_{net} \Delta t = m \Delta(v_{Af} - v_{Ai})$$

✓ Any one / *enige*

$$-21,5 \times 0,1 \checkmark = 0,5(v_{Af} - 2,5) \checkmark$$

$$-2,15 = 0,5 v_{Af} - 1,25$$

$$v_{Af} = -1,8 \text{ m}\cdot\text{s}^{-1}$$

$$v_{Af} = 1,8 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ (to the left/west)(na links/wes)} \checkmark$$

(5)

7.3.3 Remains the same. / *Bly dieselfde.* ✓

When the contact time increases, the net force decreases.

Indien die kontaktyd toeneem, verminder die netto krag. ✓✓

(3)

[18]

QUESTION/VRAAG 8

8.1 The (total) mechanical energy of an isolated system is conserved.

Die (totale) meganiese energie van 'n geïsoleerde sisteem bly behoue. ✓✓ (2)

8.2

OPTION/OPSIE 1	OPTION/OPSIE 2
$ME_B = ME_C$ $(E_P + E_K)_B = (E_P + E_K)_C$ $(mgh + \frac{1}{2}m v^2)_B = (mgh + \frac{1}{2}m v^2)_C$ $0 + \frac{1}{2}(0,2)v_i^2 \checkmark = 0,2(9,8)(1,2) + 0 \checkmark$ $v_i = 4,85 \text{ m}\cdot\text{s}^{-1} \checkmark$	$W_{nc} = \Delta E_k + \Delta E_p$ $0 = \frac{1}{2}m v_f^2 - \frac{1}{2}m v_i^2 + mgh_2 - mgh_1 \checkmark$ $0 \checkmark = 0 - \frac{1}{2}(0,2)v_i^2 + 0,2(9,8)(1,2) - 0 \checkmark$ $v_i = 4,85 \text{ m}\cdot\text{s}^{-1} \checkmark$

(4)

8.3

OPTION/OPSIE 1	OPTION/OPSIE 2	OPTION/OPSIE 3
$\Delta x = \frac{v_f + v_i}{2} \Delta t \checkmark$ $= \frac{6 + 4,85}{2} \times 0,82 \checkmark$ $= 4,45 \text{ m} \checkmark$	$v_f = v_i + a\Delta t$ $4,85 = 6 + a \times 0,82$ $a = -1,40 \text{ m}\cdot\text{s}^{-2}$ $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$ $= 6 \times 0,82 + 0,5 \times a \times 0,82^2 \checkmark$ $= 4,45 \text{ m} \checkmark$	$v_f = v_i + a\Delta t$ $4,85 = 6 + a \times 0,82$ $a = -1,40 \text{ m}\cdot\text{s}^{-2}$ $v_f^2 = v_i^2 + 2a\Delta x \checkmark$ $4,85^2 = 6^2 + 2(-1,4) \Delta x \checkmark$ $\Delta x = 4,46 \text{ m} \checkmark$

(3)

[9]

QUESTION/VRAAG 9

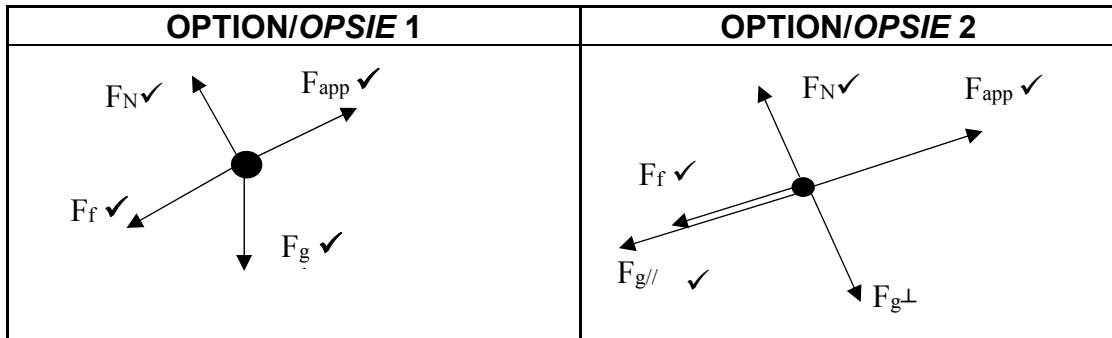
9.1 The net work done on an object is equal ✓ to the change in the kinetic energy of the object. ✓
 Die netto arbeid verrig op 'n voorwerp is gelyk aan ✓ die verandering in die kinetiese energie van die voorwerp. ✓

OR/OF

The amount of work done by a net force ✓ on object is equal to the change in the object's kinetic energy. ✓
 Die hoeveelheid arbeid wat deur 'n netto krag verrig word op 'n voorwerp ✓ is gelyk die verandering in die voorwerp se kinetiese energie. ✓

(2)

9.2



(4)

Mark awarded for both the arrow and label
 Punt toegeken vir beide pylvunt en byskrif.

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

Moenie penaliseer vir lengte van kragte want diagram is nie volgens skaal nie.

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

If force(s) do not make contact with body/Indien krag(te) nie kontak maak met voorwerp nie. Max./Maks. ^{3/4}

9.3 **OPTION/OPSIE 1**

$$\left. \begin{aligned} W_{net} &= \Delta E_K \\ W_{net} &= W_{App} + W_{//} + W_f \\ W_{App} + W_{//} + W_f &= \Delta E_K \end{aligned} \right\} \text{✓ Any one / Enige een}$$

$$260(8)\text{Cos}0^\circ \text{✓} + 0,16(25)(9,8)(\text{Cos}40^\circ)(8)(\text{Cos}180^\circ) \text{✓} +$$

$$25(9,8)(\text{sin}40^\circ)(8)(\text{Cos}180^\circ) \text{✓} = \frac{1}{2} (25)v_f^2 - 0 \text{✓}$$

$$2080 - 240,23 - 1259,86 = 12,5 v_f^2$$

$$579,91 = 12,5 v_f^2$$

$$v_f = 6,81 \text{ m}\cdot\text{s}^{-1} \text{✓}$$

OPTION/OPSIE 2

$$\left. \begin{aligned} W_{nc} &= \Delta E_K + \Delta E_p \\ W_{app} + W_f &= \Delta E_K + W_{Fg} \end{aligned} \right\} \text{Any one / Enige een ✓}$$

$$260(8)(\text{cos}0^\circ) \text{✓} + 0,16(25)(9,8)(\text{Cos}40^\circ)(8)(\text{cos}180^\circ) \text{✓} =$$

$$25(9,8)(\text{Sin}40^\circ)(8)(\text{cos}180^\circ) \text{✓} + \frac{1}{2} (25)v_f^2 - 0 \text{✓}$$

$$v_f = 6,81 \text{ m}\cdot\text{s}^{-1} \text{✓}$$

(6)

9.4

OPTION/OPSIE 1	OPTION/OPSIE 2
$\Delta x = \frac{(v_i + v_f)}{2} \Delta t$ $8 = \frac{(0 + 6,81)}{2} \Delta t \checkmark$ $\Delta t = 2,35 \text{ s}$ $P = \frac{W}{\Delta t} \checkmark$ $P = \frac{2080}{2,35} \checkmark$ $= 885,11 \text{ W} \checkmark$	$v_{av} = \frac{v_f + v_i}{2}$ $v_{av} = \frac{0 + 6,81}{2} \checkmark$ $v_{av} = 3,405$ $P_{av} = F \cdot v_{av} \checkmark$ $P_{av} = 260 \times 3,405 \checkmark$ $= 885,3 \text{ W} \checkmark$

(4)
[16]**QUESTION/VRAAG 10**

- 10.1.1 Doppler effect is the change in frequency (or pitch) of the sound detected \checkmark by a listener, because the sound source and the listener have different velocities relative to the medium of sound propagation \checkmark .

Die Doppler-effek is die verandering in frekwensie (of toonhoogte) van die klank wat deur die waarnemer waargeneem word \checkmark *omdat die bron van die klank en die luisteraar verskillende snelhede het relatief tot die medium van die klank.* \checkmark

OR/OF

Doppler effect is the apparent change in frequency of a wave \checkmark when there is relative motion between the source and an observer \checkmark .

Die Doppler-effek is die skynbare verandering in die frekwensie van 'n golf \checkmark *wanneer daar relatiewe beweging tussen die bron en luisteraar is.* \checkmark

OR/OF

Doppler Effect is an (apparent) change in observed/detected frequency (pitch), (wavelength) \checkmark as a result of the relative motion between a source and an observer (listener) \checkmark

Die Doppler-effek is die (skynbare) verandering in die waargenome frekwensie (toonhoogte)(golflengte) \checkmark *as gevolg van die relatiewe beweging tussen 'n bron en 'n luisteraar.* \checkmark

(2)

- 10.1.2 750 Hz \checkmark

(1)

- 10.1.3 1) Waves are compressed as Khosi moves towards the source. ✓
 2) Wavelength become shorter. ✓
 3) Wavelength is inversely proportional to frequency, hence the detected frequency is higher. ✓
 1) *Golwe word saamgepers soos Khosi na die bron beweeg.* ✓
 2) *Golflengte word korter.* ✓
 3) *Golflengte is omgekeerd eweredig aan frekwensie, dus is die waargeneemde frekwensie hoër.* ✓

(3)

10.1.4 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark$

When Khosi approaches: (Terwyl Khosi nader beweeg):

$$750 \checkmark = \frac{340 + v_L}{340} f_s \checkmark$$

$$f_s = \frac{750 \times 340}{340 + v_L} \dots\dots (1)$$

When the Khosi moves away: (Terwyl Khosi wegbeweeg):

$$700 \checkmark = \frac{340 - v_L}{340} f_s \checkmark$$

$$f_s = \frac{700 \times 340}{340 - v_L} \dots\dots\dots (2)$$

(1) = (2) :

$$\frac{750 \times 340}{340 + v_L} = \frac{700 \times 340}{340 - v_L}$$

$$750(340 - v_L) = 700(340 + v_L)$$

$$1450v_L = 17000$$

$$v_L = 11,72 \text{ m.s}^{-1} \checkmark$$

(6)

OPTION/OPSIE 1	OPTION/OPSIE 2
$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark$	$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark$
$f_s = \frac{750 \times 340}{340 + 11,72} \checkmark$	$f_s = \frac{700 \times 340}{340 - 11,72} \checkmark$
$f_s = 725,01 \text{ Hz} \checkmark$	$f_s = 724,99 \text{ Hz} \checkmark$

(3)

- 10.2.1
- Away/Weg van ✓
 - It shows a red shift. / Dit toon 'n rooi verskuiwing. ✓
 - Frequency is decreasing. / Frekwensie neem af. ✓
 - Wavelength becomes longer. / Golflengte word langer. ✓

(4)

10.2.2 The universe is expanding. / Die heelal is besig om uit te sit. ✓

(1)

[20]**QUESTION/VRAAG 11**

11.1 The force per unit positive charge./

Die krag per eenheid positiewe lading. ✓✓

(2)

11.2

$$E = \frac{kQ}{r^2}$$

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

✓ Any one/Enige een

$$0 = \frac{9 \times 10^9 \times 6 \times 10^{-6}}{(0,2-x)^2} + \left(-\frac{9 \times 10^9 \times 4 \times 10^{-6}}{x^2} \right)$$

$$x = 0,09 \text{ m}$$

(6)

[8]**TOTAL/TOTAAL: 150**

