Ideale Gasse Memo
November 2018/1

1.4 B ✓✓ (2)

1.5 C ✓✓ (2)

QUESTION 4/*VRAAG 4*

4.1 Boyle's law/*Boyle se wet* ✓ (1)

4.2

Criteria for hypothesis/*Riglyne vir hipotese*	
The dependent and independent variables are stated correctly. *Die afhanklike en onafhanklike veranderlikes korrek genoem.*	✓
State the relationship between the dependent and independent variables. *Stel die verwantskap tussen die afhanklike en onafhanklike veranderlike.*	✓
Dependent variable/*afhanklike veranderlike*: volume Independent variable/*onafhanklike veranderlike*: pressure/*druk*	

Example:/*Voorbeeld*:

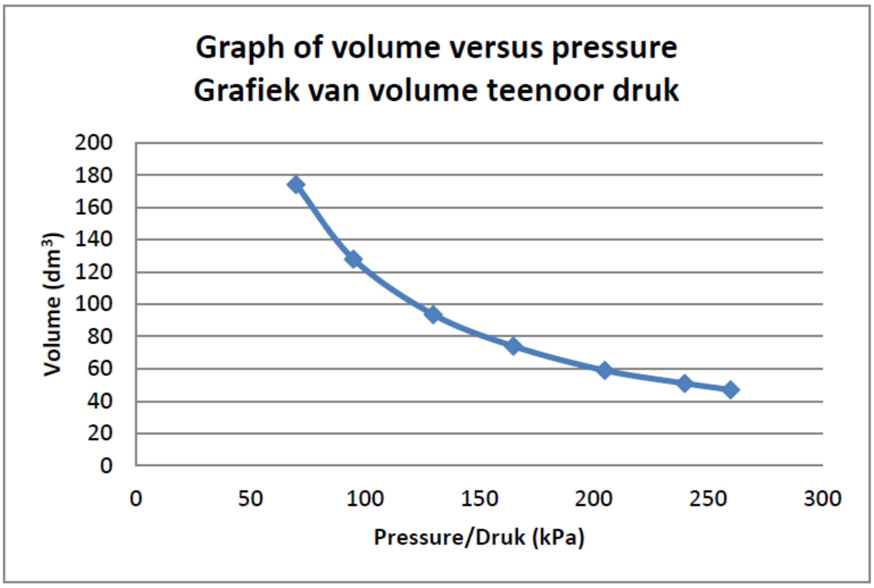
If the pressure of and enclosed gas increases the volume will decreases at constant temperature.

The pressure of an enclosed gas is inversely proportional to the volume it occupies if the temperature is kept constant.

Die druk van 'n ingeslote gas is omgekeerd eweredig aan die volume wat dit beslaan indien die temperatuur konstant gehou word.

Indien die druk van 'n ingeslote gas toeneem, sal die volume afneem. (2)

4.3



Refer to the last page of the memo for the graph drawn to scale

Verwys na die laaste bladsy van die memo vir die skaalgrafiek

Criteria for marking the graph/*Nasienkriteria vir grafiek*	
Use of correct scale on both axis (If learners used table values as scale values maximum $^1/_3$ for line drawn) *Korrekte skaal op die asse* *(Indien leerders tabelwaardes as skaalwaardes gebruik maksimum $^1/_3$ vir lyn getrek)*	✓
At least five (5) points plotted correctly *Ten minste vyf (5) punte korrek gestip*	✓
Curve is drawn *Kurwe getrek*	✓

(3)

Ideale Gasse Memo

November 2018/2

4.4 Any set of values can be used from the table :
Enige stel waardes vanaf die tabel kan gebruik word:

$p_1V_1 = p_2V_2$ ✓

$\underline{70(174) = (300)V_2}$ ✓

$V_2 = 40,6\ dm^3$ ✓

(Accept/*Aanvaar* 40,32 – 40,8 dm^3) (3)

4.5 At high pressure a gas starts to deviate from ideal gas behaviour ✓ because the volume of the molecules of a gas and the intermolecular forces start to influence the measured value, causing it to be greater than the theoretical value calculated/Forces of repulsion between the gas particles prevents them from moving closer ✓
By hoë druk sal 'n gas begin afwyk van ideale gasgedrag want die volume van die gasdeeltjies en intermolekulêre kragte begin die waarde van die volume beïnvloed, wat veroorsaak dat die gemete waarde groter is as die berekende waarde/Afstotingskragte veroorsaak dat gasdeeltjies nie nader aan mekaar kan beweeg nie (2)

4.6 Low/*Laag*✓ (1)

4.7 Temperature is an indication of the average kinetic energy of the molecules of a gas. If the temperature of a gas decreases, the molecules <u>move slower and closer together</u> ✓up to a point where the gas will start to <u>condense</u> ✓ and not behave like an ideal gas.
OR
The intermolecular forces of attraction becomes significant ✓ then the gas condenses. ✓
Temperatuur is die aanduiding van die gemiddelde kinetiese energie van die molekules van 'n gas. Indien die temperatuur afneem sal die molekules <u>stadiger en nader aan mekaar</u> beweeg tot by die punt waar die gas sal begin <u>kondenseer</u> sodat dit nie meer soos 'n ideale gas optree nie.
OF
Die intermolekulêre kragte word beduidend en dit veroorsaak dat die gas kondenseer. (2)

4.8 $pV = nRT$ ✓

$(70\ 000)(174 \times 10^{-3})$ ✓ $= n(8,31)(293)$ ✓

$n = 5$ moles ✓ (4)

[18]

Ideale Gasse Memo
November 2018/3

QUESTION 5/*VRAAG 5*

5.1

$$n = \frac{m}{M}$$

$$n = \frac{160}{40} \checkmark$$

n = 4 mole

$$pV = nRT \checkmark$$

$$(120\ 000)V = (4)(8{,}31)(288) \checkmark$$

$$V = 0{,}08\ m^3 \checkmark$$ (4)

5.2 **POSITIVE MARKING FROM QUESTION 5.1**
POSITIEWE NASIEN VANAF VRAAG 5.1
OPTION 1/*OPSIE 1*

$$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2} \checkmark$$

$$\frac{120(0{,}08)}{288} \checkmark = \frac{240V_2}{308} \checkmark$$

$V_2 = 0{,}043\ m^3$ ✓ (427,78 dm^3)

OPTION 2/*OPSIE 2*

$$pV = nRT \checkmark$$

$$(240\ 000)V \checkmark = (4)(8{,}31)(308) \checkmark$$

$V = 0{,}043\ m^3$ ✓ (426,58 dm^3) (4)

[8]

Ideale Gasse Memo
November 2017/1

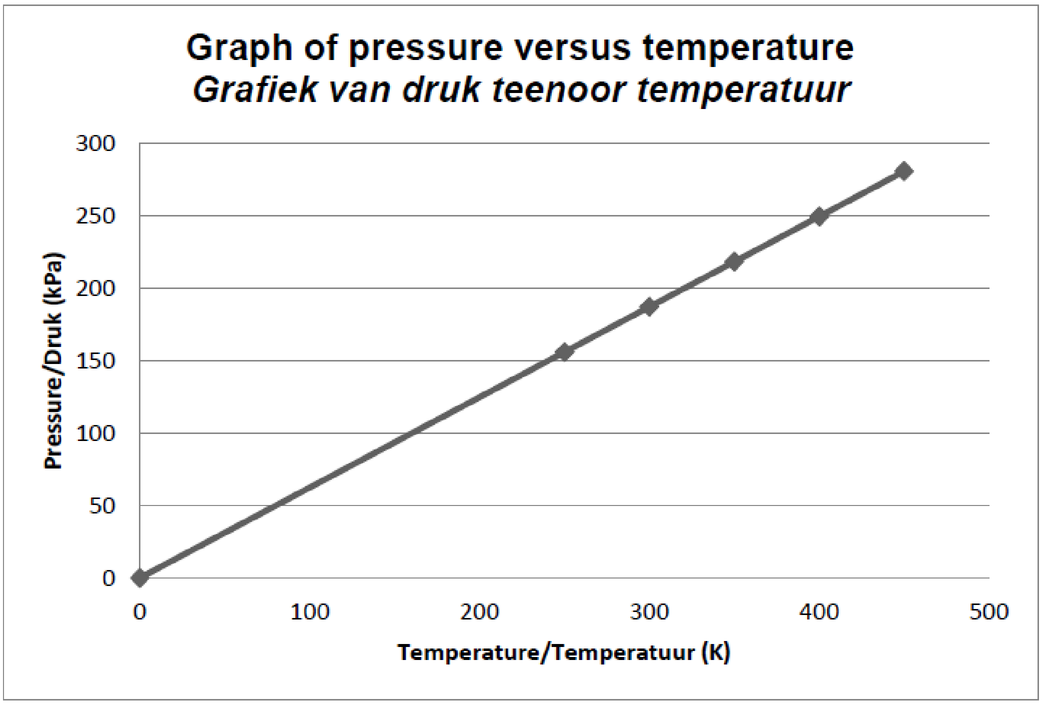
1.4 A ✓✓ (2)

1.5 C ✓✓ (2)

1.6 D ✓✓ (2)

QUESTION/*VRAAG 4*

4.1



Refer to the last page of the marking guidelines for the graph drawn to scale.
Verwys na die laaste bladsy van die nasienriglyne vir die skaalgrafiek.

Criteria for marking the graph	
Use of correct scale on both axis *Korrekte skaal op die asse*	✓
At least three (3) points plotted correctly *Ten minste drie (3) punte korrek gestip*	✓
Line of best fit drawn *Beste passing lyn getrek*	✓
Graph drawn to the origin *Grafiek getrek deur die oorsprong*	✓

(4)

4.2 Pressure of an enclosed gas is directly proportional to the (absolute) temperature ✓ if the volume stays constant. ✓
OR p α T ✓ when V is constant ✓
OR As the pressure of an enclosed gas increases, the temperature increases proportionately ✓ if the volume stays constant✓

Druk van 'n ingeslote gas is direk eweredig aan die temperatuur ✓ indien die volume konstant bly. ✓
***OF** p α T ✓ indien V konstant is ✓*
***OF** Indien die druk van 'n ingeslote gas verhoog, sal die temperatuur eweredig verhoog ✓ indien die volume konstant bly✓* (2)

Ideale Gasse Memo
November 2017/2

4.3 At very low temperature values, the gas will liquify, (not acting like a gas anymore) ✓✓
OR
At low temperature the particles come close together/intermolecular forces become significant ✓ therefor the gas liquify ✓
Teen baie lae tempertuurwaardes sal die gas vervloei en nie soos 'n gas optree nie. ✓✓
OF
Teen baie lae temperature sal die deeltjies baie nader aan mekaar wees/die intermolekulêre kragte word beduidend ✓ en die gas sal vervloei. ✓ (2)

4.4
- If the temperature increases, the average kinetic energy of the particles increases. ✓
- The particles move faster. ✓
- The number of collisions between the particles increase (and force per unit area). ✓
- If the number of collisions increases, the pressure increases. ✓

- *Indien die temperatuur verhoog, neem die gemiddelde kinetiese energie van die deeltjies toe*
- *Die deeltjies beweeg vinniger.*
- *Die aantal botsings tussen die deeltjies neem toe (en die krag per eenheid oppervlak neem toe)*
- *Indien die aantal botsings toeneem sal die druk toeneem.* (4)

4.5 High temperature ✓/*Hoë temperatuur*
Low pressure ✓/*Lae druk* (2)

4.6 Accept any combination of coordinates from the graph for example:
Aanvaar enige kombinasie van koördinate vanaf die grafiek byvoorbeeld:

$$\text{Gradient} = \frac{280{,}5 - 155{,}8 \ ✓}{450 - 250 \ ✓} = 0{,}62 \ ✓$$

OR/OF

$$\text{Gradient} = \frac{280{,}5 - 0 \ ✓}{450 - 0 \ ✓} = 0{,}62 \ ✓$$

OR/OF

$$\text{Gradient} = \frac{249{,}3 - 0 \ ✓}{400 - 0 \ ✓} = 0{,}62 \ ✓$$

OR/OF

$$\text{Gradient} = \frac{218{,}1 - 0 \ ✓}{350 - 0 \ ✓} = 0{,}62 \ ✓$$

(3)

Ideale Gasse Memo
November 2017/3

4.7 **POSITIVE MARKING FROM 4.6/*POSITIEWE NASIEN VANAF 4.6***

$n = \frac{m}{M}$

$n = \frac{48}{32}$ ✓

n = 1,5 mole/*mol* ✓

From/*Vanaf* pV = nRT

Gradient = $\frac{nR}{V}$ ✓

(**NOTE:** Pressure is in kPa on graph – to use equation it should be in Pa)
(***LET WEL:*** *Druk vanaf die grafiek is in kPa en moet eers omgeskakel word na Pa om die formule te gebruik)*

$620 = \frac{1,5(8,31)}{V}$ ✓

V = 0, 02 m^3 ✓
(20,1 dm^3) (5)

[22]

QUESTION/*VRAAG 5*

5.1 $\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$ ✓

$\frac{105\ 000(12,6)}{298}$ ✓ $= \frac{27\ 640(36,3)}{T_2}$ ✓

T_2 = 226 K
T_2 = - 47 °C ✓ (4)

5.2 pV = nRT ✓
(105 000)(12,6) ✓= n(8,31)(298) ✓
n = 534,25 mole/*mol* ✓ (4)

[8]

Ideale Gasse Memo
November 2016

1.5 D ✓✓

1.6 D ✓✓

QUESTION/*VRAAG* 4

4.1.1 Temperature ✓/*Temperatuur* (1)

4.1.2 (a) 60✓✓ (2)

(b) Volume is directly proportional ✓ to Temperature✓/ V α T
Volume is direk eweredig aan Temperatuur/ V α T OR/OF
As temperature increases volume increases proportionally
Soos die temperatuur toeneem sal die volume eweredig toeneem.

Notes/Aantekeninge:
• BOTH independent and dependent variables correctly indicated. ✓ *BEIDE onafhanklike en afhanklike veranderlikes korrek aangedui.* • Relationship between variables correctly identified.✓ *Verwantskap tussen veranderlikes korrek geidentifiseer.*

(2)

4.1.3 Pressure ✓/mass✓(number of mole)
Druk/massa (aantal mol) (2)

4.1.4 Thermometer✓/*thermometer* (1)

4.1.5 Kinetic energy of particles decrease, ✓ therefore strength of intermolecular forces increase ✓ hence pressure decrease. ✓
Kinetiese energie van deeltjies neem af, daarom neem die sterkte van intermolekulêre kragte toe en dus neem druk af. (3)

4.2 PV = nRT✓
(0,002)✓(150 000)✓ = n (8,31)(300)✓
n = 0,12 mol

n = m/M
0,12 = 2,04/M✓
M = 17 g.mol^{-1}✓ (Accept/*Aanvaar* 16,96 g.mol^{-1}) (6)

4.3 HIGHER/HOËR✓

For/*Vir* A: $p = \frac{1}{M}(\frac{mRT}{V})$

$p \; \alpha \; \frac{1}{M}$ ✓

But/*Maar* $p = 2p_B$

$2\,M_A = M_A$ ✓ (3)

[20]

Ideale Gasse
November 2015

1.3 C √√

1.4 C √√

1.5 A √√

QUESTION 5 / *VRAAG 5*

5.1 5.1.1 A √ (1)

5.1.2

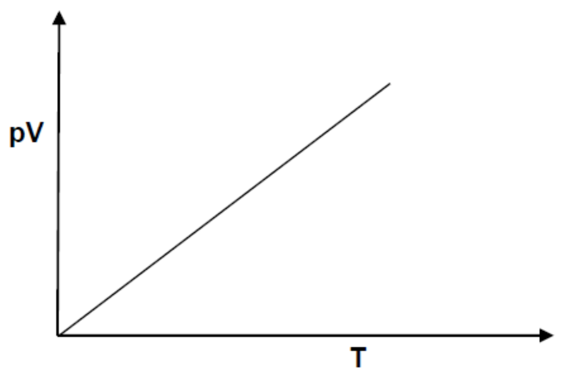
- consider/beskou: $D = \frac{m}{V} = \frac{nM}{V}$ √
- If molar mass (M) and volume (V) is the same √ –- then D ∝ n √
  As die molêre massa (M) en volume (V) dieselfde is – dan is D α n
- Gas A has more particles than gas B √ / *Gas A het meer deeltjies as gas B.*
- More collisions with sides of container A √ ∴ Exert greater pressure in A.
  Meer botsings met die kante van houer A ∴ 'n Groter druk word in A uitgeoefen. (5)

5.2 $n = \frac{m}{M} = \frac{10.5}{20}$ √ = 0,525 mol √

pV = nRT √ ∴ $p = \frac{nRT}{V} = \frac{(0,525)(8,31)(78+273)}{0,00677}$ √√ = 226 192,799 Pa √
= 226,19 kPa

Yes, it will take the strain. √ / *Ja, dit sal die spanning kan weerstaan.* (7)

5.3.1



√√ shape/vorm (2)

5.3.2 GREATER THAN / *GROTER AS* √ (1)

5.3.3 Particles of a real gas have volume √√ / there are repulsive forces between particles of a real gas
Ware gasdeeltjies het volume / daar is afstotende kragte tussen die deeltjies van 'n ware gas. (2)

[18]

Ideale Gasse
November 2014/1

1.8 C ✓✓ (2)

1.10 B ✓✓ (2)

QUESTION 5/*VRAAG 5*

5.1 Temperature of a gas is a measure of the average kinetic energy of the gas molecules. ✓
Temperatuur van 'n gas is 'n maatstaf van die gemiddelde kinetiese energie van die gasmolekule. (1)

5.2
5.2.1 The pressure (of a fixed mass of gas) is directly proportional to the temperature ✓ at constant volume. ✓
Die druk (van 'n vaste massa gas) is direk eweredig aan die temperatuur by konstante volume. (2)

5.2.2

$$\frac{p_1}{T_1} = \frac{p_2}{T_2} \checkmark$$

$$\frac{100}{298 \checkmark} = \frac{150}{X} \checkmark$$

$$X = 447 \text{ K}$$

$$= 174 \text{ °C} \checkmark$$

Marking guidelines/*Nasienriglyne*:
- Formula/*Formule* ✓
- Substitution of/*Substitusie van* 298 K ✓
- Substitution of/*Substitusie van* 100 kPa and/*en* 150 kPa ✓
- Final answer/*Finale antwoord*: 174 °C ✓

(4)

5.2.3 Gradient/*Gradiënt* = $\frac{p}{T}$ ✓

From/*Uit* pV = nRT: $\frac{p}{T} = nRT$ ✓

For constant V/*Vir konstante V*, $\frac{p}{T} \alpha\, n$ ✓

For graph Q:
Smaller gradient implies smaller number of moles and thus smaller mass of gas. ✓
Vir grafiek Q:
Kleiner gradiënt impliseer kleiner aantal mol en dus kleiner massa gas. (4)

Ideale Gasse

November 2014/2

5.3

5.3.1 **Marking criteria/*Nasienriglyne:***

- Formula/*Formule*: pV = nRT ✓
- Substitution of pressure in Pa/*Substitusie van druk in Pa* ✓
- Substitution of volume in m^3/*Substitusie van volume in* m^3 ✓
- Substitution of/*Substitusie van* $\frac{2,2}{M}$ in pV = nRT **OR/*OF*** n = $\frac{2,2}{M}$ ✓
- Substitution of 300 K and 8,31/*Substitusie van 300 K en 8,31* ✓
- Final answer/*Finale antwoord*: 44 $g \cdot mol^{-1}$ ✓

OPTION 1/*OPSIE 1*

pV = nRT ✓

(150×10^3) ✓ $(0,831 \times 10^{-3})$ ✓ $= \frac{2,2}{M}$ ✓ $(8,31)(300)$ ✓

$\therefore M = 44\ g \cdot mol^{-1}$ ✓

OPTION 2/*OPSIE 2*

pV = nRT ✓

$\therefore n = \frac{pV}{RT} = \frac{(150 \times 10^3)(0,831 \times 10^{-3})}{(8,31)(300)}$ ✓✓✓

= 0,05 mol

$n = \frac{m}{M}$ $\therefore 0,05 = \frac{2,2}{M}$ ✓

$\therefore M = 44\ g \cdot mol^{-1}$ ✓

Notes/*Aantekeninge:*

- If R = 8,3 was used, no mark is given for the substitution, but the mark for the answer can still be given.
  Indien R = 8,3 gebruik word, word geen punt vir substitusie gegee nie, maar die punt vir die antwoord kan steeds gegee word. (6)

5.3.2 **POSITIVE MARKING FROM QUESTION 5.3.1.**
POSITIEWE NASIEN VAN VRAAG 5.3.1.

CO_2 /Carbon dioxide/*Koolstofdioksied* ✓
OR/*OF* (1)
C_3H_8 /Propane/*Propaan* **[18]**

Ideale Gasse
November 2013/1

VRAAG 6

6.1 6.1.1 Wat is die verband tussen druk en volume? ✓✓ (2)

6.1.2 Volume is direk/omgekeerd eweredig ✓ aan druk. ✓ (2)

1 punt vir beide veranderlikes korrek/1 punt vir verhouding

6.1.3 Temperatuur ✓ en hoeveelheid gas ✓ (2)

6.1.4 $P_1 = 100$ kPa ; $\frac{1}{V_1} = x$ dm^{-3}

$P_2 = 120$ kPa ; $\frac{1}{V_2} = 3{,}5$ dm^{-3} $\therefore V_2 = \frac{1}{3{,}5} = 0{,}29\ dm^3$

$$P_1V_1 = P_2V_2\ ✓$$

$$100\ ✓ \times V_1 = 120\ ✓ \times 0{,}29\ ✓$$

$$\therefore V_1 = 0{,}35\ \text{dm}^3\ ✓$$

$$x = \frac{1}{V_1} = \frac{1}{0{,}35} = 2{,}86\ \text{dm}^{-3}\ ✓$$

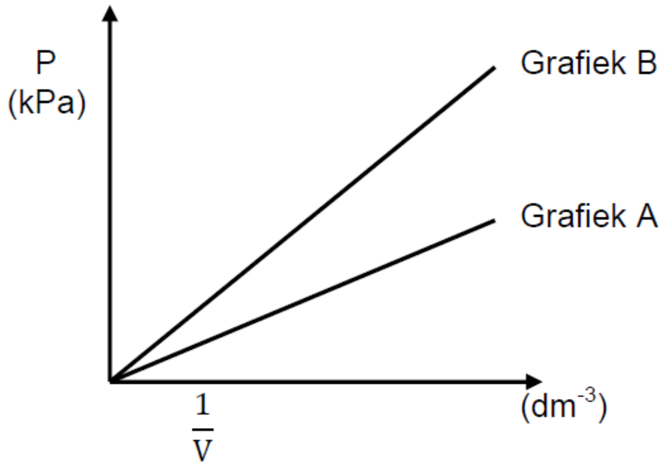
(6)

6.1.5 Boyle se wet ✓
Die volume van 'n vaste hoeveelheid gas is omgekeerd eweredig aan die druk op die gas as die temperatuur konstant bly. ✓ (2)

6.1.6 $P \propto \frac{1}{V}$ ✓ (1)

Ideale Gasse
November 2013/2

6.1.7



Riglyne vir nasien van grafiek	
Beide asse korrek benoem	✓
Steiler helling vir grafiek B	✓

(2)

6.2 Die gaspartikels in die band het kinetiese energie en bots met die binnewande van die band. Hierdie botsings is verantwoordelik vir die druk binne in die band. ✓ Wanneer die motor beweeg, veroorsaak die wrywing tussen die band en die pad dat die temperatuur van die band styg. ✓ Die hitte van die band word oorgedra aan die gaspartikels met elke botsing van die partikels teen die band. ✓ Aangesien temperatuur (van 'n gas) direk eweredig is aan die kinetiese energie van die gaspartikels, ✓ lei dit tot die gaspartikels wat meer energie by kry en dus meer gereeld en met groter krag teen die wande van die band bots. ✓ Die druk binne die band sal verhoog. ✓ Die resultaat is dat die band kan bars. ✓ (7)

[24]

VRAAG 7

7.1

$pV = nRT$ ✓

$(101,5 \times 10^3)$ ✓ $\times (70 \times 10^{-3})$ ✓ $= n \times 8,31$ ✓ $\times (273 + 23)$ ✓

$\therefore n = 2,89$ mol ✓

$n = \frac{m}{M} \Rightarrow 2,89 = \frac{m}{28}$ ✓

$\therefore m = 80,92$ g ✓ (8)

7.2 Minder (energie) ✓

- ΔH is minder as nul ✓ (2)

7.3 'n Botsing van die kant af/'n Botsing met 'n ander motor wat ook teen 'n hoë snelheid beweeg/'n Situasie waar die motor rol. ✓✓ (2)

[12]