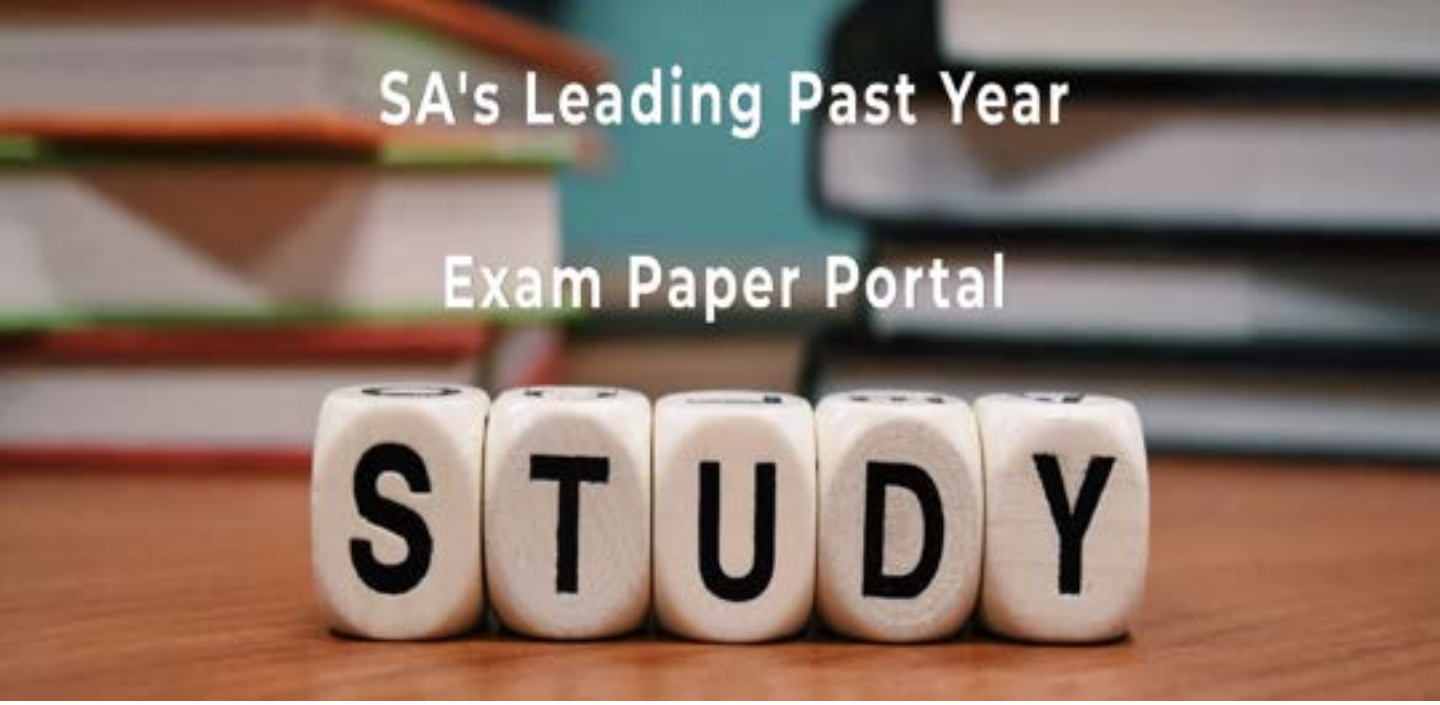


education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

PHYSICAL SCIENCES: PHYSICS (P1)
FISIESE WETENSKAPPE: FISIKA (V1)

JUNE 2020

MARKING GUIDELINES / *NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consists of 13 pages. /

Hierdie nasienriglyne bestaan uit 13 bladsye.

QUESTION 1 / VRAAG 1

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

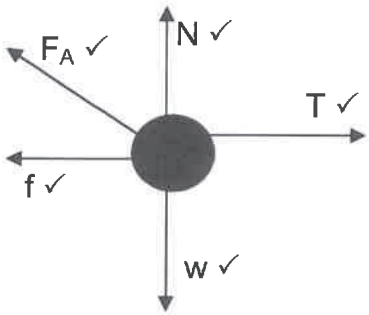
QUESTION 2 / VRAAG 2

2.1 Is the force that opposes the motion ✓of a moving object relative to a surface. ✓

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

2.2



(5)

Accepted labels / Aanvaarde benoemings	
w	F_g / F_w / force of earth on block / weight / mg / gravitational force
F_A	$F_{applied}$ / 60 N
T	Tension in rope / F_T
N	Normal force / F_N
f	friction / f_k / kinetic friction / F_f

Notes/Aantekeninge:
- Any additional forces: deduct 1 mark: max $^4/_5$
- No labels: deduct 1 mark: max $^4/_5$
- No arrows: $^0/_5$
- Force(s) not touching object: deduct 1 mark: max $^4/_5$

2.3 For the Block:

$F_{net} = ma$
$-F_x - f + T = ma$ } Any one ✓

$-60\cos30°$ ✓ $-4,83 + 80 = 5,3a$ ✓

$a = 4,38\ m\cdot s^{-2}$

For crate:

$F_{net} = ma$

$mg - T = ma$

$m(9,8) - 80 = m(4,38)$ ✓

$m = 14,76\ kg$ ✓

(5)

2.4 Remains the same / *Bly dieselfde* ✓ (1)

[13]

QUESTION 3 / VRAAG 3

3.1 8 ($m \cdot s^{-1}$) ✓

Note: -8 ($m \cdot s^{-1}$) $^0/_1$

(1)

3.2 9,8 $m \cdot s^{-2}$ ✓ downwards/*afwaarts* ✓ (2)

3.3 Inelastic/*Onelasties* ✓

The speed with which the ball leaves the ground is smaller than the speed with which it hits the ground. ✓
Die spoed waarmee die bal die grond verlaat is kleiner as die spoed waarmee dit die grond verlaat.

OR/*OF*
The speed with which the ball hits and leaves the ground is not the same. ✓
Die spoed waarteen die bal die grond tref en verlaat is nie dieselfde nie. (2)

3.4.1

Downwards as positive: ***Afwaarts as positief:*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $(9,6)^2 = (2)^2 + 2(9,8)\,\Delta y$ ✓ $\Delta y = 4,5$ m ✓	**Upwards as positive:** ***Opwaarts as positief:*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $(-9,6)^2 = (-2)^2 + 2(-9,8)\,\Delta y$ ✓ $\Delta y = -4,5$ $\Delta y = 4,5$ m ✓

(3)

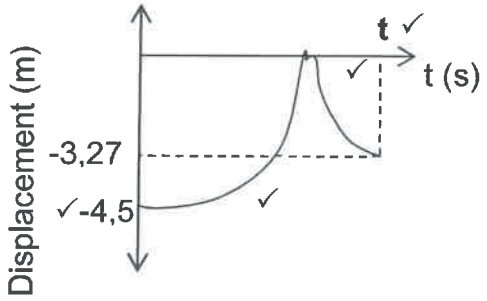
3.4.2

POSITIVE MARKING FROM QUESTION 3.4.1 ***POSITIEWE NASIEN VANAF VRAAG 3.4.1***	
Marking criteria/*Nasienriglyne* • Appropiate formula ✓ • Correct substitution✓ • Calculation of Δy (height of the bounce) ✓ • Subtraction of two heights✓ • Final answer✓	
Downwards as positive: ***Afwaarts as positief:*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = (-8)^2 + 2(9,8)\,\Delta y$ ✓ $\Delta y = -3,27$ $\Delta y = 3,27$m ✓ $\Delta y = 4,5$ -✓ $3,27 = 1,23$ m ✓	**Upwards as positive:** ***Opwaarts as positief:*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = (8)^2 + 2(-9,8)\,\Delta y$ ✓ $\Delta y = 3,27$ m ✓ $\Delta y = 4,5$ -✓ $3,27 = 1,23$ m ✓

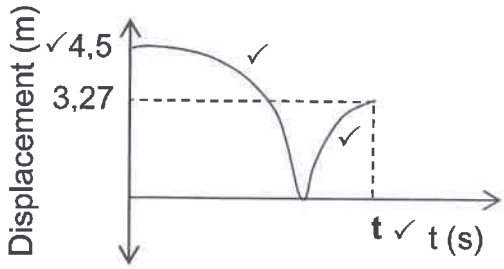
(5)

3. 5 **POSITIVE MARKING FROM QUESTION 3.4.1**
POSITIEWE NASIEN VANAF VRAAG 3.4.1

Downwards as positive:
Afwaarts as positief:



Upwards as positive:
Opwaarts as positief:



CRITERIA	
Y-intercept at ±4,5 m	✓
First part parabola to the t-axis.	✓
Second part is a parabola on the same side of t-axis and correctly drawn as indicated	✓
t correctly indicated at turning point of second parabola.	✓

(4)
[17]

QUESTION 4 / VRAAG 4

4.1 The product of the resultant/ net force acting on an object and the time the resultant/ net force acts on the object. ✓✓

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

4.2.1 **Downwards as positive**

$F_{net} \cdot \Delta t = mv_f - mv_i$ ✓
$F_{net} \cdot \Delta t = (0,15)(-3,62)$ ✓ $- (0,15)(6,2)$ ✓
$F_{net} \cdot \Delta t = -1,47$
$F_{net} \cdot \Delta t = 1,47\ N \cdot s$ ✓ upwards / *Opwaarts* ✓

Upwards as positive

$F_{net} \cdot \Delta t = mv_f - mv_i$ ✓
$F_{net} \cdot \Delta t = (0,15)(3,62)$ ✓ $- (0,15)(-6,2)$ ✓
$F_{net} \cdot \Delta t = 1,47\ N \cdot s$ ✓ upwards / *Opwaarts* ✓

(5)

4.2.2 **Downwards as positive**

$F_{net} \cdot \Delta t = \Delta p = mv_f - mv_i$
$(F_g - F_N) \cdot \Delta t = \Delta p$
} Any one ✓

$[(0,15)(9,8) - F_N]$ ✓ $(0,02)$ ✓ $= -1,47$ ✓
$F_N = -74,97$
$F_N = 74,97\ N$ ✓

Upwards as positive

$F_{net} \cdot \Delta t = \Delta p = mv_f - mv_i$
$(F_N - F_g) \cdot \Delta t = \Delta p$
} Any one ✓

$[F_N - (0,15)(9,8)]$ ✓ $(0,02)$ ✓ $= 1,47$ ✓
$F_N = 74,97\ N$ ✓

(5)

4.2.3 **Upwards as positive**

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0^2 = (3,62)^2 + 2(-9,8)\Delta y$ ✓
$\Delta y = 0,67\ m$ ✓

Downwards as positive

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0^2 = (-3,62)^2 + 2(9,8)\Delta y$ ✓
$\Delta y = -0,67$
$\Delta y = 0,67\ m$ ✓

(3)

4.3

$(E_k)_i = \frac{1}{2}mv_i^2$ ✓
$= \underline{\frac{1}{2}(0,15)(6,2)^2}$ ✓
$= 2,88$ J

$(E_k)_f = \frac{1}{2}mv_f^2$
$= \underline{\frac{1}{2}(0,15)(-3,62)^2}$ ✓ OR $\frac{1}{2}(0,15)(3,62)^2$
$= 0,98$ J

$(E_k)_i \neq (E_k)_f$ ✓

NOTE:
If started off with $(E_k)_i = (E_k)_f$ Max $^3/_4$

(4)

4.4

POSITIVE MARKING FROM QUESTION 4.3
POSITIEWE NASIEN VANAF VRAAG 4.3
$\Delta E = 0,98 - 2,88 = -1,9$ J

$$\%\text{Energy converted} = \frac{1,9✓}{2,88✓} \times 100✓ = 65,97\%\ ✓$$

(4)
[23]

QUESTION 5 / VRAAG 5

5.1 A system on which the resultant/ net <u>external force</u> is zero. ✓✓ (2 or 0)
'n Sisteem waarop die resultante/netto eksterne krag nul is.

OR/*OF*

A system that has no net force (or no force) acting on it.
'n Stelsel waarop geen netto/eksterne krag inwerk nie. (2)

5.2.1

$(E_m)_A = (E_m)_B$
$(mgh + \frac{1}{2}mv^2)_A = (mgh+\frac{1}{2}mv^2)_B$ } Any one ✓
$\underline{5(9,8)(1,2)}$ ✓ $+ 0 = 0 + \frac{1}{2}(5)v^2$ ✓
$v = 4,85\ m\cdot s^{-1}$

$\Sigma p_i = \Sigma p_f$
$(mv_i)_1 + (mv_i)_2 = (mv_f)_1 + (mv_f)_2$ } Any one ✓
$\underline{(5)(4,85)}$ ✓ $+ 0 = \underline{5v_f + (2)(4,95)}$ ✓
$v_f = 2,87\ m\cdot s^{-1}$ (to the right) ✓

(7)

5.2.2

POSITIVE MARKING FROM QUESTION 5.2.1

$(E_m)_B = (E_m)_C$
$(mgh + \frac{1}{2}mv^2)_B = (mgh+\frac{1}{2}mv^2)_C$ } Any one ✓
$\underline{0 + \frac{1}{2}(5)(2,87)^2}$ ✓ $= \underline{(5)(9,8)h + 0}$ ✓
$h = 0,42$ m ✓

NOTE:
Don't penalize for the omission of zero's

(4)

5.2.3

$\Delta x = v_i\Delta t$ ✓
$12 = (4,95)\Delta t$ ✓
$\Delta t = 2,42$ s ✓

(3)

5.3

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

ACCEPT:
The work done on an object by a resultant/net force is equal to the change in the object's kinetic energy.
Die arbeid verrig op die voorwerp deur 'n resulterende/netto krag is gelyk aan die verandering in kinetiese energie van die voorwerp.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

5.4

OPTION 1
$W_{net} = \Delta E_k$
$W_{Fg} + W_f = ½mv_f^2 - ½mv_i^2$ } Any one ✓
$(2\times9,8)(0,6)\cos180°$ ✓ $+ W_f = ½(2)(2)^2 - ½(2)(4,95)^2$ ✓
$W_f = -8,74$ J ✓

(4)

OPTION 2
$W_{nc} = \Delta E_k + \Delta E_p$
$W_f = [½mv_f^2 - ½mv_i^2] + [mgh_f - mgh_i]$ } Any one ✓
$W_f = [½(2)(2)^2 - ½(2)(4,95)^2]$ ✓ $+ [(2)(9,8)(0,6) - 0]$ ✓
$W_f = -8,74$ J ✓

(4)

[22]

QUESTION 6 / VRAAG 6

6.1 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. ✓
Die verandering in frekwensie (of toonhoogte) van klank wat deur 'n luisteraar waargeneem word omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het.

OR
The change in frequency (or pitch) of the sound detected by a listener ✓as a result of the relative motion between the source and the observer.✓
Die verandering in frekwensie (of toonhoogte) van die klank waargeneem deur 'n luisteraar as gevolg van die relatiewe beweging tussen die bron en die waarnemer.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

6.2 **Marking criteria/*Nasienriglyne***

- Appropiate formula/Toepaslike formule ✓
- Ratio $f_L:f_s$ = 1,2 : 1 / *Verhouding $f_L:f_s$ = 1,2 : 1* ✓
- Substitution of fraction / *Invervanging van breuk* ✓
- Final answer / *Finale antwoord* ✓

$f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓ OR $f_L = \frac{v}{v - v_S} f_S$ ✓

✓

$(120) = \frac{340}{340 - v_s}$ ✓ (100)

$V_s = 56{,}67\ m \cdot s^{-1}$ ✓

(4)

6.3 Equal to/ *Gelyk aan*✓ (1)

[7]

QUESTION 7 / VRAAG 7

7.1 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 magnitudes of the charges ✓ and inversely proportional to the square of the distance (r) between them ✓

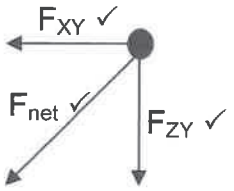
Die grootte van die elektrostatiese krag wat een puntlading (Q_1) op 'n ander puntlading (Q_2) uitoefen, is direk eweredig aan die produk van die groottes van die ladings ✓ en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle. ✓

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

- If masses used ($^0/_2$)

(2)

7.2



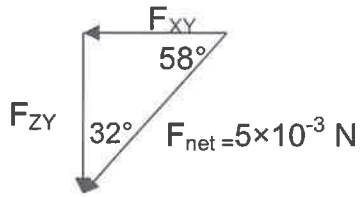
Accepted labels / Aanvaarde benoemings	
F_{XY}	Force of X on Y / F_X / *Krag van X op Y*
F_{ZY}	Force of Z on Y / F_Z / *Krag van Z op Y*

Notes/*Aantekeninge:*
- Mark is awarded for label and arrow./*Punt word toegeken vir byskrif en pyltjie.*
- Do not penalise for length of arrows./*Moenie vir die lengte van pyle penaliseer nie.*
- Deduct 1 mark if force(s) do not make contact with dot. / *Trek 1 punt af indien krag(te) nie met die kolletjie kontak maak nie.*
- If arrows missing/*Indien pylpunte uitgelaat word:* Max/*Maks* $^2/_3$

(3)

7.3 Negative / *Negatief* ✓ (1)

7.4.1 $F_X = F_{net}\sin 32°$ ✓
$= (5\times10^{-3})\sin 32°$ ✓
$= 2{,}65\times10^{-3}$ N ✓



OR/*OF*

$F_X = F_{net}\cos 58°$ ✓
$= (5\times10^{-3})\cos 58°$ ✓
$= 2{,}65\times10^{-3}$ N ✓

(3)

7.4.2 ***Marking criteria/Nasienriglyne:***

- Any appropriate formula ✓
- Correct substitution: both sides of equation for F_{XY} ✓
- F_{ZY} as $4,24\times10^{-3}$ ✓
- Final answer ✓

POSITIVE MARKING FROM QUESTION 7.4.1
POSITIEWE NASIEN VANAF VRAAG 7.4.1

$F_{XY} = \frac{kQ_1Q_2}{r^2}$

$2,65\times10^{-3} = \frac{(9\times10^9)(2\times10^{-9})(6\times10^{-9})}{r^2}$ ✓

Any correct formula✓

$r = 6,38\times10^{-3}$ m

$F_{ZY} = \frac{kQ_1Q_2}{r^2}$

$4,24\times10^{-3}$✓ $= \frac{(9\times10^9)(6\times10^{-9})Q_Z}{(3,19\times10^{-3})^2}$ ✓

$Q_Z = 7,99\times10^{-10}$ C ✓

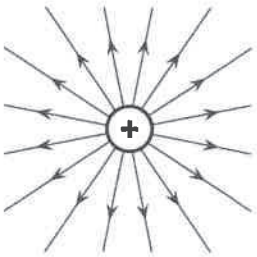
(5)
[14]

QUESTION 8 / VRAAG 8

8.1 **Marking criteria/Nasienriglyne:**
-1 mark for each of the 5 key words omitted in the correct context.
-1 punt vir elk van die 5 sleutelwoorde weggelaat in die korrekte konteks.

The electric field at a point is the (electrostatic) force experienced per unit positive charge placed at that point. ✓✓
Die elektriese veld by 'n punt is die (elektrostatiese) krag wat per positiewe eenheids-lading wat by daardie punt geplaas is, ondervind word. (2)

8.2



Shape / *Vorm*	✓
Direction / *Rigting*	✓

(2)

8.3 $n = \frac{q}{q_e}$ ✓

$q = (6\times10^6)(-1,6\times10^{-19})$ ✓

$= -9,6\times10^{-13}$ C✓ & charge indicated as negative✓ (4)

8.4 **POSITIVE MARKING FROM QUESTION 8.1**
POSITIEWE NASIEN VANAF VRAAG 8.1

$E_M = \frac{kQ}{r^2}$ ✓
$= \frac{(9\times10^9)(6\times10^{-12})}{(0,4)^2}$ ✓
$= 0,34\ N\cdot C^{-1}$ (to the right)

$E_N = \frac{kQ}{r^2}$
$= \frac{(9\times10^9)(9,6\times10^{-13})}{0,1^2}$ ✓
$= 0,86\ N\cdot C^{-1}$ (to the left)

$E_{net} = E_N - E_M$
$= 0,86 - 0,34$ ✓
$= 0,53\ N\cdot C^{-1}$ ✓ (5)

[13]

QUESTION 9 / VRAAG 9

9.1 Temperature (of the rheostat) / *Temperatuur (van die reostaat)* ✓ (1)

9.2 Negative/*Negatief* (1)

9.3 $\frac{r}{\varepsilon}$ ✓ (1)

9.4 $\frac{1}{\varepsilon}$ ✓ (1)

9.5.1 $\frac{1}{\varepsilon} = 1,3$ ✓
$\varepsilon = 0,77\ V$ ✓ (2)

9.5.2 **POSITIVE MARKING FROM QUESTION 9.5**
- **Note: Can use any applicable coordinates of a point on the line.**

OPTION 1

$\frac{r}{\varepsilon}$ = Gradient= $\frac{3,3-1,3}{1,5-0}$ ✓

$\frac{r}{0,77}$ ✓ $= \frac{2}{1,5}$

$r = 1,03\ \Omega$ ✓

OPTION 2

$\frac{1}{V} = \frac{r}{\varepsilon R} + \frac{1}{\varepsilon}$

$3,3 = \frac{r}{0,77}$ ✓ $(1,5)+1,3$ ✓

$r = 1,03\ \Omega$ ✓ (3)

[9]

QUESTION 10 / VRAAG 10

10.1 10 V ✓ (1)

10.2 0 (V) ✓ (1)

10.3.1

$$\frac{1}{R_p} = \frac{1}{r_1} + \frac{1}{r_2} \checkmark$$

$$= \frac{1}{10} + \frac{1}{5} \checkmark$$

$R_p = 3{,}33\ \Omega$ ✓ (3)

10.3.2

POSITIVE MARKING FROM QUESTION 10.3.1 ***POSITIEWE NASIEN VANAF VRAAG 10.3.1***	
OPTION 1	**OPTION 2**
$R = R_p + R_s$ $= 3{,}33 + 2$ ✓ $= 5{,}33\ \Omega$ $V = IR$ $8 = I\,(5{,}33)$ ✓ $I = 1{,}5$ A $V = IR$ ✓ $2 = 1{,}5(R)$ ✓ $R = 1{,}33\ \Omega$ ✓	$R_{ext} = R_p + R_s + R$ $= 3{,}33 + 2 + R$✓ $V=IR$✓ $10 = I(5{,}33+R)$ ✓ $I=\frac{10}{5{,}33+R}$ For resistor R: $V = IR$ $2=\frac{10}{5{,}33+R}(R)$ ✓ $R = 1{,}33\ \Omega$ ✓

(5)

10.4.1 Increases/*Toeneem* ✓ (1)

10.4.2 Decreases/*Afneem* ✓ (1)

[12]

TOTAL/*TOTAAL*: 150