Province of the
EASTERN CAPE
EDUCATION

NATIONAL/*NASIONALE* SENIOR CERTIFICATE/*SERTIFIKAAT*

GRADE/*GRAAD* 12

JUNE/*JUNIE* 2017

PHYSICAL SCIENCES P1/ *FISIESE WETENSKAPPE V1* MEMORANDUM

MARKS/PUNT: 150

This memorandum consists of 16 pages./
Hierdie memorandum bestaan uit 16 bladsye.

GENERAL GUIDELINES/*ALGEMENE RIGLYNE*

1. CALCULATIONS/*BEREKENINGE*

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

1.2 **No marks** will be awarded if an **incorrect or inappropriate formula is used**, even though there are many relevant symbols and applicable substitutions.
***Geen punte** sal toegeken word waar 'n **verkeerde of ontoepaslike formule gebruik** word nie, selfs al is daar relevante simbole en relevante substitusies.*

1.3 When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.
*Wanneer 'n fout gedurende **substitusie in 'n korrekte formule** begaan word, sal 'n punt vir die korrekte formule en vir korrekte substitusies toegeken word, maar **geen verdere punte** sal toegeken word nie.*

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

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

1.6 Mathematical manipulations and change of subject of appropriate formulae carry no marks, but if a candidate starts off with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and correct substitutions. The mark for the incorrect numerical answer is forfeited.
Wiskundige manipulasies en verandering van die onderwerp van toepaslike formules tel geen punte nie, maar indien 'n kandidaat met die korrekte formule begin en dan die onderwerp van die formule 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, no a full stop, for example, $m{\cdot}s^{-1}$.
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 $m{\cdot}s^{-1}$. Vir nasiendoeleindes sal $m.s^{-1}$ en m/s ook aanvaar word.

4. POSITIVE MARKING/*POSITIEWE NASIEN*

Positive marking regarding calculations will be followed in the following cases:
Positiewe nasien met betrekking tot berekeninge sal in die volgende gevalle geld:

4.1 **Subquestion to subquestion**: When a certain variable is calculated in one subquestion (e.g. 3.1) and needs to be substituted in another (3.2 of 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks** are to be awarded for the subsequent subquestions.
***Subvraag na subvraag**: Wanneer 'n sekere veranderlike in een subvraag (bv. 3.1) bereken word en dan in 'n ander vervang moet word (3.2 of 3.3), bv. indien die antwoord vir 3.1 verkeerd is en word korrek in 3.2 of 3.3 vervang, word **volpunte** vir die daaropvolgende subvraag toegeken.*

4.2 **A multistep question in a subquestion**: If the candidate has to calculate, for example, current in die first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.
*'n **Vraag met veelvuldige stappe in 'n subvraag**: Indien 'n kandidaat bv. die stroom verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verloor die kandidaat die punt vir die substitusie sowel as die finale antwoord.*

5. NEGATIVE MARKING/*NEGATIEWE NASIEN*

Normally an incorrect answer cannot be correctly motivated if based on a conceptual mistake. If the candidate is therefore required to motivate in QUESTION 3.2 the answer given in QUESTION 3.1, and 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.

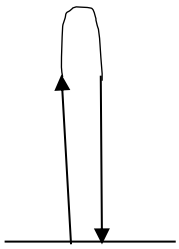
QUESTION/*VRAAG* 1

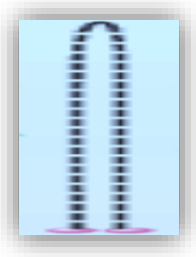
1.1	D ✓✓	(2)
1.2	B ✓✓	(2)
1.3	A ✓✓	(2)
1.4	B ✓✓	(2)
1.5	A ✓✓	(2)
1.6	A ✓✓	(2)
1.7	B ✓✓	(2)
1.8	C ✓✓	(2)
1.9	A ✓✓	(2)
1.10	A ✓✓	(2)

[20]

QUESTION/*VRAAG* 2

2.1





2.1.1 It is called a **projectile**/*Dit word 'n* ***projektiel*** *genoem* ✓ (1)

2.1.2

OPTION/*OPSIE* 1

Data: $v_i = 15\ m\cdot s^{-1}$,
$g = -9,8\ m\cdot s^{-2}$
$h_{max} = ?$
$v_f = 0\ m.s^{-1}$ at max height
(*by maks hoogte*)
(Let downward be negative)
(Laat afwaarts negatief wees)
$v_f^2 = v_i^2 + 2g\Delta y$ ✓
0^2 ✓ $= \underline{(15)^2 + 2(-9,8)(\Delta y)}$ ✓
$19,6\Delta y = 225$
∴ $\Delta y = h_{max} = 11,48\ m$ ✓

OPTION/*OPSIE* 2

[for upward motion]
[*vir opwaartse beweging]*
$v_f = v_i + g\,\Delta t$
$\underline{0 = 15 + (-9,8)\,\Delta t}$ ✓
$\Delta t = \frac{15}{9,8} = 1,53s$
$\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ ✓
$=(15)(1,53)+\frac{1}{2}(-9,8)(1,53)^2$ ✓
∴ $\Delta y = h_{max} = 11,48\ m$ ✓

OPTION/*OPSIE* 3

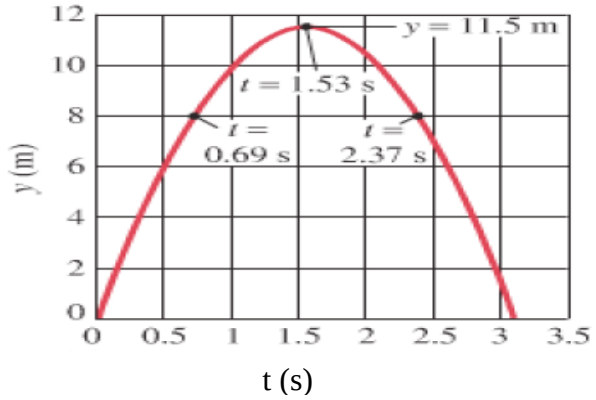
$v_f = v_i + g\,\Delta t$
$\underline{0 = 15 + (-9,8)\,\Delta t}$ ✓
$\Delta t = \frac{15}{9,8}$
$= 1.53s$
$\Delta y = \frac{v_f + v_i}{2}\Delta t$ ✓
$= \frac{0+15}{2} \times 1,53$ ✓
∴ $\Delta y = h_{max} = 11,48\ m$ ✓

(4)

	2.1.3	**OPTION/*OPSIE* 1** Δt = ? $\Delta y = v_i\Delta t + \frac{1}{2} g\Delta t^2$ ✓ $0 = 15\Delta t + \frac{1}{2}(-9,8)\Delta t^2$ ✓ $-9,8\ \Delta t^2 + 30\Delta t = 0$ $-\Delta t(9,8\Delta t - 30) = 0$ $\Delta t = \frac{30}{9,8}$ $\therefore\ \Delta t = 3,06s$ ✓	**OPTION/*OPSIE* 2** $v_f = v_i + g\ \Delta t$ ✓ [for upward motion] [*vir opwaartse beweging]* $0 = 15 + (-9,8)\ \Delta t$ ✓ $\Delta t = \frac{15}{9,8} = 1,53s$ $\therefore$ total time / *totale <u>tyd</u>* = 2(1,53) = 3,06s✓	(3)
	2.1.4	Δy = 8 m Δt = ? $\Delta y = v_i\ \Delta t + \frac{1}{2} g\Delta t^2$ ✓ 8✓ $= 15\ \Delta t + \frac{1}{2}(-9,8)\Delta t^2$ ✓ $4,9\ \Delta t^2 - 15\ \Delta t + 8 = 0$ Using a quadratic formula to find the roots: *Gebruik 'n kwadratiese formule of die wortels te bereken:* $\Delta t = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $= \frac{-(-15) \pm \sqrt{(-15)^2-4(4,9)(8)}}{2(4,9)}$ $= \frac{15 \pm \sqrt{225-156,8}}{9,8}$ $= \frac{15 \pm 8,26}{9,8}$ $\therefore\ \Delta t = 2,37s$ ✓or $\Delta t = 0,69s$ ✓ Both values of Δt are acceptable/*Albei waardes vir Δt aanvaarbaar*		(5)

2.1.5

Position vs time graph / *Posisie vs tyd grafiek*



Both axes labelled /*Albei asse met byskrifte*	✓
All points plotted as directed/ *Alle punte geplot soos gevra*	✓✓
Correct shape	✓
NOTE: Take away a mark if not all points are plotted **: For the maximum height accept y value = 11.48 m or 11.5 m on the graph** ***AANDAG: Neem 1 punt weg indien nie alle punte geplot nie.*** ***: Vir die maksimum hoogte, aanvaar y = 11,48 of 11,5 m op die grafiek.***	

(4)

2.2

OPTION/*OPSIE* 1

(Take downwards as positive)
(*Afwaarts positief)*

Stone/*Klip* 1:

$\Delta y_1 = v_i \Delta t + \frac{1}{2} g\Delta t^2$ For both ✓

$= 0 \times \Delta t + \frac{1}{2}(9,8)\Delta t^2$ ✓

$\Delta y_1 = 4,9\ \Delta t^2$ {For $\Delta t = t$}

$\therefore \Delta y_1 = 4,9\ t^2$

Stone/*Klip* 2:

$\Delta y_2 = v_i \Delta t + \frac{1}{2} g\Delta t^2$

$= 30\ \Delta t + \frac{1}{2}(9,8)\Delta t^2$ ✓ {$\Delta t = t - 2$}

$\therefore \Delta y_2 = 30(t - 2) + 4,9(t - 2)^2$

But / *maar* $\Delta y_1 = \Delta y_2$, $\therefore$

$4,9\ t^2 = 30(t - 2) + 4,9(t - 2)^2$ ✓

$10,4t = 40,4$

$\therefore t = 3,89s$

For second stone / *Vir tweede klip*

$t - 2 = 3,89 - 2$ ✓

$= 1,89s$✓

OPTION/*OPSIE* 2

(Take downwards as positive)
(Afwaarts positief)

Stone/*Klip* 1:

$\Delta y_1 = v_i \Delta t + \frac{1}{2} g\Delta t^2$ ✓

$= 0 \times \Delta t + \frac{1}{2}(9,8)\Delta t^2$ ✓

$\Delta y_1 = 4,9\ \Delta t^2$ {For $\Delta t = t + 2$}

$\therefore \Delta y_1 = 4,9\ (t + 2)^2$

Stone/*Klip* 2:

$\Delta y_2 = v_i \Delta t + \frac{1}{2} g\Delta t^2$ For both ✓ */Vir beide*

$= 30\ \Delta t + \frac{1}{2}(9,8)\Delta t^2$✓ {$\Delta t = t$}

$\therefore \Delta y_2 = 30(t) + 4,9(t)^2$

But / *maar* $\Delta y_1 = \Delta y_2$, $\therefore$

$4,9\ (t + 2)^2 = 30(t) + 4,9(t)^2$ ✓

$10,4t = 19,6$

$\therefore t = 1,89s$ ✓✓

For second stone / *Vir tweede klip*

1,89s

(6)

[23]

QUESTION/*VRAAG* 3

<table>
<tr><td>3.1</td><td>3.1.1</td><td colspan="2">Impulse is the <u>product of the net force acting</u> ✓on an object and the <u>time the net force acts on the object</u> ✓.
OR
It is a <u>measure of how hard</u> ✓and <u>for how long does a net force act</u>✓ on an object
Impuls is die produk van die netto krag ✓ wat op ’n voorwerp inwerk en <u>die tyd wat die netto krag op die voorwerp inwerk</u>. ✓
OF
Dit is die <u>maatstaf vir hoe hard</u> ✓ en <u>vir hoe lank ’n netto krag op ’n voorwerp inwerk</u>. ✓</td><td>(2)</td></tr>
<tr><td></td><td>3.1.2</td><td><u>OPTION/OPSIE 1</u>
$F_{net}\ \Delta t = m\ \Delta v$ ✓
$= 0,045(45 - 0)$ ✓
$= 2,03$ N·s✓</td><td><u>OPTION/OPSIE 2</u>
Impulse = Change in momentum
Impuls = verandering in momentum
$\Delta p = m\Delta v$ ✓
$= 0,045(45 - 0)$ ✓
$= 2,03\ kgm{\cdot}s^{-1}$
Impulse / Impuls = 2,03 N·s ✓</td><td>(3)</td></tr>
<tr><td></td><td>3.1.3</td><td colspan="2">$F_{net} = \frac{m\ \Delta v}{\Delta t}$
$= \frac{2,03}{3,5 \times 10^{-3}}$ ✓
= 580 N ✓</td><td>(2)</td></tr>
<tr><td>3.2</td><td>3.2.1</td><td colspan="2">Take direction towards the wall as positive/
Neem rigting na die muur as positief
m = 60 g = 0,060 kg
$v_i = 12\ m{\cdot}s^{-1}$
$v_f = -10\ m{\cdot}s^{-1}$
Δp = ?
$\Delta p = m(v_f - v_i)$ ✓
$= 0,060$✓ $(-10 - 12)$ ✓
$= -1,32\ kg{\cdot}m{\cdot}s^{-1}$
$\Delta p = 1,32\ kg{\cdot}m{\cdot}s^{-1}$✓ away from the wall/weg vanaf die muur ✓</td><td>(5)</td></tr>
<tr><td></td><td>3.2.2</td><td colspan="2">1,32 N·s or/of $1,32\ kg{\cdot}m{\cdot}s^{-1}$ ✓</td><td>(1)</td></tr>
</table>

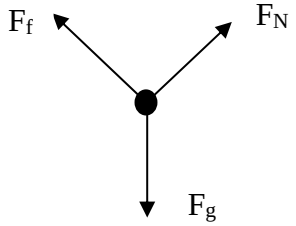
3.3	3.3.1	The total linear momentum of an isolated ✓system remains constant / is conserved. ✓ **OR/*OF*** The total linear momentum of an isolated system before collision ✓is equal to the total linear momentum after collision. ✓ *Die totale lineêre momentum van 'n geslote sisteem ✓ bly konstant / bly behoue ✓* **OF** *Die totale lineêre momentum van 'n geslote sisteem voor 'n botsing ✓ is gelyk aan die totale liniêre momentum na die botsing ✓*	(2)
	3.3.2	There is a need to calculate the velocity of block **m** just before collision/*Bereken die snelheid van blok **m** voor die botsing*: $E_{m\ top/bo} = E_{m\ bottom/onder}$ $(E_P + E_K)_{top/bo} = (E_P + E_K)_{bottom/onder}$ ✓ $mgh + 0 = 0 + \frac{1}{2}mv^2$ $2gh = v^2$ $v = \sqrt{2gh}$ $= \sqrt{2(9,8)(3,6)}$ ✓ $= 8,40\ m\cdot s^{-1}$ ✓ $m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ ✓ $2,2 \times 8,4 + 7 \times 0 = 2,2 \times 0 + 7\ v_{2f}$ ✓ $v_{2f} = 2,64\ m\cdot s^{-1}$ ✓	(6)

[21]

QUESTION/*VRAAG* 4

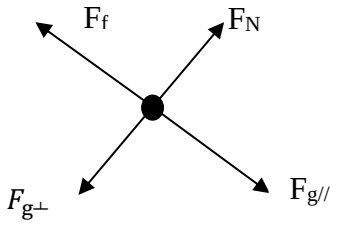
4.1 4.1.1

OPTION/*OPSIE* 1



F_g	✓
F_N	✓
F_f	✓

OPTION/*OPSIE* 2



Both components ($F_{g//}$ and $F_{g\perp}$) *Albei komponente* ($F_{g//}$ en $F_{g\perp}$)	✓
F_N	✓
F_f	✓

(3)

4.1.2

$F_{g//} = mg \sin\theta$

$F_{g\perp} = -mg\cos\theta$ (opposite direction of F_N)/
(*teenoorgestelde rigting as* F_N)

Applying Newton's Second law for the motion parallel to the slope:
Toepassing van Newton se Tweede Wet van die beweging parallel aan die skuinsvlak:

$F_{g//} + F_f = ma$
$mg\sin\theta - \mu_k F_N = ma$ …….. (1)

✓ for one of the two/
vir een van die twee

Applying Newton's Second law for the motion perpendicular to the slope/*Toepassing van Newton se Tweede Wet van die beweging loodreg aan die skuinsvlak:*:

$F_N + F_{G\perp} = ma$
$F_N - mg\cos\theta = ma$ …… (2)

(Since there is no motion perpendicular to the slope a = 0 $m.s^{-2}$)
(*Geen beweging loodreg aan skuinsvlak dus a = 0* $m.s^{-2}$)

$\therefore F_N = mg\cos\theta$ ✓ (Substitute/*Vervang* F_N in (1))
$mg\sin\theta - \mu_k(mg\cos\theta) = ma$ (dividing by m)
$g\sin\theta - \mu_k(g\cos\theta) = a$ ✓
(Substitute/*Vervang* $\mu_k = 0{,}10$, $g = 9{,}8\ m\cdot s^{-2}$ and/*en* $\theta = 30°$)

$\underline{9{,}8\sin30° - 0{,}10 \times 9{,}8 \times \cos30°}$ ✓= a
$\therefore a = 4{,}00\ m\cdot s^{-2}$ ✓

(5)

4.1.3

$v_f = v_i + a\Delta t$ ✓
$= 0 + 4 \times 4$ ✓
$= 16\ m\cdot s^{-1}$ ✓

(3)

4.2 4.2.1

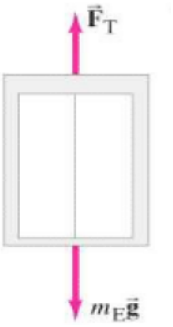
When a net force/resultant force acts on an object, it produces the acceleration of the object in the direction of the net force/resultant force. This acceleration is directly proportional to the net/resultant force ✓ and inversely proportional to the mass of the object. ✓

Indien 'n netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die netto krag. Die versnelling is direk eweredig aan die netto krag ✓ en omgekeerd eweredig aan die massa van die voorwerp. ✓ (2)

4.2.2

Take down wards as negative/*Afwaarts as negatief*

For the Elevator/*Vir die hysbak*



$F_{net} = F_T - m_Eg = m_Ea_E = -m_Ea$ $(a_E = -a)$

$F_T - m_Eg = -m_Ea$ ✓ ---------- (1)

For the counterweight/*Vir die teengewig*

$F_{net} = F_T - m_Cg = m_Ca_C = m_Ca$ $(a_E = a)$

$F_T - m_Cg = m_Ca$ ✓ …… (2)

(2) – (1) : $m_Eg - m_Cg = m_Ea + m_Ca$

$g(m_E - m_C) = a(m_E + m_C)$ ✓

$a = \frac{g(m_E - m_C)}{(m_E + m_C)}$

$= \frac{9{,}8(1150 - 1000)✓}{(1150 + 1000)✓}$ **OR/*OF***

$= 0{,}68\ m\cdot s^{-2}$ ✓

$9{,}8(1150 - 1000)✓ = a(1150 + 1000)✓$

$1470 = 2\,150a$

$a = 0{,}68\ m\cdot s^{-2}✓$

(6)

4.2.3

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
For the counterweight	For the Elevator
$F_T - m_Cg = m_Ca$ ✓	$F_T - m_Eg = -m_Ea$ ✓
$F_T - 1000(9{,}8) = 1000(0{,}68)$ ✓	$F_T - 1150(9{,}8) = -1150(0{,}68)$ ✓
$F_T = 10\,480$ N ✓	$F_T = 10\,488$ N✓

(3)

[22]

QUESTION/*VRAAG* 5

5.1

$W = F\Delta x\cos\theta$ ✓
$= 600 \times 30 \times \cos 0°$
$= 600 \times 30 \times 1$ ✓
$= 18\,000$ J ✓ (3)

5.2

5.2.1

$W_f = F_f \Delta x\cos\theta$ ✓
$= 50 \times 6 \times \cos 180°$
$= 50 \times 6 \times -1$ ✓
$= -300$ J ✓ (3)

5.2.2

OPTION/*OPSIE* 1
{Positive marking from/ *Merk positief vanaf* 5.2.1}

$W_{net} = W_f + W_{HC}$ ✓
$= F_f \Delta x\cos\theta + F_{app}\Delta x\cos\Phi$
$= -300$ ✓ $+ 300 \times 6 \times \cos 60°$ ✓
$= -300 + 900$
$= 600$ J ✓

OPTION/*OPSIE* 2
{Positive marking from/ *Merk positief vanaf* 5.2.1}

$F_{net} = F_f + F_{app}\cos 60°$
$= -50 + 300 \times 0,5$ ✓
$= 100$ N
$W_{net} = F_{net}\Delta \times \cos\theta$ ✓
$= 100 \times 6 \times 1$ ✓
$= 600$ J ✓ (4)

5.3

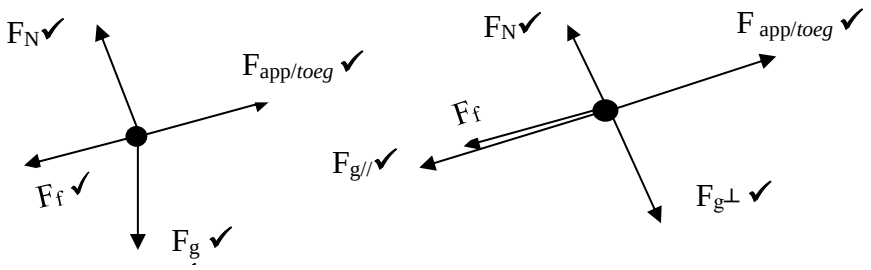
5.3.1

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

5.3.2

$W_{net} = \Delta E_K$ ✓
$W_f = E_{Kf} - E_{Ki}$
$F_f \Delta x\cos\theta = \frac{1}{2} mv_f^2 - \frac{1}{2} mv_i^2$ ✓ **for any of the 2/ *vir enige van die 2***

$6\,000(\Delta x)\cos 180°$ ✓ $= \frac{1}{2}(800)(0) - \frac{1}{2}(800)(20,5)^2$ ✓
$-6000\,\Delta x = -168\,100$
The braking distance/ *Remafstand* $= \Delta x = 28,02$ m ✓ (5)

5.4	5.4.1	$W_{net} = \Delta E_K$ ✓ $= \frac{1}{2} m(v_f^2 - v_i^2)$ $= \frac{1}{2} (80)(25^2 - 0^2)$ ✓ $= 40(625)$ $= 25\,000$ J ✓ $= 25$ kJ	(3)
	5.4.2	$f_K = \mu_K F_N$ ✓ $= 0{,}34(mg\ Cos\theta)$ $= \underline{0{,}34 \times 80 \times 9{,}8}$ ✓ $\times \frac{1.09}{1{,}20}$ ✓ $=$ 242,13 N✓	(4)
	5.4.3		(4)
	5.4.4	**OPTION/*OPSIE* 1** $W_{net} = W_{App} + W_{//} + W_f$ $= F_{app}\Delta x Cos\theta + F_{G//}\Delta x Cos\Phi + F_f \Delta x Cos\Phi$ $= F_{app}\Delta x Cos\theta + mgSin\delta\Delta x Cos\Phi + F_f\Delta x Cos\Phi$ $= 450\times1{,}2\times Cos0°+80\times9{,}8\times\frac{0.5}{1.2}\times1{,}2Cos180°+242{,}13\times1{,}2\times Cos180°$ $= 450 \times 1{,}2 \times 1 + 80 \times 9{,}8 \times \frac{0{,}5}{1{,}2} \times 1{,}2 \times -1$✓ $+ 242{,}13 \times 1{,}2 \times -1$✓ $= 540 - 392 - 290{,}56$ $W_{net} = -142{,}56$ J✓ **OPTION/*OPSIE* 2** $F_{net} = F_{app} + F_{g//} + F_f$ $= F_{app} + mgSin\delta + F_f$ $= 450 - (80 \times 9{,}8 \times \frac{0{,}5}{1{,}2} + 242{,}13)$ ✓ $= -118{,}80$ N $W_{net} = F_{net}\Delta \times Cos\theta$ $= 118{,}80 \times 1{,}2 \times -1$✓ $= -142{,}56$ J✓ ✓ for any of the two *vir enige van die twee*	(4)
	5.4.5	$E_P = mgh$ ✓s $= 80 \times 9{,}8 \times 0{,}5$ ✓ $= 392$ J✓	(3)

[35]

QUESTION/*VRAAG* 6

6.1	6.1.1	Doppler effect is the change in frequency (or pitch) of the sound detected ✓ by a listener, because the sound source and the listener have different velocities relative to the medium of sound propagation✓. **OR** Doppler effect is the apparent change in frequency of a wave✓when there is relative motion between the source and an observer✓. **OR** Doppler Effect is an (apparent) change in observed/detected frequency (pitch), (wavelength) ✓ as a result of the relative motion between a source and an observer (listener) ✓. *Die Doppler effek is die verandering in frekwensie (of toonhoogte) van die klank waargeneem ✓deur 'n luisteraar want dit klankbron en luisteraar het verskillende snelhede relatief tot die medium van die voortplanting van die klank.* ✓ ***OF*** *Die Doppler effek is die skynbare verandering in die frekwensie van 'n golf ✓ as daar relatiewe beweging is tussen die bron en die waarnemer.* ✓ ***OF*** *Die Doppler effek is 'n waarskynlike verandering in die waargenome frekwensie (toonhoogte)(golflengte) ✓ as gevolg van die relatiewe beweging tussen die bron en die luisteraar* ✓	(2)
	6.1.2	Towards the Listener. (*Na die luisteraar)*✓ The frequency of the sound waves heard by the listener is greater than the frequency of the sound waves emitted by the ambulance. ✓ The compressions in front of the source are closer together because the source is moving towards the previously emitted wavefront when the next wavefront is sent✓ resulting in a decrease in wavelength✓ and a sound of higher pitch is heard. *Die frekwensie van die klankgolwe gehoor deur die luisteraar is hoër as die frekwensie van die klankgolwe uitgestraal deur die ambulans.* ✓ *Die samepersing aan die voorkant van die bron is nader aanmekaar want die bron beweeg na die uitgestraalde golffront wanneer die vorige golffront gestuur word ✓en veroorsaak 'n afname in die golflengte en die hoër toonhoogte word gehoor.* ✓	(4)
	6.1.3	$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓ ✓ $400 = \frac{340}{340 - v_s} 350$ ✓ $340 - v_s = \frac{340}{400} 350$ v_s = 42,5 m·s^{-1}✓	(4)

6.2	6.2.1	$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓ When the car approaches/ *Soos die motor naderbeweeg*: ✓ $450 = \frac{343}{343 - v_s} f_s$ ✓ $f_s = \frac{450(343 - v_s)}{343}$ When the car moves away/ *Soos die motor weg beweeg*: ✓ $390 = \frac{343}{343 + v_s} f_s$ ✓ $f_s = \frac{390(343 + v_s)}{343}$ $\frac{450(343 - v_s)}{343} = \frac{390(343 + v_s)}{343}$ ✓ for either of the two/ *vir enige van die twee* $154350 - 450 v_s = 133770 + 390 v_s$ v_s = 24,5 m·s^{-1} ✓	(7)
	6.2.2	**OPTION/*OPSIE* 1** $f_s = \frac{450(343 - v_s)}{343}$ ✓ $f_s = \frac{450(343 - 24{,}5)}{343}$ ✓ f_s = 417,86 Hz ✓ **OPTION/*OPSIE* 2** $f_s = \frac{390(343 + v_s)}{343}$ ✓ $f_s = \frac{390(343 + 24{,}5)}{343}$ ✓ f_s = 417,86 Hz ✓	(3)
			[20]

QUESTION/*VRAAG* 7

7.1	7.1.1	The magnitude of the electrostatic force exerted by one point charge (Q_1) on another point charge (Q_2) is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance (r) between them. ✓ **OR** The magnitude of the electrostatic force between two point charges is directly proportional to the product of the magnitudes of the charges ✓ and inversely proportional to the square of the distance between them. ✓ *Die grootte van die elektrostatiese krag wat deur een puntlading (Q_1) op 'n ander puntlading (Q_2) uitoefen, is direk eweredig aan die grootte van die produk van die lading ✓ en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.* ✓ **OF** *Die grootte van die elektrostatiese krag tussen twee puntladings is direk eweredig aan die produk van die massas van die ladings ✓ en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.* ✓	(2)
	7.1.2	Electrostatic force exerted by Q_1 on Q_2/ *Elektrostatiese krag uitgeoefen deur Q_1 op Q_2*: $F = k\frac{Q_1Q_2}{r^2}$ ✓ $= \frac{(9\times10^9)(4\times10^{-9})(2\times10^{-9})}{0,04^2}$ ✓ ✓ $= 4,5 \times 10^{-5}$ N, to the East/*na die Ooste* Electrostatic force exerted on Q_2 by Q_3/*Elektrostatiese krag uitgeoefen deur Q_2 op Q_3*: $F = k\frac{Q_2Q_3}{r^2}$ $= \frac{(9\times10^9)(2\times10^{-9})(6\times10^{-9})}{0,06^2}$ ✓ ✓ $= 3,0 \times 10^{-5}$ N, to the East Both forces are towards the same direction/ *Albei kragte is in dieselfde rigting*: The net electrostatic force/ *Die netto elektrostatiese krag* $F_{net} = 4,5 \times 10^{-5}$ N + $3,0 \times 10^{-5}$ N ✓ $= 7,5 \times 10^{-5}$ N ✓ (To the East)	(7)
			[9]

TOTAL/*TOTAAL*: 150