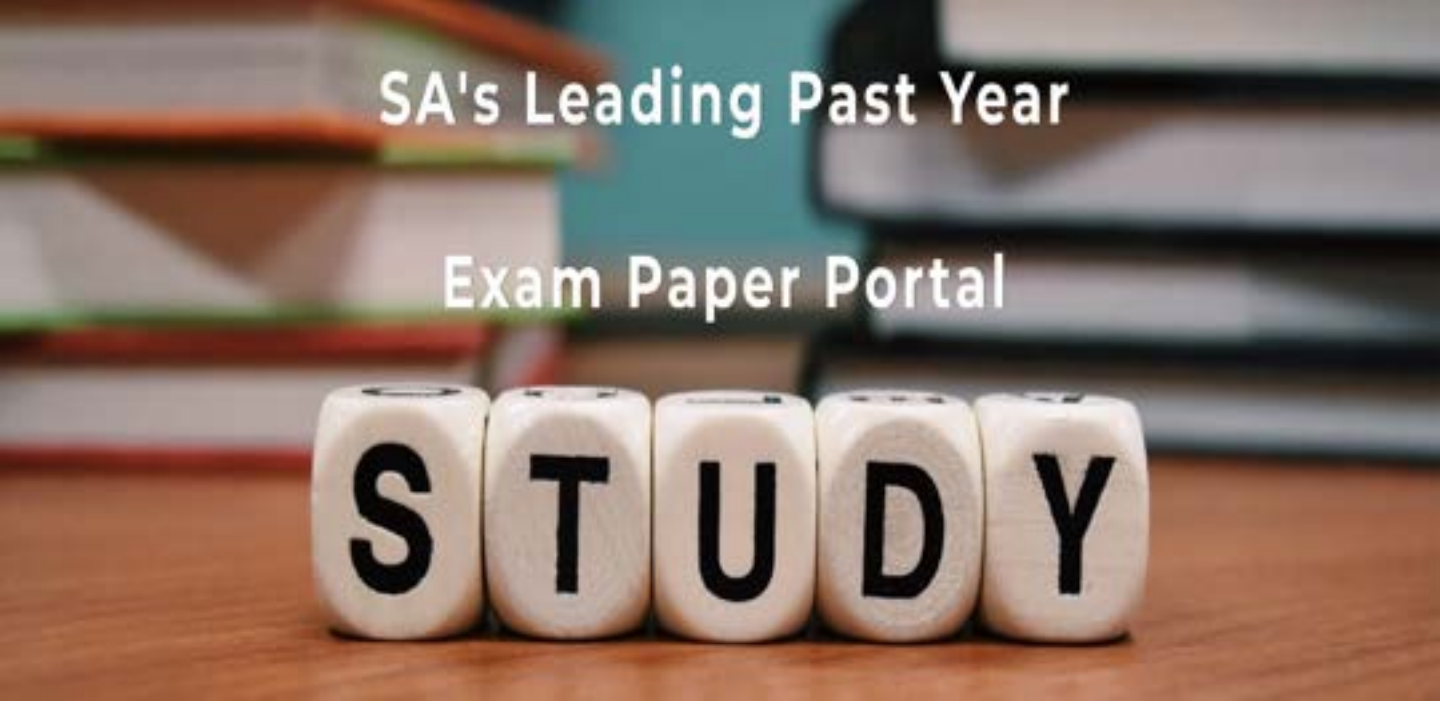

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GRADE/*GRAAD* 12

SEPTEMBER 2022

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

MARKS/*PUNTE*: 150

This marking guideline consists of 18 pages./
Hierdie nasienriglyn bestaan uit 18 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, $m•s^{-1}$.
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 **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 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 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 the 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 B ✓✓ (2)

1.2 B ✓✓ (2)

1.3 C ✓✓ (2)

1.4 C ✓✓ (2)

1.5 D ✓✓ (2)

1.6 A ✓✓ (2)

1.7 C ✓✓ (2)

1.8 C ✓✓ (2)

1.9 B ✓✓ (2)

1.10 D ✓✓ (2)

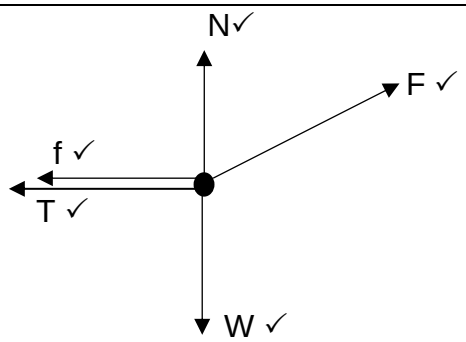
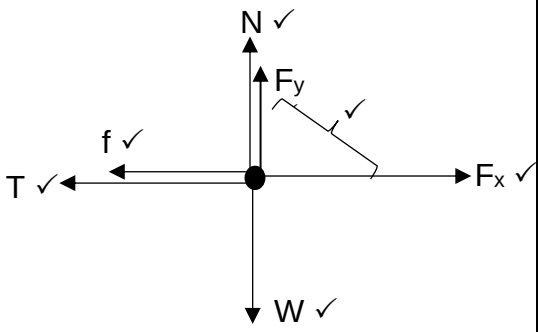
[20]

QUESTION/*VRAAG* 2

2.1 (If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase)
When a 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 enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/frase)
Wanneer 'n resulterende/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)

2.2

OPTION 1/*OPSIE* 1	**OPTION 1/*OPSIE* 2**
	

Alternative labels:	***Alternatiewe byskrifte***
W / W_g / F_g	*W / W_g / F_g*
N / F_N / F_{normal}	*N / F_N / $F_{Normaal}$*
f / F_f / $F_{friction}$	*f / F_w / $F_{wrywing}$*
T / F_{string} / F_s	T / F_{tou} / F_T
F / F_{app}	F / $F_{toegepas}$

Marking criteria	***Nasienkriteria***
• Mark awarded for arrow and label. • Do not penalise for length of arrows since drawing not drawn to scale. • Any additional force(s) ¾ • If force(s) do not make. contact with the body – max. ¾.	• Punt word vir byskrif en pyltjie toegeken. • Moenie vir die lengte van die pyltjies penaliseer nie aangesien skets nie volgens skaal geteken is nie. • Enige addisionele krag(te) ¾ • Indien krag(te) nie kontak met die voorwerp maak nie – maks. ¾.

(5)

2.3.1 $f_k = \mu_k N$
$f_k = \mu(mg - F\sin\theta)$ ✓ Any one/*Enige een*
$f_k = [0,16\ (8 \times 9,8 - 55\sin 15^\circ)$ ✓] ✓
$f_k = 10,27$ N ✓ (4)

2.3.2 **Positive marking from QUESTION 2.3.1 / *Positiewe nasien vanaf VRAAG 2.3.1***

3-kg block / *blok*

$F_{net} = ma$
$T - f - F_{//} = ma$
$T - f - mg \sin\theta = ma$
$F\cos\theta - T - f = ma$

Any one ✓
Enige een

$T - 5 - (3 \times 9,8 \times \sin 30^{\circ})$ ✓ $= 3a$

$T - 19,7 = 3a$
$T = 3a + 19,7$… (1)

Any one/ ✓
Enige een

8-kg block / *blok*

$F \cos\theta - T - f = ma$

$[55 \cos 15^{o} - T - 10,27]$ ✓$= 8a$
$42,8559 - T = 8a$
$42,86 - T = 8a$ … (2)

(1) = (2)
$42,86 - (3a + 19,7) = 8a$
$a = 2,11\ m.s^{-2}$ …(3)

(3) in (1):
$T = 19,7 + 3 \times 2,11$ ✓
$T = 26,03\ N$ ✓ (6)

[17]

QUESTION/*VRAAG* 3

3.1 (If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase)
Motion of an object upon which the only force acting is the force of gravity. ✓✓
(Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/frase)
Beweging van 'n voorwerp waarop die enigste krag wat daarop inwerk, die gravitasiekrag is. (2)

3.2.1

UPWARD POSITIVE/ *OPWAARTS POSITIEF*	**UPWARD NEGATIEF/ *OPWAARTS NEGATIEF***
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = 0^2 + 2(-9,8)(-8)$ ✓ $v_f = 12,52\ m.s^{-1}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = 0^2 + 2(9,8)(8)$ ✓ $v_f = 12,52\ m.s^{-1}$ ✓

(3)

3.2.2

UPWARD POSITIVE/*OPWAARTS POSITIEF*

$v_f = v_i + a\Delta t$
$-12,52 = 0 + (-9,8)(\Delta t)$ ✓
$\Delta t = 1,28\ s$

$\Delta y = v_i\Delta t + \frac{1}{2}\ a\Delta t^2$ ✓
-8✓$= v_i\ \underline{(1,28-0,6) + \frac{1}{2}(-9,8)(1,28-0,6)}$ ✓

$-8 = v_i\ (0,68) + \frac{1}{2}(-9,8)(0,68)$

$\therefore v_i = 8,43\ m.s^{-1}$ ✓

UPWARD NEGATIEF/*OPWAARTS NEGATIEF*

$v_f = v_i + a\Delta t$
$12,52 = 0 + (9,8)(\Delta t)$ ✓
$\Delta t = 1,28\ s$
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
8 ✓$= v_i\ \underline{(1,28-0,6) + \frac{1}{2}(9,8)(1,28-0,6)^2}$ ✓

$8 = v_i\ (0,68) + \frac{1}{2}(9,8)(0,68)^2$

$\therefore\ v_i = 8,43\ m.s^{-1}$ ✓

(5)

3.3

OPTION 1/*OPSIE* 1 **UPWARD POSITIVE/ *OPWAARTS POSITIEF***	**UPWARD NEGATIEF/ *OPWAARTS NEGATIEF***
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = v_i^2 + 2(-9,8)(6,5)$ ✓ $v_f = 11,29\ m.s^{-1}$ upwards/*opwaarts* ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = v_i^2 + 2(9,8)(-6,5)$ ✓ $v_f = 11,29\ m.s^{-1}$ upwards/*opwaarts* ✓

OPTION 2/*OPSIE 2*

UPWARD POSITIVE/*OPWAARTS POSITIEF*

$E_{mech(f)} = E_{mech(i)}$
$(mgh_f + ½mv_f^2) = (mgh_i + ½mv_i^2)$] (Any one/*Enige een)* ✓
$m(-9,8)(6,5) + ½m(0^2) = m(-9,8)(0) + ½m\ v_i^2$ ✓
$v_i = 11,29\ m.s^{-1}$ ✓

UPWARD NEGATIVE/*OPWAARTS NEGATIEF*

$E_{mech(f)} = E_{mech(i)}$
$(mgh_f + ½mv_f^2) = (mgh_i + ½mv_i^2)$] (Any one/*Enige een)* ✓
$m(9,8)(-6,5) + ½m(0^2) = m(9,8)(0) + ½m\ v_i^2$ ✓
$v_i = 11,29\ m.s^{-1}$ ✓

OPTION 3/*OPSIE 3*

UPWARD POSITIVE/*OPWAARTS POSITIEF*

$W_{NC} = \Delta E_K + \Delta E_P$] Any one/*Enige een)*
$0 = (½mv_f^2 - ½mv_i^2) + (mgh_f + mgh_i)$] ✓
$0 = (½m + ½m(0^2) = m(-9,8)(6,5) + m(-9,8)\ 0$ ✓
$v_i = 11,29\ m.s^{-1}$ ✓

UPWARD NEGATIVE/*OPWAARTS NEGATIEF*

$W_{NC} = \Delta E_K + \Delta E_P$] Any one/*Enige een)*
$0 = (½mv_f^2 - ½mv_i^2) + (mgh_f + mgh_i)$] ✓
$0 = (½m\ 0^2 + ½m(v_i^2) = m(9,8)(-6,5) + m(9,8)\ 0$ ✓
$v_i = 11,29\ m.s^{-1}$ ✓

OPTION 4/*OPSIE 4*

UPWARD POSITIVE/*OPWAARTS POSITIEF*

$W_{NETT} = \Delta E_K$] Any one/*Enige een)*
$F_G.\Delta x.\cos\Theta = (½mv_f^2 – ½mv_i^2)$]
$mg.\Delta x.\cos\Theta = (½mv_f^2 – ½mv_i^2)$] ✓
$m(-9,8)(6,5)\cos 180^\circ = ½m(0^2 – v_i^2)$ ✓
$v_i = 11,29\ m.s^{-1}$ ✓

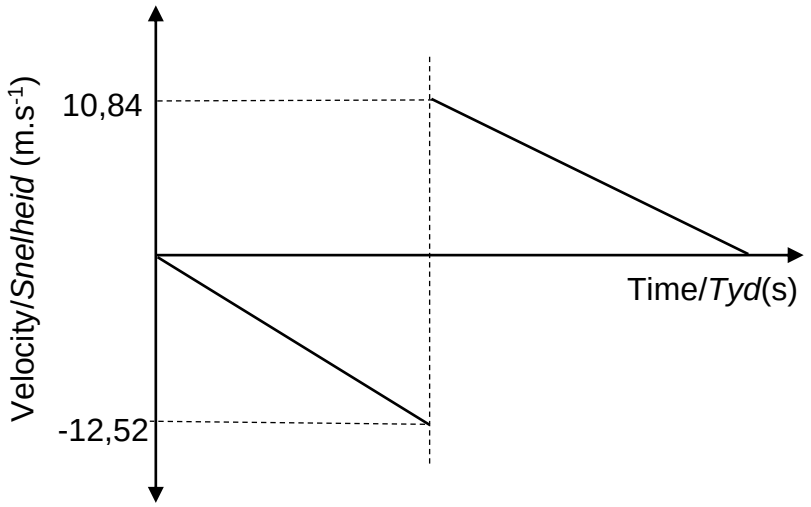
UPWARD NEGATIVE/*OPWAARTS NEGATIEF*

$W_{NETT} = \Delta E_K$] Any one/*Enige een)*
$F_G.\Delta x.\cos\theta = (½mv_f^2 – ½mv_i^2)$]
$mg.\Delta x.\cos\theta = (½mv_f^2 – ½mv_i^2)$] ✓
$m(9,8)(-6,5)\cos 180^\circ = ½m(0^2 – v_i^2)$ ✓
$v_i = 11,29\ m.s^{-1}$ ✓

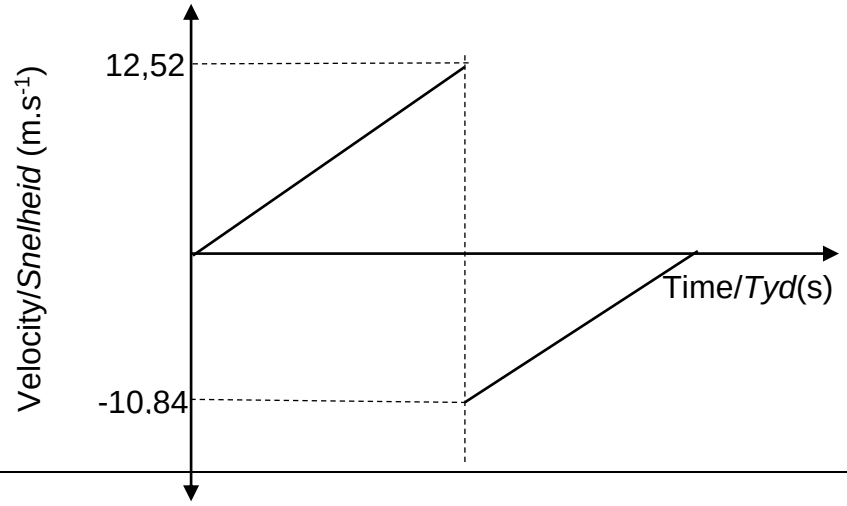
3.4

	MARKING CRITERIA/*NASIENKRITERIA*	
✓	Correct shape (Straight line)	*Korrekte vorm (Reguitlyn)*
✓	Similar gradients	*Dieselfde gradiënte*
✓	Final velocity indicated and bounce off velocity indicated	*Eindsnelheid aangedui en terugbons-snelheid aangedui*

UPWARDS POSITIVE/*OPWAARTS POSITIEF*



DOWNWARDS POSITIVE/*AFWAARTS POSITIEF*



(3)
[17]

QUESTION/*VRAAG 4*

4.1 Zero/*nul* or/ *of* 0 $m.s^{-1}$ ✓ (1)

4.2 $\sum p_i = \sum p_f$
$m_A v_i + m_B v_i = (m_A + m_B)v_f$ } Any one/*Enige een* ✓
$52\ v_{ig} + 5 \times 0$ ✓$= (52 + 5) \times 2,4$ ✓
$v_i = 2,63\ m.s^{-1}$ ✓ (4)

4.3 Force of hands-on brick upwards, ✓ force of brick on hands downwards. ✓
Force of girl on earth/weight of girl downwards, ✓ force of Earth on girl upwards. ✓
Krag van hand op baksteen opwaarts, krag van baksteen op hande afwaarts. Krag van meisie op aarde/gewig van meisie afwaarts, krag van Aarde op die meisie opwaarts. (2)

4.4

OPTION 1/*OPSIE* 1	**OPTION 2/*OPSIE* 2**
$\Delta y = \frac{v_f + v_i}{2} \Delta t$ $2 = \frac{0+(2,4)}{2}$ ✓x Δt $\Delta t = 1,67$ s $F_{net}\Delta t = \Delta p$ $F_{net}\Delta t = m(v_f - v_i)$ } Any one/*Enige een* ✓ $F_{net} \times 1,67 = (52 + 5)$ ✓$(0 - 2,4)$ ✓ $F_{net} = -81,92$ $F_{net} = 81,92$ N ✓	$v_f^2 = v_i^2 + 2a\Delta y$ $0^2 = 2,4^2 + 2 \times a \times 2$ ✓ $a = -1,44\ m.s^{-2}$ $F_{net} = ma$ ✓ $F_{net} = (52 + 5)$ ✓ $(-1,44)$ ✓ $F_{net} = -82,08$ $F_{net} = 82,08$ N ✓

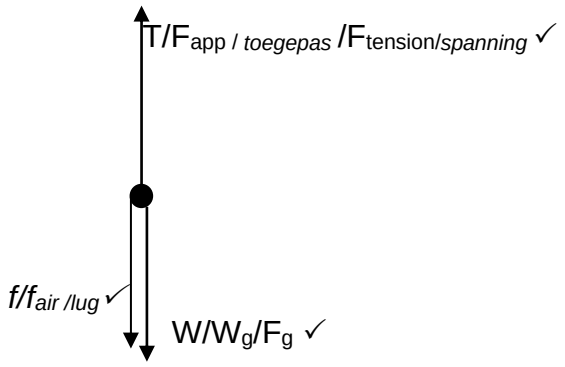
(5)
[12]

QUESTION/*VRAAG* 5

5.1 (If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase)
The net work done on an object is equal to the change in the object's kinetic energy. ✓✓
The work done on an object by a net force is equal to the change in kinetic energy of the object. ✓✓

(Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/frase)
Die netto arbeid verrig op 'n voorwerp is gelyk aan die verandering in die kinetiese energie van die voorwerp.
Die arbeid verrig op 'n voorwerp deur 'n netto krag is gelyk aan die verandering in kinetiese energie van die voorwerp. (2)

5.2



(3)

5.3 Tension force (of the rope) / *Spanningskrag (van die tou)*
Air resistance / *Lugweerstand*
} Any one/*Enige een* ✓ (1)

5.4

OPTION 1/*OPSIE* 1
$W_{Fg} = F_g.\Delta x \cos\theta$ ✓ $W_{Fg} = (75 \times 9,8) \times 12 \cos 180^\circ$ ✓ $W_{Fg} = -8\,820$ J ✓

OPTION 1/*OPSIE* 2
$W_{Fg} = -\Delta E_p$ $W_{Fg} = -[mg(h_2 - h_1)]$ $W_{Fg} = -mg\Delta h$ } Any one/*Enige een* ✓ $W_{Fg} = -[75 \times 9,8 (12 - 0)]$ ✓ $W_{Fg} = -8\,820$ J ✓

(3)

5.5 **Positive marking from QUESTION 5.2/*Positiewe nasien vanaf VRAAG 5.2***

OPTION 1/*OPSIE* 1
$W_{net} = \Delta E_k$ $W_f + W_F + W_{Fg} = \Delta E_k$ $f \times \Delta x \cos\theta + F\Delta x\cos\theta + F_g\Delta x\cos\theta = \Delta E_k$ } Any one/*Enige een* ✓ $1\,540 \times 12\cos 180^o$ ✓ + $2\,400 \times 12\cos 0^o + (-8\,820)$ ✓ = $\frac{1}{2} \times 75 \times v_f^2 - 0$ ✓ $v_f = 6,32$ m.s^{-1} ✓

OPTION 2/*OPSIE* 2
$W_{nc} = \Delta E_p + \Delta E_k$ $W_f + W_F = \Delta E_p + \Delta E_k$ $f \times \Delta x \cos\theta + F\Delta x\cos = mg(h_2 - h_1) + \Delta E_k$ } Any one/*Enige een* ✓ $\underline{62,5 \times 24 \cos 180^o}$ ✓ $\underline{2\,400 \times 12 \cos 0^o}$ ✓ $= 75 \times 9,8(12 - 0) + \frac{1}{2}\underline{\times 75 \times v_f - 0}$ ✓ $m = 6,32\ m.s^{-1}$ ✓ (5)

[14]

QUESTION/*VRAAG* 6

6.1 (If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase)
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 ✓✓

(Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/frase)
Die (skynbare) verandering in frekwensie wat deur 'n luisteraar waargeneem word want die luisteraar en die klankbron verskillende snelhede het relatief tot die medium wat die klank veroorsaak.

OR/*OF*

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

Die (skynbare) verandering in die frekwensie wat 'n luisteraar waarneem as gevolg van relatiewe beweging tussen die klankbron en die luisteraar. (2)

6.2 When the source moves towards a stationary observer, the wave in front of the source is compressed ✓ resulting in a shorter wavelength and a higher frequency ✓ (speed of sound constant).
Wanneer die bron nader aan 'n stilstaande waarnemer beweeg word die golf voor die bron saamgepers wat veroorsaak dat die golflengte korter is en die frekwensie hoër is terwyl die (spoed van klank konstant bly). (2)

6.3 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓
$1,02\ f_s$ ✓ $= \frac{343}{343 - v_s}$ ✓ $\times f_s$ ✓
$v_s = 6,73\ m.s^{-1}$ ✓
(Accept any set of values for frequency that indicates that f_L is 2% higher than f_s)
(Aanvaar enige stel waardes vir frekwensie wat aandui dat f_L 2% hoër is as f_s) (5)

6.4 $v = \lambda f$ ✓
$343 = \lambda \times 720$ ✓
$\therefore \lambda = 0,48$ m (0,476 m) ✓ (3)

6.5 Used to measure the direction and speed of blood flow in arteries and veins.
Used to measure the heartbeat of a foetus in the womb. (Any one) ✓

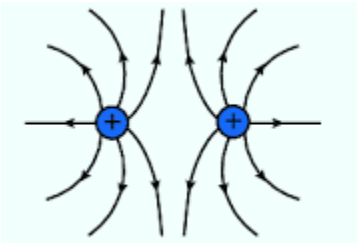
Gebruik om die rigting en spoed van bloedvloei in die are te meet.
Word gebruik om die hartklop van 'n fetus in die baarmoeder te meet.
(Enige een) (1)
[13]

QUESTION/*VRAAG 7*

7.1 (If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase)
The electrostatic force per unit positive charge placed at the point. ✓✓

(Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/frase)
Die elektrostatiese krag per eenheid positiewe lading wat by die punt geplaas word. (2)

7.2



Marking criteria /*Nasienkriteria*		
✓	Correct shape	*Korrekte vorm*
✓	Direction of field lines	*Rigting van veldlyne*
✓	Field lines touch surface of point charge and do not cross	*Veldlyne raak oppervlakte van puntlading en kruis nie*

(3)

7.3 $E = \frac{kQ}{r^2}$ ✓

$E_1 = \frac{(9 \times 10^9)(5 \times 10^{-6})}{(0,1)^2}$ ✓

$E_1 = 4,5 \times 10^6$ N.C^{-1} left

$E_2 = \frac{(9 \times 10^9) \times Q}{(0,4)^2}$ ✓ left

$E_{net} = E_1 + E_2$

$4,70 \times 10^6 = 4,5 \times 10^6$ ✓ $+ \frac{(9 \times 10^9) \times Q}{(0,4)^2}$ ✓

$2 \times 10^5 = \frac{(9 \times 10^9) \times Q}{(0,4)^2}$ ✓

$Q_T = 3,56 \times 10^{-6}$ C ✓ (6)

7.4

OPTION 1/*OPSIE* 1

$E = \frac{F}{q}$ ✓

$4,70 \times 10^{6}$ ✓ $= \frac{F}{-2 \times 10^{-6}}$ ✓

$F = - 9,4$

$F =$ 9,4 N to the right ✓

OPTION 2/*OPSIE 2*

$F_E = \frac{kQ_1Q_2}{r^2}$ ✓

$F1 = \frac{(9 \times 10^{9})(5 \times 10^{-6})(2 \times 10^{-6})}{(0,1)^2}$ ✓ right

$F_1 = 9$ N

$F_2 = \frac{(9 \times 10^{9})(3,56 \times 10^{-6})(2 \times 10^{-6})}{(0,4)^2}$ ✓ right

$F_2 = 0,4$

$F_{net} = F_1 + F_2$

$F_{net} = 9 + 0,4$ ✓

$F_{net =}$ 9,4 N to the right ✓ (4)

[15]

QUESTION/*VRAAG* 8

8.1 (If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase)
The total energy per coulomb of charge that a battery can supply. ✓✓

(Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/frase)
Die totale energie per coulomb lading wat 'n battery kan lewer. (2)

8.2.1 1,4 V ✓ (1)

8.2.2 Gradient/*Gradiënt* $= \frac{\Delta V}{\Delta I} = \frac{1,4 - 0}{0 - 2,5}$ ✓ $= -0,56$
Gradient/*Gradiënt* $= - r = -0,56$ ✓
$r = 0,56\ \Omega$ ✓ (3)

8.3.1 $V_{int} = \varepsilon - V$
$V_{int} = 15 - 13,5$ ✓
$V_{int} = 1,5$ V
$r = \frac{V}{I}$ ✓
$0,5 = \frac{1,5}{I}$ ✓
I = 3 A
$V_s = IR_s$
$V_s = 3 \times 3$✓ = 9 V
$V_p = 13,5 - 9 = 4,5$ V
$R = \frac{V}{I}$
$4 = \frac{4,5}{I}$ ✓
I = 1,125 A ✓ (6)

8.3.2

OPTION 1/*OPSIE 1*
Positive marking from QUESTION 8.3.1/*Positiewe nasien vanaf VRAAG 8.3.1*
I = 3 – 1,125 ✓ = 1,875 A
$R = \frac{V}{I}$
$R = \frac{4,5}{1,875}$ ✓

R = 2,4 Ω ✓

OPTION 2 / *OPSIE 2*
Positive marking from QUESTION 8.3.1/*Positiewe nasien vanaf VRAAG 8.3.1*
$V_{ext\ /\ eks} = I\ R_{ext\ /\ eks}$
$13,5 = 3 \times R_{ext/\ eks}$
$\therefore R_{ext/eks} = 4,5\ \Omega$ ✓

$R_{ext/eks} = R_p + 3$
$4,5 = R_p + 3$
$\therefore R_p = 1,5\ \Omega = \frac{3}{2}\ \Omega$ ✓

$\frac{1}{R_p} = \frac{1}{R} + \frac{1}{4}$
$\frac{2}{3} = \frac{1}{R} + \frac{1}{4}$
$\therefore R = 2,4\ \Omega$ ✓ (3)

[15]

QUESTION/*VRAAG* 9

9.1 AC generator. ✓ It has slip rings. ✓
WS generator. Dit het sleepringe. (2)

9.2 Y to/*na* X ✓✓ (2)

9.3 9.3.1 The rms potential difference is the AC potential difference which dissipates/produces the same amount of energy as an equivalent DC potential difference. ✓✓
(If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase)

Die wgk potensiaalverskil is die WS-potensiaalverskil wat dieselfde hoeveelheid energie produseer/opwek as 'n ekwivalente GS-potensiaalverskil.
(Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/frase). (2)

9.3.2 $P_{average/gem} = \frac{V^2_{rms/wgk}}{R}$ ✓
$1\ 200 = \frac{220^2}{R}$ ✓
$R = 40{,}33\ \Omega$ ✓ (3)

9.3.3 $P_{average/gem} = V_{rms/\ wgk}\ I_{rms/wgk}$ ✓
$1\ 200 = I_{rms/\ wgk} \times 220$ ✓
$I_{rms/wgk} = 5{,}45$ A
$I_{rms/wgk} = \frac{I_{max/maks}}{\sqrt{2}}$ ✓
$5{,}45 = \frac{I_{max/maks}}{\sqrt{2}}$ ✓
$I_{max/maks} = 7{,}71$ A ✓ (5)
[14]

QUESTION/*VRAAG* 10

10.1 (If any of the underlined key words/phrases in the correct context are omitted: -1 mark per word/phrase)
The photo-electric effect is the process where electrons are released from a (metal) surface ✓when light of appropriate frequency is shone on the surface. ✓
(Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -1 per woord/fase)
Die foto-elektriese effek is die proses waardeur elektrone uit 'n (metaal) oppervlak vrygestel word wanneer lig van geskikte frekwensie invallend op die oppervlak is. (2)

10.2 The minimum energy of light needed to emit (photo) electrons from a metal surface. ✓✓
Die minimum energie van lig wat nodig is om (foto) elektrone uit 'n metaal oppervlakte vry te stel. (2)

10.3

OPTION 1/*OPSIE* 1

$W_0 = \frac{hc}{\lambda_0}$ ✓

$W_0 = \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{(555 \times 10^{-9})}$ ✓

$W_0 = 3,58 \times 10^{-19}$ J ✓

OPTION 2/*OPSIE* 2

$E = W_0 + E_{k(max)/(maks)}$

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

Any one/*Enige een* ✓

$\frac{(6,63 \times 10^{-34})(3 \times 10^8)}{(555 \times 10^{-9})} = W_0 + 0$ ✓

$W_0 = 3,58 \times 10^{-19}$ J ✓ (3)

10.4 Increases. ✓ With light of higher intensity more photons strike the metal surface per second. Thus more (photo) electrons are emitted per second, resulting in a bigger current ✓

Neem toe. Indien die lig 'n hoër intensiteit het, sal meer fotone die metaal oppervlate per sekondes tref. Dus word meer (foto) elektrone per sekonde vrygestel wat 'n groter stroom gee. (2)

10.5 $E = W_0 + E_{k(max)/ (maks)}$

$hf = W_0 + E_{k(max)/ (maks)}$

$hf = W_0 + + \frac{1}{2} mv_{(max/maks)}^2$

Any one/*Enige een* ✓

$\frac{6,63 \times 10^{-34} f}{} ✓ = \frac{3,58 \times 10^{-19}}{} ✓ + \frac{1}{2} \times 9,11 \times 10^{-31} \times (5 \times 10^6)^2$ ✓

$f = 1,72 \times 10^{16}$ Hz ✓ (4)

[13]

TOTAL/*TOTAAL*: 150