Western Cape Government
Education
FOR YOU

CAPE WINELANDS EDUCATION DISTRICT

PHYSICAL SCIENCES PAPER 1
MARKING GUIDELINE
GRADE 12

COMMON TRIAL EXAMINATION
SEPTEMBER 2025

MARKS: 150

TIME: 3 hours

This exam paper consists of 14 pages.

QUESTION 1/ VRAAG 1

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

QUESTION 2/ VRAAG 2

2.1 When a net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force and inversely proportional to the mass of the object. ✔✔

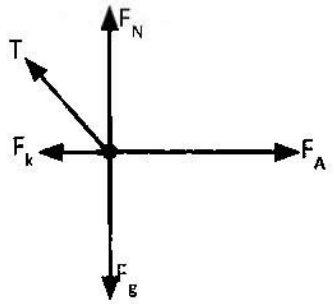
(Deduct one mark if any of the underlined phrases are omitted.)

Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

(Trek een punt af indien enige van die onderstreepte frases weggelaat word.) (2)

2.2 *Note:* 1 mark for each arrow WITH its label, deduct 1 mark for every extra force included.

Let wel: 1 punt vir elke pyl MET sy byskrif, trek 1 punt af vir elke ekstra krag wat ingesluit is.



✔✔✔✔✔ (5)

2.3 $F_k = \mu_k N$

$= \mu_k mg\cos\theta$ ✔ mark for either

$= (0,2)\left(2\right)(9,8)(cos40^o)$ ✔

$= 3,0\ N$ down the slope ✔ (3)

2.4 **POSITIVE MARKING FROM QUESTION 2.3/POSITIEWE NASIEN VANAF VRAAG 2.3:**

2kg:	5kg:
$F_{net} = ma$ ✔	$F_{net} = ma$
$T - F_k - Fg_{\parallel} = ma$	$F_A - F_k - T\cos\theta = ma$
$T - F_k - mg\sin\theta = ma$	$(70 - 17,15 - T\cos 20^o)$✔ $= 5a$
$(T - 3 - (2\times 9,8\times \sin 40^o))$✔ $= 2a$✔ (for both 2a & 5a)	$52,85 - T\cos 20^o = 5a$ ... eq 2
$T = 2a + 15,599$ ...eq 1	

Substitute **equation 1** into **equation 2**:

$$52,85 - (2a + 15,599)\cos 20^o = 5a \text{ ✔}$$

$$38,19 = (5 + 2\cos 20^o)a$$

$$a = 5,55\ m.s^{-2} \text{ ✔} \qquad (6)$$

[16]

QUESTION 3/ VRAAG 3

3.1 An object which has been given an initial velocity and then it moves under the influence of the gravitational force only. ✔✔ **(2 or 0)**
'n Voorwerp waaraan 'n beginsnelheid gegee is en wat dan slegs onder die invloed van die gravitasiekrag beweeg. **(2 of 0)** (2)

3.2

Downwards as positive	**Upwards as positive**
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✔	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✔
$1,8 = v_i(0,5) + \frac{1}{2}(9,8)(0,5^2)$ ✔	$-1,8 = v_i(0,5) + \frac{1}{2}(-9,8)(0,5^2)$✔
$v_i = 1,15\ m\cdot s^{-1}$ ✔	$v_i = -1,15\ m\cdot s^{-1}$
	$\therefore speed = 1,15\ m\cdot s^{-1}$ ✔ (3)

3.3

$v_f^2 = v_i^2 + 2a\Delta y$ ✔	$v_f^2 = v_i^2 + 2a\Delta y$ ✔
$0 = v_i^2 + 2(9,8)(-0,9)$ ✔	$0 = v_i^2 + 2(-9,8)(0,9)$✔
$v_i = \sqrt{17,64}$	$v_i = \sqrt{17,64}$

$v_i = 4,2\ m{\cdot}s^{-1}\ upwards$ ✔

3.4 $v_f = v_i + a\Delta t$ ✔

$0 = -4,2 + 9,8\Delta t$ ✔ **+ MARKING**

$\Delta t = 0,43\ s$

$t = 0,5 + 2(0,43)$ ✔

$t = 1,36\ s$ ✔

$v_i = 4,2\ m{\cdot}s^{-1}\ upwards$ ✔ (3)

$v_f = v_i + a\Delta t$ ✔

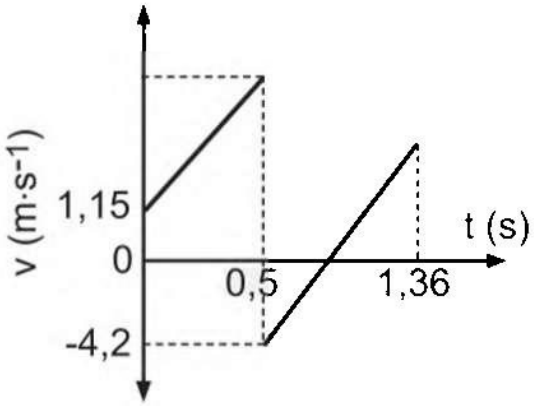
$0 = 4,2 + (-9,8)\Delta t$ ✔ **+ MARKING**

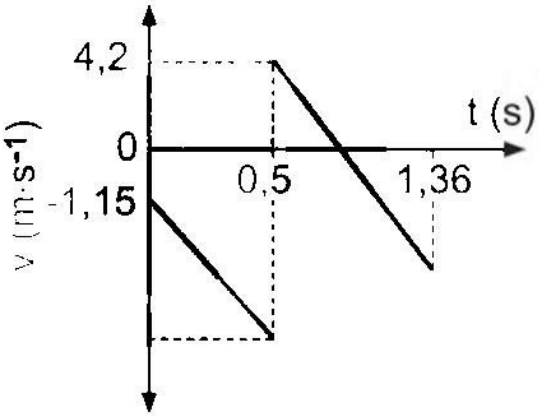
$\Delta t = 0,43\ s$

$t = 0,5 + 2(0,43)$ ✔

$t = 1,36\ s$ ✔ (4)

3.5





POSITIVE MARKING FROM Q3.3/POSITIEF NASIEN VANAF V3.3

Criteria for marking/ Nasienkriteria:

- Lines are correctly drawn (parallel)/ Lyne is korrek getrek (parallel) ✔
- Initial velocity correctly indicated/ Aanvangssnelheid korrek aangedui ✔
- Velocity of the ball as it leaves the ground./ Snelheid van die bal soos dit die grond verlaat. ✔
- Time when the ball strikes the ground after the first bounce (0,5 s)/ Tyd wanneer die bal die grond tref na die eerste bons (0,5 s).✔ (4)

[16]

QUESTION 4/ VRAAG 4

4.1 The total linear momentum of an isolated system✔ remains constant / is conserved ✔

Die totale lineêre momentum in 'n geïsoleerde sisteem ✔bly konstant / behoue.✔

OR

Accept: In an isolated system, ✔ the total linear momentum before collision is equal to the total linear momentum after collision. ✔

Aanvaar: In 'n geïsoleerde stelsel, ✔ is die totale lineêre momentum voor botsing gelyk aan die totale lineêre momentum na botsing. ✔ (2)

4.2

Right as +:	**Left as +:**
$\Sigma p_{(initial)} = \Sigma p_{(final)}$ ✔ OR	$\Sigma p_{(initial)} = \Sigma p_{(final)}$ ✔
$m_1v_{i1} + m_2v_{i2} = (m_1 + m_2)v_f$	$m_1v_{i1} + m_2v_{i2} = (m_1 + m_2)v_f$
(5)(4) + (2)(-1) ✔ = (5 + 2) (v_f) ✔	(5)(-4) + (2)(1) ✔ = (5 + 2) (v_f) ✔
$\therefore v_f = 2,57\ m\cdot s^{-1}$ ✔	$\therefore v_f = -2,57\ m\cdot s^{-1}$ ✔

If no subscripts: mv + mv = mv + mv max. 3/4

(4)

4.3 **POSITIVE MARKING FROM 4.2/ POSITIEF NASIEN VANAF 4.2**

OPTION 1:	**OPTION 2:**
$F_{net}\Delta t = m\Delta v$ ✔ or $F_{net}\Delta t = \Delta p$	$v_f = v_i + a\Delta t$
$F_{net}(0,3)$✔ $= (7)(0 - 2,57)$✔	$0 = 2,57 + a(0,3)$✔
$F_{net} = -59,97\ N$	$a = -8,57\ m.s^{-2}$
$magnitude\ of\ F_{net} = 59,97\ N$✔	$F_{net} = ma$✔
	$F_{net} = (7)(-8,57)$✔
	$F_{net} = -59,99\ N$
	$magnitude\ of\ F_{net} = 59,99\ N$✔
Range/Gebied: 59,97 N to/tot 60,20 N	**Range/gebied: 59,97 N to/tot 60,20 N**

(4)
[10]

QUESTION 5/ VRAAG 5

5.1.1 The total mechanical energy in an isolated system✔ is conserved/remains constant. ✔

Die totale meganiese energie in 'n geïsoleerde stelsel✔ word behoue/bly konstant. ✔ (2)

5.1.2

OPTION 1:	**OPTION 2:**
$E_{M(initial)} = E_{M(final)}$ ✔ $\frac{1}{2}mv_i^2 + m(9,8)(1,3)$ ✔ $= m(9,8)(5)$ ✔ $+ 0$ $v_i = 8,52\ m.s^{-1}\ upwards/opwaarts$ ✔	$W_{net} = \Delta E_K$ ✔ $m(9,8)(3,7)cos180^o$ ✔ $= 0 - \frac{1}{2}mv^2$ ✔ $v = 8,52\ m.s^{-1}\ upwards/opwaarts$ ✔
OPTION 3: $W_{nc} = \Delta E_K + \Delta E_P$ ✔ $= (\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2) + (mgh_f - mgh_i)$ $0 = \frac{1}{2}m(0) - \frac{1}{2}mv_i^2$ ✔ + m(9,8)(5) - m(9,8)(1,3)✔ $v_i = 8,52\ m.s^{-1}\ upwards/opwaarts$ ✔	**NOTE/LET WEL:** If learners used equations of motion: 0/4 Indien leerders bewegingsvergelykings gebruik het: 0/4

(4)

5.1.3 DECREASE / AFNEEM ✔

Friction will remove energy from the system.✔ /

Wrywing sal energie uit die stelsel verwyder.

OR/OF

Some of the object's kinetic energy would be converted into heat and sound due to friction, leaving less energy available to convert into gravitational potential energy./

Van die voorwerp se kinetiese energie sal as gevolg van wrywing in hitte en klank omgeskakel word, wat minder energie beskikbaar laat om in gravitasiepotensiële energie om te skakel.

OR/OF

Friction opposes motion, causing the object to lose energy more quickly as it moves upward. /
Wrywing staan beweging teë, wat veroorsaak dat die voorwerp vinniger energie verloor soos dit opwaarts beweeg.

OR/OF

With less energy available to overcome gravity, the object would not rise as high, resulting in a lower maximum height. /
Met minder energie beskikbaar om gravitasiekrag te oorkom, sal die voorwerp nie so hoog styg nie, wat 'n laer maksimum hoogte tot gevolg sal hê.

OR/OF

Increased F_{net} downwards/increased acceleration downwards/loses velocity faster, resulting in a lower maximum height./
F_{net} afwaarts neem toe/versnelling afwaarts neem toe/verloor snelheid vinniger, wat lei tot 'n laer maksimum hoogte. (2)

5.2.1 Non-conservative/ Nie-konserwatiewe krag ✔
It is a force for which the work done in moving an object between two points depends on the path taken. ✔
Dit is 'n krag waarvoor die arbeid verrig om 'n voorwerp tussen twee punte te beweeg, afhanklik is van die roete wat gevolg word. (2)

5.2.2 $W_{nc} = \Delta E_K + \Delta E_P$ ✔

$W_{friction} = (\frac{1}{2}(1,4)(3)^2 - \frac{1}{2}(1,4)(0,6)^2)$ ✔ $+ (1,4)(9,8)(0 - 1,5)$ ✔

$W_{friction} = -14,532\ J$

$W_{friction} = F_{friction}\Delta x cos\theta$

$-14,532 = F_{friction}(1,8)$✔$cos180^o$ ✔

$F_{friction} = 8,07\ N$ ✔

OR/OF

$W_{net} = \Delta E_K$ ✔

$W_f + W_{fg//} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$F_f \Delta x cos180 + mg\Delta x sin\theta cos0 = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$F_f(1,8)$✔$cos180$✔ $+ 1,4(9,8)(1,8)(\frac{1,5}{1,8})$✔ $= \frac{1}{2}(1,4)(3)^2 - \frac{1}{2}(1,4)(0,6)^2$✔

OR/OF

$F_{friction} = 8,07\ N$ ✔

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

$(3)^2$✔ $= (0,6)^2 + 2a(1,8)$ ✔

$a = 2,4\ m.s^{-2}$

$F_{net} = ma$ ✔

$F_{net} = (1,4)(2,4)$✔

$F_{net} = 3,36\ N$

$F_{net} = F_{g\,parallel} - F_f$

$F_{net} = F_g sin\theta - F_f$

$3,36 = (1,4)(9,8)(\frac{1,5}{1,8})$✔ $- F_f$

$3,36 = 11,43 - F_f$

$F_f = 8,07\ N$ ✔ (6)

[16]

QUESTION 6/ VRAAG 6

6.1 The apparent change in frequency (or pitch)✔ detected by a listener because the source and the listener have different velocities relative to the medium of propagation. ✔

Die skynbare verandering in frekwensie (of toonhoogte) wat deur 'n luisteraar waargeneem word omdat die bron en die luisteraar verskillende snelhede het relatief tot die voortplantingsmedium.

OR/OF

An apparent change in detected frequency✔ as a result of the relative motion between a source and a listener. ✔

'n Skynbare verandering in waargenome frekwensie as gevolg van die relatiewe beweging tussen 'n bron en 'n luisteraar. (2)

6.2 $v = f\lambda$ ✔

$340 = f(0.013)$ ✔

$f = 26153,85$ Hz ✔ (3)

6.3 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✔

$f_L = \frac{340 + v_{car}}{340}(26153,85)$ ✔ ***positive marking from Q6.2***

$f_L = (340 + v_{car})(76,92308824)$

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

31500 ✔ $= \left(\frac{340}{340 - v_{car}}\right)(340 + v_{car})(76,92308824)$ ✔

$409,4999398 = \frac{115600 + 340 v_{car}}{340 - v_{car}}$

$139229,9795 - 409,4999398 v_{car} = 115600 + 340 v_{car}$

$23629,97953 = 749,4999398 v_{car}$

$v_{car} = 31,53\ m.s^{-1}$ ✔ *OR/OF* $v_{car} = 113,51\ km.h^{-1}$ (Note: 100 $km.h^{-1}$ = 27,78 $m.s^{-1}$)

∴ The car is speeding./Die kar oorskry die spoedgrens ✔(***positive marking from v_{car}***)

(6)

[11]

QUESTION 7/ VRAAG 7

7.1.1 The magnitude of the electrostatic force exerted by one point charge on another point charge is directly proportional to the product of the magnitude of the charges and inversely proportional to the square of the distance between them. ✓ ✓

Die grootte van die elektrostatiese krag wat deur een puntlading op 'n ander puntlading uitgeoefen word, is direk eweredig aan die produk van die grootte van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.

Deduct one mark if any of the underlined phrases are omitted./Trek een punt af indien enige van die onderstreepte frases weggelaat word. (2)

7.1.2 $F = \frac{kQ_1Q_2}{r^2}$ ✔

$8,54 \times 10^{-7} = \frac{(9 \times 10^9)(3,8 \times 10^{-9})Q_2}{(0,4)^2}$ ✔

$Q_2 = 4 \times 10^{-9}$ C ✔

If Q_2 is written as a negative charge, no mark for final answer.

Indien Q_2 as 'n negatiewe lading geskryf is, geen punt vir die finale antwoord nie

(3)

7.2.1 The electric field at a point is the electrostatic force experienced per unit positive charge placed at that point. ✔✔ **(2 or 0)**

Die elektriese veld by 'n punt is die elektrostatiese krag wat per eenheidspositiewe-lading wat by daardie punt geplaas is, ondervind word. **(2 of 0)** (2)

7.2.2

Right as positive	Left as positive
$E_{net} = \frac{kQ_1}{r^2} + \frac{kQ_2}{r^2}$ ✔ $= (\frac{(9\times10^{9})(6\times10^{-6})}{(4)^2})$ ✔ $- \frac{(9\times10^{9})(3\times10^{-6})}{(1)^2}$ ✔ $= 3375 - 27\,000$ $= 23\,625\ N.C^{-1}$ to the left/ na links ✔	$E_{net} = \frac{k}{r^2} + \frac{kQ_2}{r^2}$ ✔ $= - (\frac{(9\times10^{9})(6\times10^{-6})}{(4)^2})$ ✔ $+ \frac{(9\times10^{9})(3\times10^{-6})}{(1)^2}$ ✔ $= -3375 + 27\,000$ $= 23\,625\ N.C^{-1}$ to the left/ na links ✔

(4)

7.2.3 ***POSITIVE MARKING FROM Q7.2.2/POSITIEF NASIEN VANAF V7.2.2***

OPTION 1/OPSIE 1	**OPTION 2/OPSIE 2**
$E = \frac{F}{q}$ ✔ OR/OF $F = Eq$ $F = (1,6 \times 10^{-19})(23\,625)$ ✔ $= 3,78 \times 10^{-15} N$ $a = \frac{F}{m}$ $a = \frac{3,78\times10^{-15}}{1,67\times10^{-27}}$ ✔ $a = 2,26 \times 10^{12} m.s^{-2}$ ✔	$F_{net} = \frac{kQ_1Q_2}{r^2} + \frac{kQ_1Q_2}{r^2}$ ✔ $F_{net} = \frac{(9\times10^{9})(3\times10^{-6})(1,6\times10^{-19})}{(1)^2} - \frac{(9\times10^{9})(6\times10^{-6})(1,6\times10^{-19})}{(4)^2}$ ✔ $F_{net} = 3,78 \times 10^{-15} N$ $F_{net} = ma$ $3,78 \times 10^{-15} = (1,67 \times 10^{-27})$ ✔a $a = 2,26 \times 10^{12} m.s^{-2}$ ✔
Marking Criteria: • Correct formula • Calculate force • Substitute mass in F = ma • Correct answer	**Nasienkriteria:** • Korrekte formule • Bereken krag • Vervang massa in F = ma • Korrekte antwoord

(4)

7.2.4 Greater than/Groter as ✔ (1)

[16]

QUESTION 8/ VRAAG 8

8.1.1 The potential difference across a conductor is directly proportional to the current ✔

in the conductor at constant temperature. ✔

Deduct one mark if any of the underlined phrases are omitted.

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur.

Trek een punt af indien enige van die onderstreepte frases weggelaat word. (2)

8.1.2

Diagram 1:

$R_Y = \frac{V}{I}$ ✔

$= \frac{6}{2}$ ✔

$= 3\ \Omega$

Diagram 2:

$V_Y = emf - V_X$

$= 6 - 4$

$= 2\ V$ ✔

$I_Y = \frac{V_Y}{R_Y}$

$= \frac{2}{3}$ ✔

$= 0,67\ A$

$R_X = \frac{V_X}{I_X}$

$= \frac{4}{0.67}$ ✔

$= 5,97\ \Omega$ ✔ **Range/Gebied:** 5,71Ω to/tot 6Ω

(6)

8.2.1 $12,6\ V$ ✔ (1)

8.2.2 ***POSITIVE MARKING FROM Q8.2.1/POSITIEF NASIEN VANAF V8.2.1***

OPTION 1/OPSIE 1

$\varepsilon = I(R + r)$ ✔

$12,6$ ✔ $= I(5 + 0,08)$ ✔ $\quad I = 2,48\ A$

$V_{ext} = IR$

$V_{ext} = (2,48)(5)$ ✔

$V_{ext} = 12,4\ V$ ✔

OPTION 2/OPSIE 2

$V_1 = \frac{R_1}{R_1+R_2} \times V_{total}$✔ OR/OF $V_2 = \frac{R_2}{R_1+R_2} \times V_{total}$

$V_{headlamps} = \frac{5✔}{5+0,08✔} \times 12,6✔$

$V_{headlamps} = 12,4V$✔ (5)

8.2.3 Decrease (brightness) /Verminder (helderheid)✔

- $R_{external}$ decrease/ $R_{eksterne}$ verminder✔
- I_t increase/ I_t vermeerder✔
- $V_{internal\ resistance}$ (or V_{lost}) increase **OR** V_{ext} decrease (emf remain constant)✔/

  $V_{interne\ weerstand}$ (of $V_{verlore}$) vermeerder **OF** V_{ext} verminder (as emk konstant bly)
- P (Power) decrease (according to $P = V^2/R$)✔ /

  P (Drywing) verminder (volgens $P = V^2/R$) (5)

[19]

QUESTION 9/ VRAAG 9

9.1.1 AC / Alternating current / WS / Wisselstroom ✔ (1)

9.1.2 DC / Direct current✔ / GS / Gelykstroom

Due to the presence of the split ring/commutator. ✔

A.g.v. die teenwoordigheid van die splitring/kommutator. (2)

9.2.1 The AC generator has slip rings ✔ whilst a DC generator has a split ring/commutator. ✔

Die WS generator het sleepringe, terwyl die GS generator splitring/kommutator het. (2)

9.2.2 Increase in voltage and decrease in current. ✔

Verhoging in potensiaalverskil en verlaging in stroom.

Loss in power/energy decreases. ($P = I^2R$) ✔

Verlies aan drywing/energie verminder ($P = I^2R$) (2)

9.3.1 0,1 s ✔ (1)

9.3.2 $V_{rms} = \frac{V_{max}}{\sqrt{2}} = \frac{84,8}{\sqrt{2}}$ ✔ $= 59,96V$ ✔ (2)

9.3.3 $P_{ave} = \frac{(V^2_{rms})}{R}$ ✔

$40 = \frac{59,96^2}{R}$ ✔ ***Positive marking from Q9.3.2***

$R = 89,88\ \Omega$ ✔ (3)

[13]

QUESTION 10/ VRAAG 10

10.1 $f = \frac{c}{\lambda}$ ✔ (Accept/Aanvaar: $f = \frac{v}{\lambda}$)

$= \frac{3 \times 10^{8}}{284 \times 10^{-9}}$ ✔

$= (1,06 \times 10^{15} Hz)$✔ (3)

10.2 It is the minimum energy that an electron in the metal needs to be emitted from the metal surface✔✔

Dit is die minimum energie benodig om 'n elektron uit die oppervlak van 'n metaal vry te stel.

Deduct one mark if any of the underlined phrases are omitted./Trek een punt af indien enige van die onderstreepte frases weggelaat word. (2)

10.3 ***POSITIVE MARKING FROM Q10.1/ POSITIEF NASIEN VANAF V10.1***

$E = W_o + E_{k(max)}$ OR/OF $hf = W_o + \frac{1}{2}mv^2$ ✔ (Any one of the formulae)

$(6,63 \times 10^{-34})(1,06 \times 10^{15})$✔ $= W_o + \frac{1}{2}(9,11 \times 10^{-31})(1,48 \times 10^{5})^2$ ✔

$W_o = 6,93 \times 10^{-19}$ J ✔(**Range/Gebied:** $6,90 \times 10^{-19}$ J to/tot $6,93 \times 10^{-19}$ J)

∴ The metal is zinc/ Die metaal is sink ✔ (5)

10.4.1 No effect / Geen effek ✔ (1)

10.4.2 No effect / Geen effek ✔ (1)

10.4.3 Increases / Toeneem ✔ (1)

[13]

TOTAL/TOTAAL: 150 MARKS/PUNTE