

NATIONAL DEPARTMENT OF EDUCATION**PHYSICAL SCIENCE (SG) – PAPER 1/NATUUR- en SKEIKUNDE (SG) – VRAESTEL 1****QUESTION 1 / VRAAG 1**

| | | | | |
|--------|--------|--------|--------|--------|
| 1.1 C | 1.2 A | 1.3 D | 1.4 C | 1.5 B |
| 1.6 A | 1.7 D | 1.8 A | 1.9 C | 1.10 B |
| 1.11 A | 1.12 D | 1.13 B | 1.14 B | 1.15 A |

[15 x 3 = 45]**QUESTION 2 / VRAAG 2**

- 2.1 Force of pole / krag van paal ✓
 Force of stay wire / krag van ankerdraad ✓
 Tension in cable / 1200N / spanning in die kabel
 Tension in stay wire / spanning in ankerdraad
 Equilibrant used once only / ekwilibrant kan net een keer gebruik word.

Force of cable / krag van kabel ✓

pole/ stay wire/ cable
paal/ ankerdraad/ kabel --> okayF_{gravity} X (3)

✓✓

- 2.2.1 The pole is in equilibrium / paal is in ewewig / F_{res} = 0 N / $\sum F = 0$

2 or 0

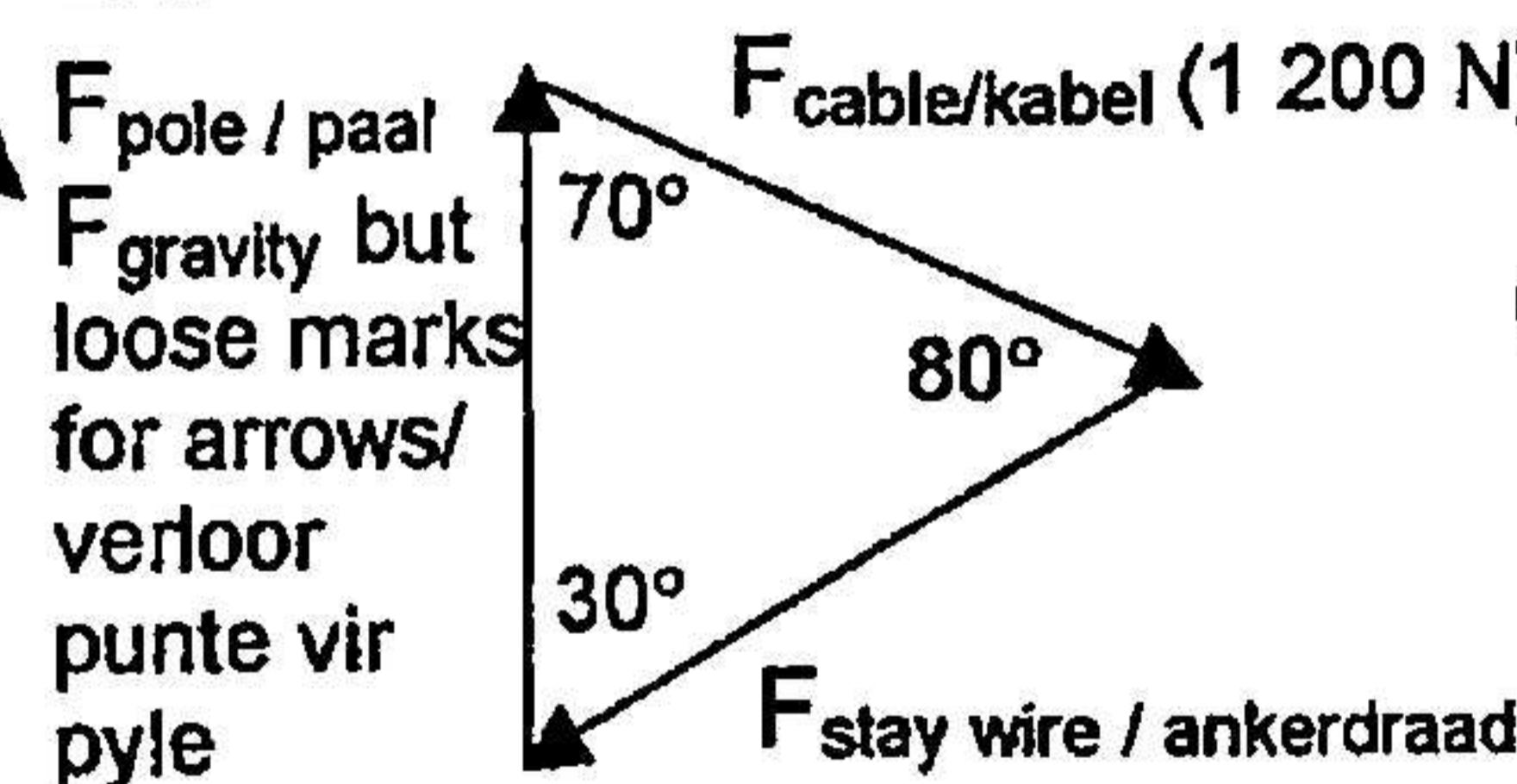
Forces are in equilibrium / kragte is in ewewig

Point P is at rest / punt P is in rus

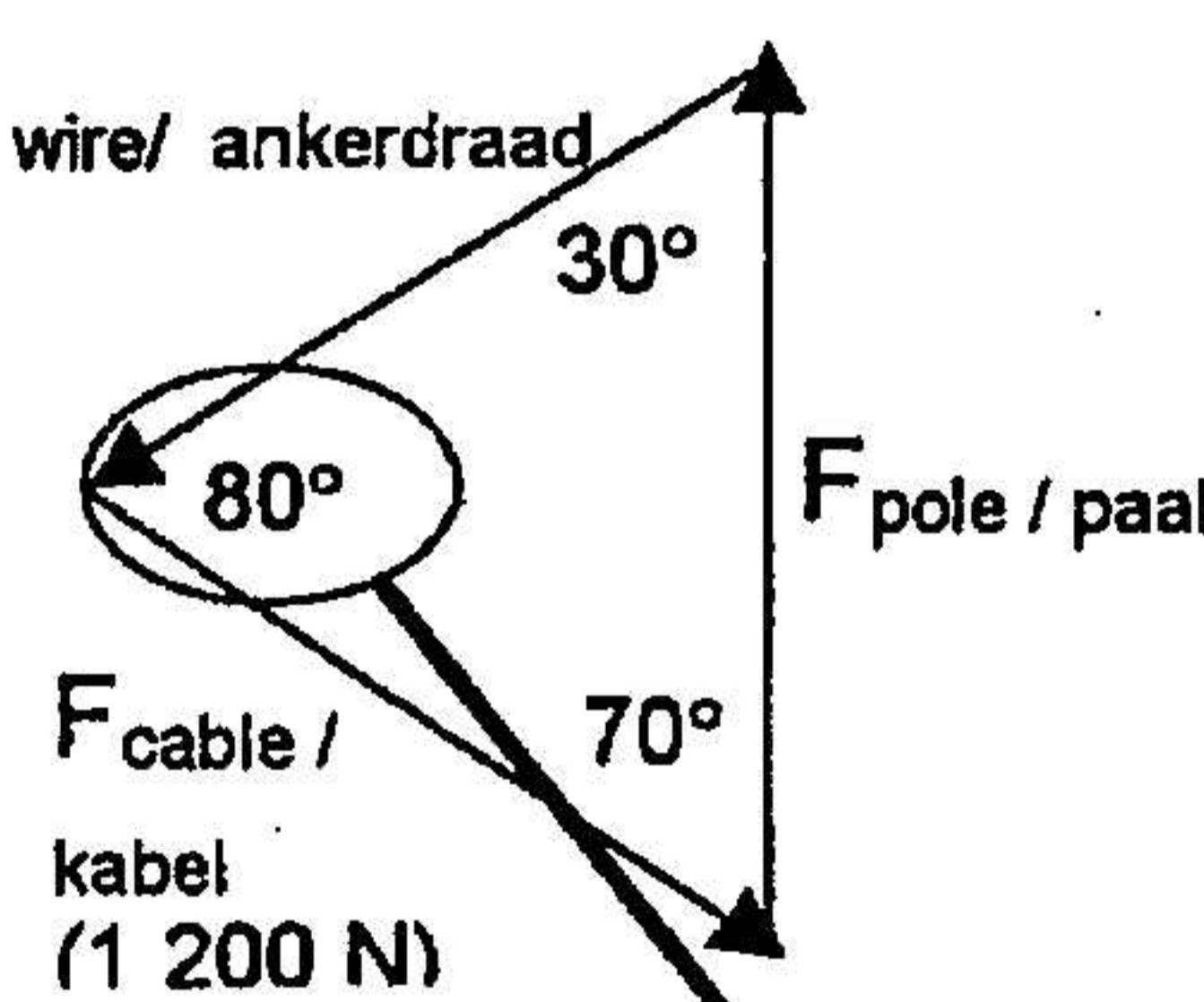
(2)

Forces are balanced/Kragte gebalanseerd : 0 marks

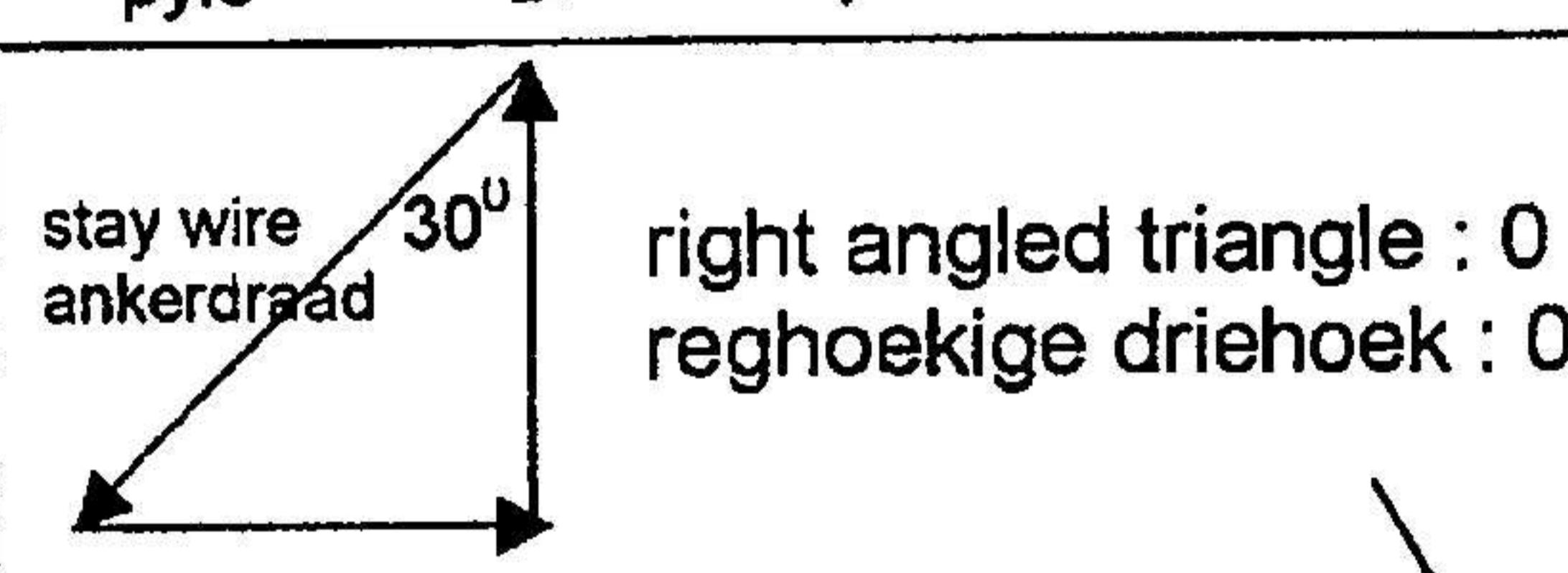
2.2.2



OR



- ✓ labels opposite appropriate angle byskrifte oorkant toepaslike hoeke
- ✓ arrows in correct order pyle in korrekte volgorde
- ✓ one angle indicated correctly een hoek korrek aangedui



(3)

2.3

By Calculation:

$$\frac{F_{\text{stay wire}}}{\sin 70^\circ} = \frac{1200}{\sin 30^\circ}$$

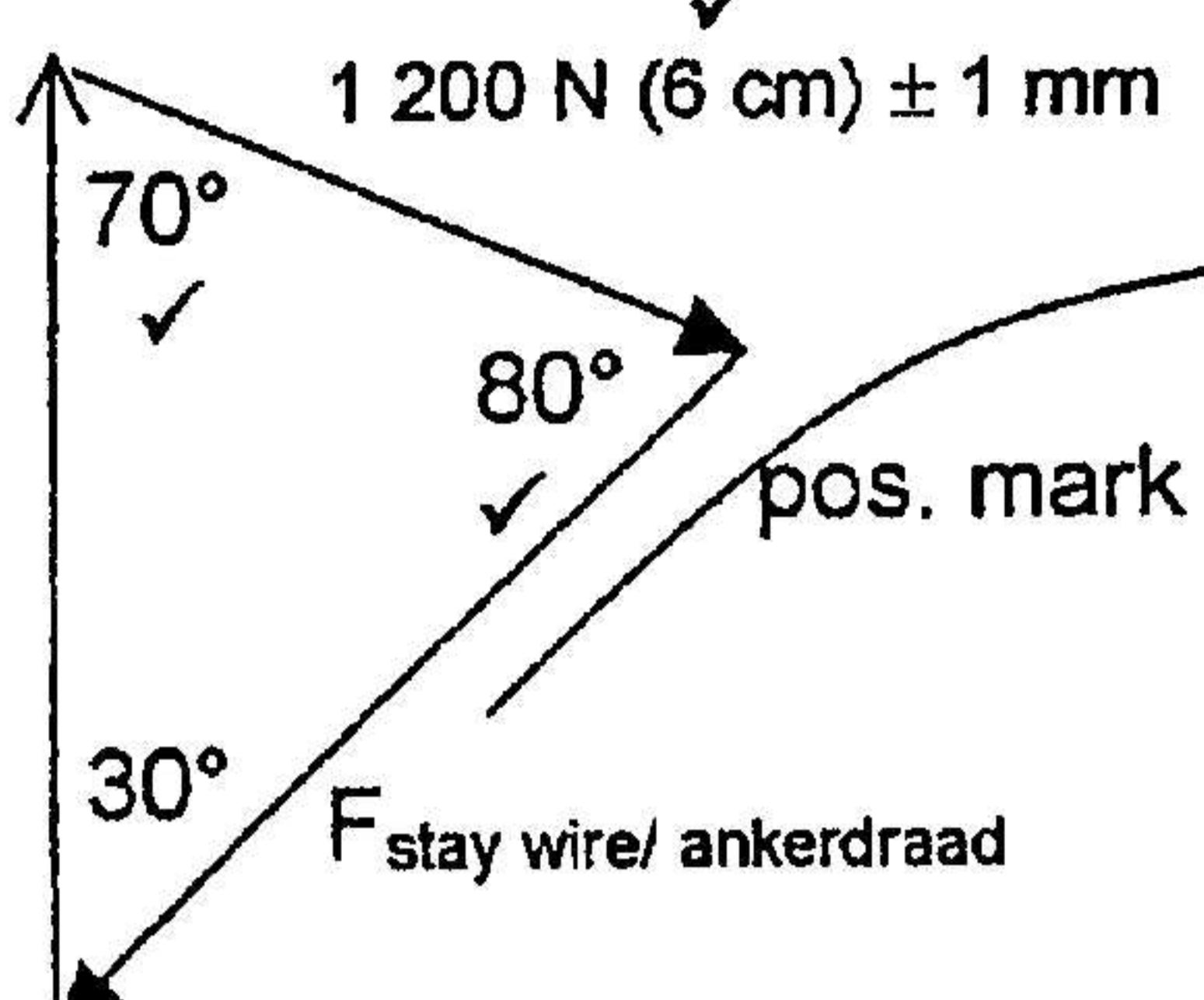
+ marking in 2.3

$$F_{\text{stay wire}} = \frac{1200 \cdot \sin 70^\circ}{\sin 30^\circ}$$

$$= 2255,26 \text{ N}$$

If 90° indicated then loose mark for angle

Indien 90° aangedui, verloor punt vir hoek

By construction / Met behulp van 'n konstruksie

$$= 113 \text{ mm} \times 200 (\pm 4 \text{ mm}) \\ = 2260 \text{ N } \checkmark (\pm 80 \text{ N})$$

1 mark for 6 cm ($\pm 1 \text{ mm}$) / 1 punt vir 6 cm
1 mark 70° ($\pm 1^\circ$) / 1 punt vir 70° ($\pm 1^\circ$)
1 mark 80° ($\pm 1^\circ$) / 1 punt vir 80° ($\pm 1^\circ$)
1 mark for converted answer
1 punt vir verwerkte antwoord

It is not necessary to indicate the arrows and angles in the final construction BUT markers should measure these to make sure that they are accurate – using a stencil or template solves this problem as the orientation may be different.

Dit is nie nodig om die pyle en die hoeke in die finale konstruksie aan te duif nie maar nasieners moet dit meet om van die akkuraatheid seker te maak – die gebruik van 'n "stencil" of templaat los die probleem op aangesien die orientasie mag verskil.

(4)

[12]

GENERAL COMMENT ABOUT DIRECTION (Q 3.2 ; 3.4)

If answer is incorrect, mark for direction is automatically lost.

Indien antwoord verkeerd is, word punt vir rigting outomaties verloor.

QUESTION 3 / VRAAG 3

3.1

$$\bar{v}_{0-5} = \frac{\Delta s}{\Delta t} = \frac{70}{5} \checkmark = 14 \text{ m.s}^{-1} \checkmark$$

$$\bar{v}_{0-5} = \frac{s}{t} = \frac{70}{5} \checkmark = 14 \text{ m.s}^{-1} \checkmark$$

$$\bar{v}_{0-5} = \frac{\Delta s}{\Delta t} = \frac{0 - 70}{5} = \frac{-70}{5} \checkmark = -14 \text{ m.s}^{-1} \checkmark$$

$$\bar{v}_{0-5} = \frac{\Delta s}{\Delta t} = \frac{-70}{-5} \checkmark = 14 \text{ m.s}^{-1} \checkmark \quad \left(\frac{2}{4} \right)$$

$$\bar{v}_{0-5} = \frac{70}{5} \checkmark = 14 \text{ m.s}^{-1} \checkmark$$

$$v = \frac{s}{t} \checkmark = 14 \text{ m.s}^{-1} \checkmark \quad \left(\frac{2}{4} \right)$$

$$v = 14 \text{ m.s}^{-1} \checkmark \quad \left(\frac{1}{4} \right)$$

(4)

to 3.2

3.2

$$\therefore a_{0-10} = \frac{\Delta v}{\Delta t} = \frac{10-14}{5} = -0,8 \text{ m.s}^{-2}$$

$$\text{or } a = \frac{v-u}{t}$$

$= 0,8 \text{ m.s}^{-2}$; opposite direction to motion
teenoorgestelde rigting van beweging

$$a = \frac{v}{t}$$

0marks

combinations for
 u & v & t
 14 & 10 & 5
 14 & 12 & 2,5
 12 & 10 & 2,5

IF / AS u & v swapped loose marks for subst. & answer & direction $\therefore 2 \text{ marks max.}$

$$s = \frac{u+v}{2} t = \frac{14+10}{2} \times 5 = 60 \text{ m}$$

$$v^2 = u^2 + 2as$$

$$10^2 = 14^2 + 2 \cdot a \cdot 60$$

$$a = -0,8 \text{ m.s}^{-2}$$

$= 0,8 \text{ m.s}^{-2}$ opposite to direction of motion

teenoorgestelde rigting van beweging

only if 60 m is calculated as shown
slegs as 60 m bereken is soos getoon
otherwise / anders
max / maks

4/6

$$0,8 \text{ m.s}^{-2}$$

(6)

3.3

$$s = ut + \frac{1}{2} at^2$$

$$70 = u \times 5 + \frac{1}{2} (-0,8) 5^2$$

$$u = 16 \text{ m.s}^{-1}$$

or any other set of s & t

$$v = u_x + at$$

$$14 = u_x + (-0,8)(2,5)$$

$$u_x = 16 \text{ m.s}^{-1}$$

$$v = u_x + at$$

$$10 = u_x + (-0,8)(7,5)$$

$$u_x = 16 \text{ m.s}^{-1}$$

combinations for

 v & t

14 & 2,5

12 & 5

10 & 7,5

8 & 10

+ marking

$$u = 12 \text{ m.s}^{-1}$$

3.4

$$v = u + at$$

$$0 = 16 + (-0,8)t$$

$$t = 20 \text{ s}$$

$$s = \left(\frac{u+v}{2} \right) t$$

$$= \frac{16+0}{2} 20$$

$$= 160 \text{ m, right}$$

$$s = ut + \frac{1}{2} at^2$$

$$= (16)(20) + \frac{1}{2} (-0,8)(20)^2$$

$$= 160 \text{ m right}$$

$$v^2 = u^2 + 2as$$

$$0 = 16^2 + 2(-0,8)s$$

$$s = 160 \text{ m right}$$

(5)

[20]

QUESTION 4 / VRAAG 4

4.1

An object which experiences a resultant force will accelerate in the direction of the (resultant) force. The acceleration is directly proportional to the (resultant) force and is inversely proportional to the mass of the object.

'n Voorwerp waarop 'n resulterende krag inwerk sal versnel in die rigting van die (resulterende) krag. Die versnelling is direk eweredig aan die (resulterende) krag en omgekeerd eweredig aan die massa van die voorwerp.

The resultant force acting on an object is directly proportional to (equal to) the rate of change of momentum and the rate of change of momentum is in the direction of the resultant force.

'n Resulterende krag wat op 'n voorwerp inwerk is direk eweredig (gelyk aan) die tempo van verandering in die momentum en die tempo van verandering in momentum is in die rigting van die resulterende krag.

(3)

4.2.1

$$F_{\text{res on car/ res op motor}} = 1160 - 600 = 560 \text{ N}$$

in the direction of the truck / towards T or forward or to right
in die rigting van die insleepvoertuig / na T of na regs
NOT : east / oost

mark direction independantly of magnitude
net rigting --> gee punte

3
—
3

(3)

4.2.2

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

$$560 = 1400 \times a$$

$$a = 0,4 \text{ m.s}^{-2}$$

(4)

4.3 450 N to the back / na agter / backwards / terugwaarts / left / links

(2)

NOT: West

4.4 Inertia / Traagheid ✓✓

(2)

[14]

QUESTION 5 / VRAAG 5

5.1

In an isolated system, the total linear momentum remains constant (conserved) in magnitude and direction or

The total momentum before collision is equal to the total momentum after collision if there are no external forces acting.

Die totale liniére momentum in 'n geisoleerde sisteem bly behoue in grootte en rigting of

Die totale momentum voor 'n botsing is gelyk aan die totale momentum na die botsing indien daar geen eksterne kragte daarop inwerk nie.

(3)

5.2 Forwards / voorwaarts ✓✓

NOT : right

(2)

5.3

$$\left. \begin{array}{l} p_{\text{before}} = p_{\text{after}} \\ (m_1 + m_2)u = m_1v_1 + m_2v_2 \end{array} \right\} \checkmark$$

$$\left(140 + 5 \right) \times 2 = (140 \times 1,5) + 5 \times v$$

$$v = 16 \text{ m.s}^{-1}$$

$$\left. \begin{array}{l} p_{\text{before}} = p_{\text{after}} \\ m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \end{array} \right\} \checkmark$$

$$(140 \cdot 2) + (5 \cdot 2) = (140 \times 1,5) + (5 \times v)$$

$$v = 16 \text{ m.s}^{-1}$$

$$\left. \begin{array}{l} p_{\text{before}} = p_{\text{after}} \\ (m_1 + m_2)u = m_1v_1 + m_2v_2 \end{array} \right\} \checkmark$$

$$140 \times 2 = (135 \times 1,5) + 5 \times v$$

$$v = 15,5 \text{ m.s}^{-1}$$

4 marks

(6)

[11]

QUESTION 6 / VRAAG 6

If Δ missing: -1
Indien Δ makeer: -1

6.1

$$\begin{aligned} W = \Delta E_k &= \frac{1}{2}m(v^2 - u^2) \\ &= \frac{1}{2}(800)(12^2 - 30^2) \\ &= -302400 \text{ J} \end{aligned}$$

$$\begin{aligned} W = \Delta E_k &= \frac{1}{2}m(u^2 - v^2) \\ &= \frac{1}{2}(800)(30^2 - 12^2) \\ &= 302400 \text{ J} \end{aligned}$$

$$\begin{aligned} (E_k)_{\text{initial}} &= \frac{1}{2}mu^2 \\ &= \frac{1}{2}(800)(30^2) \\ &= 360000 \text{ J} \\ (E_k)_{\text{final}} &= \frac{1}{2}(800)(12^2) \\ &= 57600 \text{ J} \\ \therefore W = \Delta E_k &= 360000 - 57600 \\ &= 302400 \text{ J} \end{aligned}$$

$$\begin{aligned} W &= Fx_s \\ &= m\left(\frac{v-u}{t}\right)x\left(\frac{u+v}{2}\right)t \\ &= m \cdot \frac{1}{2} \cdot (v-u)(v+u) \\ &= \frac{1}{2}m(v^2 - u^2) \\ &= \frac{1}{2}(800)(12^2 - 30^2) \\ &= -302400 \text{ J} \end{aligned}$$

$$\begin{aligned} v^2 &= u^2 + 2as \\ 12^2 &= 30^2 - 2as \\ a &= \frac{12^2 - 30^2}{2s} \\ \therefore W &= Fx_s \\ &= mas \\ &= (800)\left(\frac{12^2 - 30^2}{2s}\right)s \\ &= 302400 \text{ J} \end{aligned}$$

$$\begin{aligned} W &= Fx_s \\ &= mas \\ &= ma\left(\frac{v^2 - u^2}{2a}\right) \\ &= (800)\left(\frac{12^2 - 30^2}{2}\right) \\ &= 302400 \text{ J} \end{aligned}$$

Cannot use $F = 2016 \text{ N}$ from 6.2 to calculate 6.1

Kan nie $F = 2016 \text{ N}$ van 6.2 gebruik om 6.1 te bereken nie.

(4)

6.2

$$\begin{aligned} W &= Fx_s \\ 302400 &= 2016 \times s \\ s &= 150 \text{ m} \end{aligned}$$

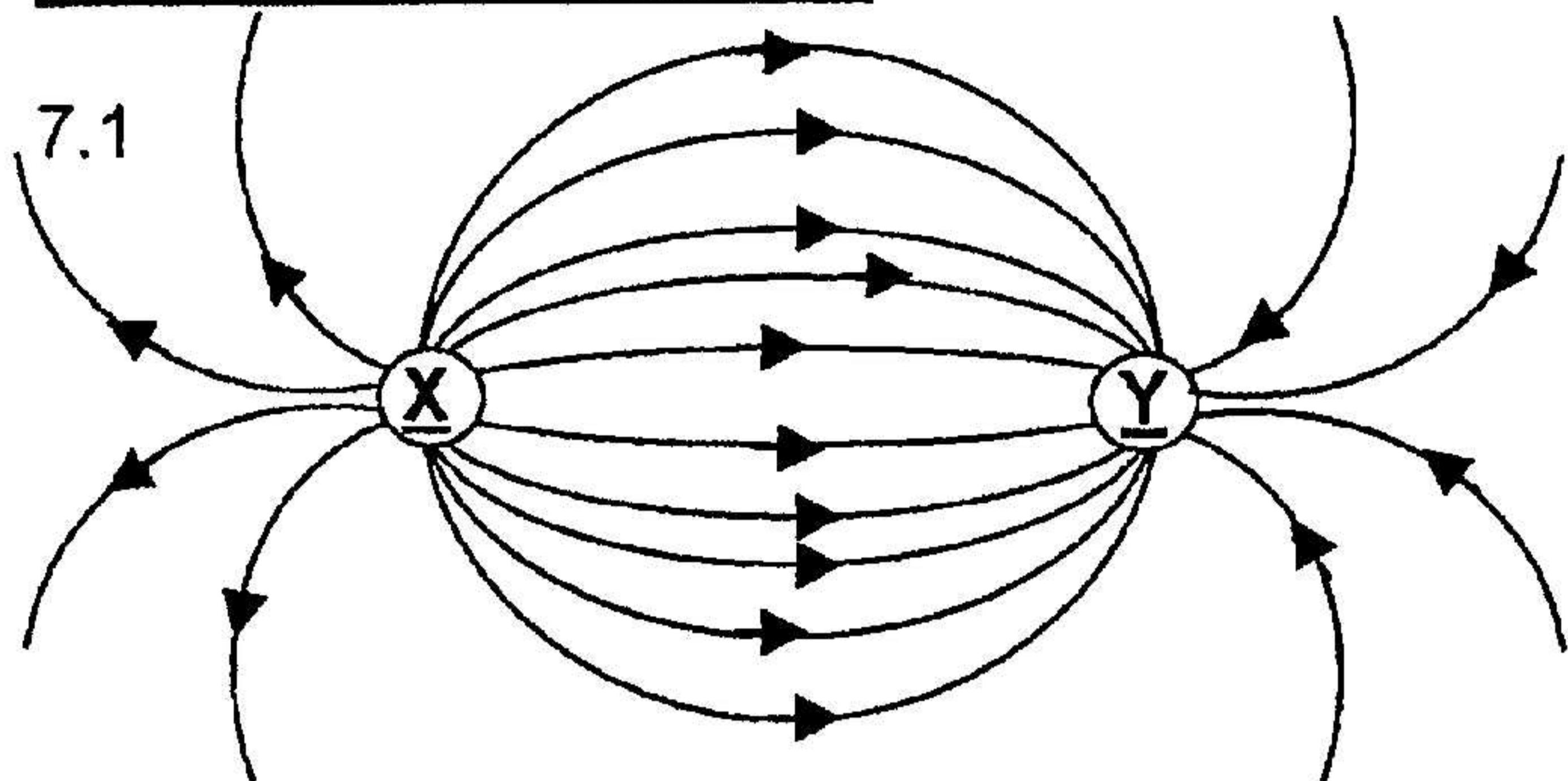
$$\begin{aligned} a &= \frac{F}{m} = \frac{-2016}{800} = -2,52 \text{ m.s}^{-2} \\ v^2 &= u^2 + 2.a.s \\ 12^2 &= 30^2 + 2(-2,52)(s) \\ s &= 150 \text{ m} \end{aligned}$$

(4)

[8]

QUESTION 7 / VRAAG 7

7.1



- ✓ direction in between charge
 - ✓ shape in between and touching
 - ✓ direction outside charge
 - ✓ shape outside and touching
- If not touching: -1 max.
- ✓ rigting tussen die ladings
 - ✓ vorm tussen die ladings en moet ladings raak
 - ✓ rigting buite die ladings
 - ✓ vorm buite die ladings en moet raak
- Indien nie raak: -1 maks

(4)

7.2

The (electrostatic) force of attraction or repulsion which one (point) charge exerts on another (point) charge is directly proportional to the product of their charges and is inversely proportional to the square of the distance between them/ their centres /the charges.

Die (elektrostasiese) krag van aantrekking of afstoting wat een (punt)lading op 'n ander (punt)lading uitoefen, is direk eweredig aan die produk van hulle ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle/ hulle middelpunte / die ladings

(4)

If charged objects/particles used – **between their centres must be mentioned**
As gelaaide liggame/deeltjies gebruik word – tussen hulle middelpunte moet genoem word.

7.3

$$\begin{aligned}
 F &= \frac{kQ_1Q_2}{r^2} \quad \checkmark \\
 &= \frac{(9 \times 10^9) (5 \times 10^{-9}) (8 \times 10^{-9})}{(0,02)^2} \quad \checkmark \\
 &= 9 \times 10^{-4} \text{ N}
 \end{aligned}$$

neg. sign of charge is substituted: acceptable

Neg. teken van lading ingestel: aanvaarbaar

Incorrect conversion (r) mark answer positively
Verkeerde omskakeling(r) sien antw. positief na : $\frac{4}{5}$

Square of r in formula but no square in subst. and wrong answer.
Kwadraat van r in formula maar nie in subst. nie en verkeerde antw. : $\frac{3}{5}$

wrong formula
verkeerde formule : 0

Conversion correct but the square is omitted in subst. however answer correct.

Omskakeling korrek, kwadraat weggelaat in subst. maar antwoord korrek.

$\frac{4}{5}$

(5)

7.4

$$\text{new charge / nuwe lading} = \frac{(-8 + 5) \times 10^{-9}}{2} \\ = -1.5 \times 10^{-9} \text{ C } (-1.5 \text{ nC})$$

Answer only
2 marks
Slegs antwoord
2 punte

If candidate explains that the spheres are not identical and therefore the new charge cannot be calculated.

Indien kandidate verduidelik dat die sfere nie identies is nie en die nuwe lading dus nie bereken kan word nie.

$\frac{3}{3}$

"New charge cannot be calculated" without a reason

"Nuwe lading kan nie bereken word nie" sonder 'n rede

0 marks

(3)

[16]

QUESTION 8 / VRAAG 8

8.1

The potential difference between any two points in a conductor is directly proportional to the current passing through the points provided its temperature (physical properties) remains constant. (If V an I swapped accept)

Die potensiaalverskill tussen enige twee punte in 'n geleier is direk eweredig aan die stroom tussen die twee punte mits die temperatuur (fisiiese eienskappe) konstant bly. (as V en I omgeruil aanvaar)

The ratio of potential difference to current is a constant provided the temperature (physical properties) remains constant.

Die verhouding tussen potensiaalverskill en stroom bly konstant mits die temperatuur (fisiiese eienskappe) konstant bly.

(3)

8.2

$$R = \frac{V_1}{I} \checkmark$$

$$\checkmark$$

$$12 = \frac{V_1}{1,5} \checkmark$$

$$V_1 = 18V \checkmark$$

If only answer / as slegs antwoord : 18 V

$$\frac{1}{4}$$

(4)

8.3

$$V_2 = 24 - 18 = 6V \checkmark$$

$$R = \frac{V_2}{I} = \frac{6}{1,5} \checkmark = 4\Omega \checkmark$$

$$R_T = \frac{V}{I} = \frac{24}{1,5} \checkmark = 16\Omega$$

$$R = 16 - 12 \neq 4\Omega \checkmark$$

(4)

8.4

$$\frac{1}{R_p} = \frac{1}{12} + \frac{1}{24} = \frac{1}{8}$$

$$R_p = 8\Omega \checkmark$$

OR

$$R_p = \frac{\text{product}}{\text{sum}} \checkmark$$

$$= \frac{12 \times 24}{12 + 24} \checkmark = 8\Omega \checkmark$$

$$R_p = 8\Omega \checkmark$$

1 mark

$$R_p = \frac{1}{12} + \frac{1}{24}$$

$$R_p = 8\Omega \checkmark$$

0 marks

(4)

8.5

$$I = \frac{V}{R} = \frac{24}{8+4} \checkmark = 2A \checkmark$$

(4)

8.6

$$W_{4\Omega} = I^2 R t \checkmark$$

$$= 2^2 \times 4 \cdot (120) \checkmark$$

$$= 1920J \checkmark$$

$$V = IR = 2 \times 4 = 8V$$

$$W = VIt \checkmark$$

$$= 8 \times 2 \cdot (120) \checkmark$$

$$= 1920 J \checkmark$$

$$W = \frac{V^2 t}{R} \checkmark$$

$$= \frac{8^2 \cdot (120)}{4} \checkmark$$

$$= 1920J \checkmark$$

(5)

[24]

GRAND TOTAL [150] GROOT TOTAAL