Education and Sports Development

Department of Education and Sports Development
Department van Onderwys en Sport Ontwikkeling
Lefapha la Thuto le Tlhabololo ya Metshameko
NORTH WEST PROVINCE

NATIONAL SENIOR CERTIFICATE

GRADE/GRAAD 11

PHYSICAL SCIENCES: MARKING MEMORANDUM
FISIESE WETENSKAP: MEMORANDUM

JUNE /JUNIE 2019

QUESTION/VRAAG 1

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

QUESTION/VRAAG 2

2.1 The vector sum of two or more vectors
OR The single vector that has the same effect as two or more vectors together. ✓✓
Die vektorsom van twee of meer vektore
OF *die enkele vektor wat dieselfde effek het as twee of meer vektore tesame.* (2)

2.2.1 **OPTION/*OPSIE 1***
P: F_x = 130 cos 60°✓ = 65 N ✓
Q: F_x = 91,92 cos 45°✓= 65 N ✓ (4)

OPTION/*OPSIE 2*
P: F_x = 130 sin 30° = 65 N
Q: F_x = 91,92 sin 45° = 65 N

2.2.2 **OPTION/*OPSIE 1***
P: F_y = 130 sin 60°✓ = 112,58 N ✓
Q: F_y = 91,92 sin 45° ✓= 65 N ✓ (4)

OPTION/*OPSIE 2*
P: F_y = 130 cos 30° = 112,58 N
Q: F_y = 91,92 cos45° = 65 N

2.2.3 **POSITIVE MARKING FROM/*POSITIEWE NASIEN VANAF 2.2.1***
Rx = 65 + (-65) = 0 N ✓ (1)

2.2.4 **POSITIVE MARKING FROM/*POSITIEWE NASIEN VANAF 2.2.2***
Ry = 112,58 + 65 = 177,58 N ✓ (1)

2.2.5 **POSITIVE MARKING FROM/*POSITIEWE NASIEN VANAF 2.2.4***

R = 177,58 N ✓ or $F_{res}^2 = F_x^2 + F_y^2$ (1)

$= 0^2 + (177,58)^2$

$F = \sqrt{31534,6564}$

$= 177,58N$ ✓

2.3 **POSITIVE MARKING FROM/*POSITIEWE NASIEN VANAF 2.2.5***

$F_g / w = mg$ ✓

$177,58 = m(9,8)$ ✓

$m = 18,12$ kg ✓ (3)

[16]

QUESTION/VRAAG 3

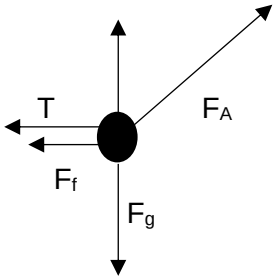
3.1 If a net(resultant) force acts on an object, the object will accelerate in the direction of the net force. ✓The acceleration is directly proportional to the net force and inversely proportional to the mass of the object. ✓

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

3.2 **Note/*Aantekening*:**

One mark is allocated for each force represented by an arrow pointing in the correct direction and correctly labelled.

Een punt word toegeken vir elke krag voorgestel as pyl in die regte rigting en korrek benoem.



F_N = F_N/N/normal force/*normaalkrag* ✓
T = T/F_T/tension/*spanning* ✓
F_A = F/Applied force/50 N/*Toegepaste krag* ✓
F_g = w/weight/*gewig*/mg/98 N ✓
F_f = f/frictional force/*wrywingskrag* ✓

Subtract 1 mark for any of the following/*Trek een punt af vir enige van die volgende*:

- Arrows do not touch the point./ *Pyle raak nie aan die punt nie.*
- Label is incorrect./ Krag is verkeerd benoem.
- Arrows are missing./ Geen pylpunte nie.
- Forces is omitted or added./ *Kragte is uitgelaat of bygevoeg*. (5)

3.3.1 **Upward positive/*Opwaarts positief:***

$F_N + F_y + w = 0$

$F_N + F_y - w = 0$ ✓

$F_N + 50 \sin 30° ✓ – (10)(9,8) ✓ = 0$

$F_N = 73 N$ ✓

OR/OF $F_N = F_g – F_y$ ✓

$= mg – F\sin\theta$

$= (10x9,8)✓ – (50 \sin 30^\circ)$ ✓

$= 73N✓$ (4)

3.3.2 **To the right as positive/*Na regs as positief:***

For 10 kg crate/Vir 10 kg-krat:

$Fnet = ma$ }

$FH + f + T = ma$ } ✓

$50 \cos 30° - 20 - T ✓ = 10a$ ✓

$23,3 - T = 10a$ ……(1)

For 5 kg crate/Vir 5 kg-krat:

$Fnet = ma$

$T + f = ma$

$T – (0,2 \times 5 \times 9,8) ✓ = 5a$ ✓

$T – 9,8 = 5a$ ……..(2)

Add (1) and (2)/*Tel (1) en (2) op:*

$13,5 = 15a$ ✓

$a = 0,9 m·s^{-2}$ ✓

IF/*INDIEN:*

$F_{net} = ma$ ✓

$43,30 – 20 – 9,8 =✓ 10a ✓ + 5a$ ✓

$a = 0,9 m·s^{-2}$ ✓ Max./Maks. 7

OR/OF To the right as positive/*Na regs as positief:*

For 5 kg crate/*Vir 5 kg-krat:*

$F_{net} = ma$

$T- F_g = 5a$

$T-9,8 ✓ = 5a$ ✓

$T = 5a +9,8$ ……(1)

$f_k = \mu F_N$

$= 0,2 (5x9,8)$

$= 9,8 N$

For 10 kg crate/*Vir 10 kg-krat:*

$Fnet = ma$ }

$F_x – T - f_k = 10a$ }✓

$F \cos\theta – T - 20 = 10a$

$50 \cos 30^\circ - T - 20✓ = 10a$✓

$43,30 – T - 20 = 10a$

$-T = 10a -23,30$

$T = 23,30 -10a$ …….(2)

But /Maar (1) = (2)

$5a +98 = 23,30 -10a$

$15a = 13,5$ ✓

$a = 0,9 m·s^{-2}$ ✓

(7)

3.3.3 **Substitute a = 0,9 m·s^{-2} in equation 1 or 2:**
Vervang* a = 0,9 m·s^{-2} *in vergelyking 1 of 2:

$23,30 - T = 10(0,9)$ ✓
$T = 14,3$ N ✓

OR/*OF* $T - 9,8 = 5(0,9)$
$T = 14,3$ N (2)

3.4 Increases/*Vermeerder* ✓
If the angle decreases, the vertical component (F_y) decreases. ✓
For the same w, ✓F_N increases.
As die hoek kleiner word, word die komponent (F_y) kleiner.
Vir dieselfde w, word F_N groter. (3)

3.5 When a car comes to a sudden stop the child will continue moving at its initial velocity✓ according to Newton's first law /inertia law✓and be flung against the windscreen or even out of the car. ✓
Wanneer 'n motor tot 'n skielike stilstand kom sal die kind steeds beweeg teen sy oorspronklike snelheid volgens Newton se eerste wet /traagheidswet en sal die kind bots met die voorruit of selfs uit die motor geslinger word. (3)
[26]

QUESTION/VRAAG 4

4.1 Every particle in the universe exerts a force of gravitational attraction on every other particle. The force between the two particles is directly proportional to the product of their masses ✓and inversely proportional to the square of the distance between their centres. ✓
Elke voorwerp in die heelal trek elke ander voorwerp aan met 'n krag wat direk eweredig is aan die produk van die massas van die voorwerpe en omqekeerd eweredig is aan die kwadraat van die afstand tussen die twee voorwerpe. (2)

4.2 **OPTION/*OPSIE 1***

$F_{AC} = \frac{Gm_Am_C}{r^2}$ ✓ $F_{BC} = \frac{Gm_Bm_C}{r^2}$

$35 = \frac{G3m_c}{r^2}$ ✓ $F_{BC} = \frac{G8m_c}{(2r)^2}$ ✓

$m_c = \frac{35\,r^2}{G3}$ $m_c = \frac{F_{BC}(2\,r)^2}{G8}$

$\frac{35\,r^2}{G3} = \frac{F_{BC}\,4\,r^2}{G8}$ ✓ ✓

$F_{BC} = \frac{(35)r^2(G)(8)}{(G)(3)(4)r^2}$

$F_{BC} = 23,33$ N attraction ✓ / *aantrekkingskrag*

OPTION/*OPSIE 2*

$F_{AC} = G\frac{m_1 m_2}{r^2}$ ✓

$35 = G\frac{3m}{r^2}$ ✓

$G3m = 35r^2$

$G = \frac{35r^2}{3m}$ .....①

$F_{BC} = G\frac{m_1 m_2}{r^2}$

$x = G\frac{8m}{r^2}$ ✓

$G8m = xr^2$

$G = \frac{xr^2}{8m}$ .....②

① = ②

$\frac{(35)1^2}{3m} = \frac{x(2)^2}{8m}$ ✓ ✓

$12mx = 280m$

$x = 23{,}33$

✓

F = 23,33 N attraction / *aantrekkingskrag*

OPTION/*OPSIE 3*
Using ratios/*gebruik verhoudings*
F = $\frac{Gm_1m_2}{r_2}$ ✓
= $\frac{(8✓/3✓)}{4✓}$
F = 0,667 x 35✓
= 23,33 N attraction/ aantrekkingskrag✓

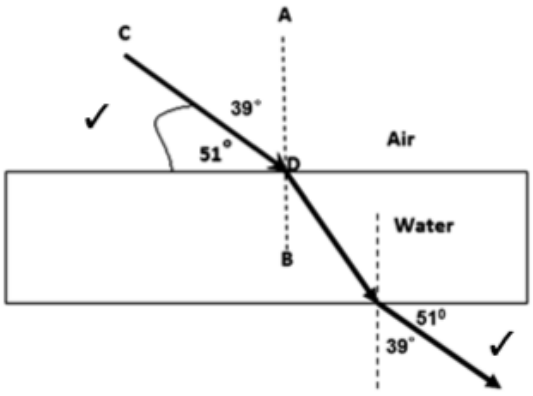
(6)
[8]

QUESTION/VRAAG 5

5.1.1 Normal line/ *Normaal lyn* ✓ (1)

5.1.2 $n_i \sin\theta i = n_r \sin\theta_r$ ✓
1 x sin 39°✓ = 1,33 ✓ sin θ_r
θ_r = 28,24 ° ✓ (4)

5.1.3



✓ ✓

Angles must be correct/
Hoeke moet korrek wees.
- 1 for any extra vectors
- *1 vir enige ekstra vektore*
(max / *maks* ½)

(2)

5.1.4 DECREASES/*VERLAAG*. ✓✓ (2)

5.1.5 The patricles of the water are much closer together ✓ and thus it will slow down the light ray✓or the refractive index of water(1,33) is higher than the refractive index of air✓ and thus it will slow down the light ray . (1)
D*ie deeltjies van die water is baie meer kompak en sal dus die ligstraal se spoed verlaag of water se biekingsindeks(1,33) is hoër as die van lug en sal dus die ligstraal se spoed verlaag.*

OR/*OF*
Light moves from an optically less dense to optically more dense medium thus it slow down the light ray*.*
Lig beweeg van 'n opties minder digte na 'n opties meer digte medium en dus verlaag die ligstraal se spoed. (2)

5.2.1 Total internal reflection ✓ will only occur if the outer medium is of lesser density. ✓/ *Totale interne weerkaatsing sal slegs voorkom indien die buitenste medium van 'n minder digte medium gemaak is.* (2)

5.2.2 Endoscope, telecommunications, binoculars (any one)/ *Endoskope, telekommunikasie, verkykers (enige een)* ✓ (1)

5.2.3
$$n = \frac{v}{c} \quad \checkmark$$
$$v = \frac{3 \times 10^8}{1.44} \quad \checkmark$$
$$= 2.08 \times 10^8 \text{ m·s}^{-1} \quad \checkmark$$ (3)

[17]

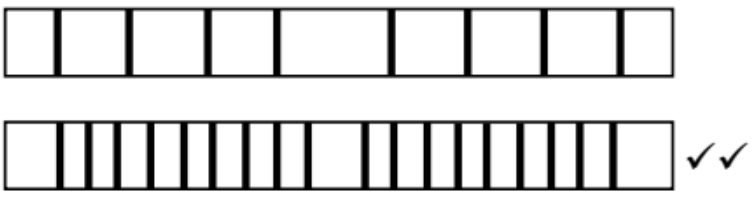
QUESTION/VRAAG 6

6.1 Diffraction/*Diffraksie* ✓ (1)

6.2 X ✓ (1)

6.3 Light/*Ligte areas* - constructive interference/*konstruktiewe interferensie* ✓
Dark/*Donker areas* - destructive interference/*destruktiewe interferensie* ✓ (2)

6.4.1



✓✓ (2)

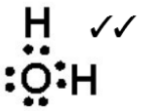
Marking criteria:/*Nasienriglyne:*
- Central light line narrower than with red light. ✓
  Sentrale helder lyn smaller as met rooi lig.
- Light lines to sides also narrower than with red light. ✓
  Helder lyne na die kante ook smaller as vir rooi lig.

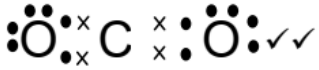
6.4.2 Blue light has a smaller wavelength ✓and thus will experience less diffraction. ✓
Blou lig het 'n kleiner golflengte en ondergaan dus minder diffraksie.

OR/OF
Red light has a longer wavelength than blue light and therefore the amount of diffraction through the same slit (constant width) is more for red light than blue light with the shorter wavelength
Rooi lig het 'n langer golflengte as blou lig en dus is die hoeveelheid diffraksie deur dieselfde spleet (konstante wydte) meer vir rooi lig as vir blou lig met die korter golflengte. *(2)*
[8]

QUESTION/VRAAG 7

7.1 In a covalent bond, electrons of different atoms (non-metals) ✓ with half-filled orbitals are shared, and a molecule is formed ✓
In 'n kovalente binding, word elektrone van verskillende atome (nie-metale) met half gevulde orbitale gedeel en 'n molekule word gevorm. (2)

7.2.1  ✓✓ (2)

7.2.2  ✓✓ (2)

7.3.1 Hydrogen bonds / Waterstofbinding ✓ (1)

7.3.2 Induced dipole-dipole forces/London forces ✓
Geïnduseerde dipool-dipoolkragte/Londonkragte (1)

7.4.1 Angular/*Hoekig* ✓ (1)

7.4.2 Linear/*Lineêr* ✓ (1)

7.5.1 The distance ✓ between the nuclei of atoms. ✓
Die afstand tussen die kerne van atome. (2)

7.5.2 Bond energy is inversely propotional to bond length/ *Bindingsenergie is omgekeerd eweredig aan die bindingslengte.* ✓✓

OR/*OF*
Bond energy **increases/decreases** as the bond length **decreases/increases**.
Bindingsenergie ***verhoog/verminder*** *soos die bindingslengte* ***verminder/ verhoog.***

OR/*OF*
Shorter/higher bond length, **higher/shorter** bond energy.
Korter/langer *bindinglengte,* ***hoër/laer*** *bindingsenergie.* (2)

7.5.3 Due to the double bond, atoms in bond **4** are closer together. ✓
Die atome in binding **4** *is nader aan mekaar as gevolg van die dubbelbinding tussen die atome.*
OR/OF
The shorter the bond, the stronger the bond and will require more energy to break than a longer bond.
Hoe korter die binding, hoe sterker is die binding en sal meer energie benodig om die binding te breek as vir 'n langer binding (1)
[15]

QUESTION / VRAAG 8

8.1 Between the molecules of both I_2 and Br_2 are London forces/dispersion forces/ induced dipole forces. ✓
The molecular mass of I_2 is more than the molecular mass of Br_2 thus the intermolecular forces of I_2 are stronger than those of Br_2. ✓
More energy is needed to overcome/break the intermolecular forces of I_2 than those of Br_2. ✓
Tussen die molekule van beide I_2 en Br_2 word Londonkragte/dispersiekragte/ geïnduseerde dipoolkragte aangetref.
Die molekulêre massa van I_2 is groter as dié van Br_2. Die intermolekulêre kragte van I_2 is sterker as dié van Br_2.
Meer energie is nodig om die intermolekulêre kragte van I_2 te oorkom / te breek as die van Br_2. (3)

8.2 Yes /*Ja* ✓ (1)

8.3 In addition to London forces/dispersion forces/induced dipole forces H_2O and etanol has hydrogen bonds between the molecules. ✓✓
The intermolecular forces are therefore of comparable strength. ✓

H_2O en etanol het beide London kragte/dispersie kragte/geïnduseerde dipool kragte sowel as waterstofbindings tussen die molekules.
Die intermolekulêre kragte is van dieselfde/vergelykbare soort/sterkte. (3)

8.4.1 The pressure exerted by a vapour at equilibrium with its liquid ✓
in a closed system. ✓
Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem. (2)

8.4.2 The boiling point is inversely proportional to the vapour pressure./intermolecular strength ✓✓
Die kookpunt is omgekeerd eweredig aan die dampdruk of intermolekulêre sterkte.

OR/*OF*
The lower the boiling point the higher the vapour pressure.
Hoe laer die kookpunt, hoe hoër is die dampdruk. (2)
[11]

QUESTION / VRAAG 9

9.1 Boyle's Law:✓ The volume of an enclosed gas is inversely proportional to the pressure, provided that the temperature remains constant. ✓✓

Boyle se wet. Die volume van 'n ingeslote gas is omgekeerd eweredig aan die druk daarop uitgeoefen, as die temperatuur konstant gehou word. (3)

9.2.1 Pressure/Druk ✓ (1)

9.2.2 Volume/*Volume* ✓ (1)

9.3 Temperature/*Temperatuur*
Amount of gass/*Hoeveelheid gas*
mass of gas/*massa gas* ✓ (any one/*enige een*) (1)

9.4 Question with only yes/no answers, **no marks**
*Vraag geantwoord met slegs ja/nee**, geen punte***

Criteria for marking: The relationship between the dependent and independent variables must be mentioned in a question form.

Die verband tussen die afhanklike en onafhanklike veranderdelikes moet in die vraag genoem word.

E.g. How will the volume of a fixed amount of gas change if the pressure is increased while the temperature remains constant? ✓✓

***Bv**. Hoe sal die volume van 'n konstante hoeveelheid gas beïnvloed word as die druk verhoog word terwyl die temperatuur konstant gehou word?* (2)

9.5 **Column 3**/ ***Kolom 3***

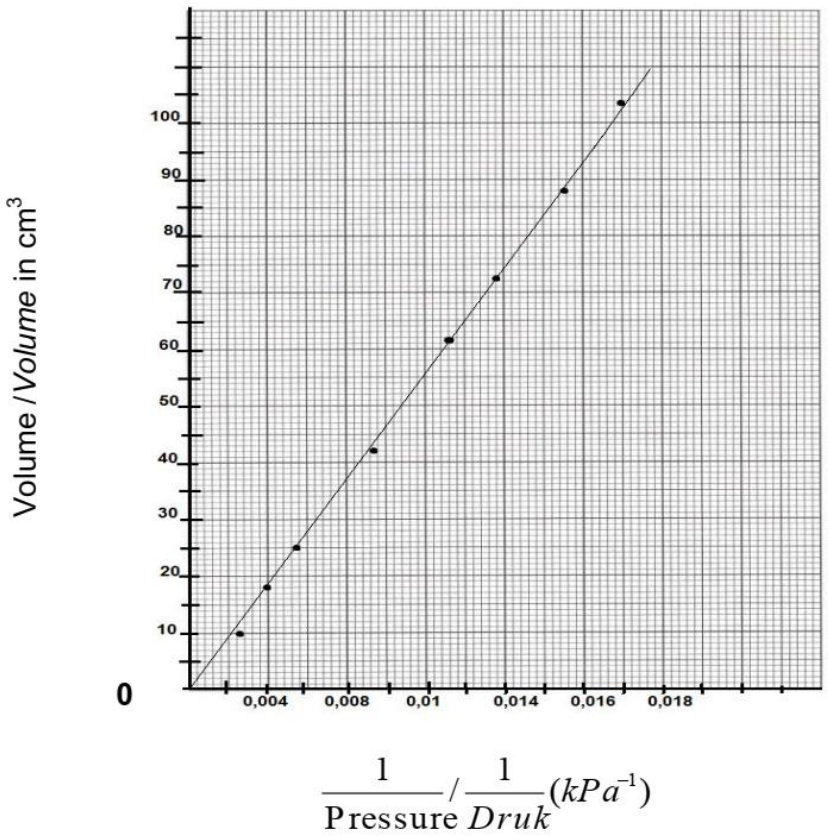
1/pressure of 1/druk(kpa $^{-1}$)
1.6 x 10 $^{-2}$
1.4 x 10 $^{-2}$
1.3 x 10 $^{-2}$
1.1 x 10 $^{-2}$
0.9 x 10 $^{-2}$
0.6 x 10 $^{-2}$
0.4 x 10 $^{-2}$
0.3 x 10 $^{-2}$.

OR/OF

Pressure (kPa)	Volume (cm^3)	$\frac{1}{\text{Pressure}}$ (kPa^{-1})
62	103	0,016
70	88	0,014
80	73	0,0125
90	62	0,011
110	42	$9,09x10^{-3}$ / 0,00909
180	25	$5,56x10^{-3}$/ 0,00556
250	18	$4x10^{-3}$ / 0,004
360	10	$2,78x10^{-3}$ / 0,00278

✓

Volume vs Pressure / *Volume teenoor Druk*



Marking criteria:

Correctly labelled x- and y-axes with correct units✓
At least 5 points plotted correctly✓
Best fit line through origin ✓

Kriteria vir merk:

Korrekte x- en y-as benoeming met korrekte eenhede✓
Ten minste 5 punte korrek op grafiek ✓
Beste lyn getrek deur oorsprong ✓

OR/OF

The scale on the x–axis could be for eg 0,4 etc with x 10^{-2}
Die skaal op die X-as kon bv begin met 0,4 ens. met x 10^{-2}

(4)
[12]

QUESTION / VRAAG 10

10.1

- Particles are in continuous motion in all directions.
- Particles do not contribute to the volume of the gas.
- There are no forces between the particles or the particles and the wall of the container, except during collisions.
- Collisions are perfectly elastic with no loss of total energy of the molecules.
- All molecules are identical.
- The temperature of the gas is a measure of the average kinetic energy of the particles.
- Collisions of particles on the surface cause pressure.
- There is no motion and therefore no pressure at 0 K. 0 K is called absolute zero. (ANY 2) ✓✓

- *Deeltjies is in konstante in beweging in alle rigtings.*
- *Deeltjies dra nie tot die volume van die gas by nie.*
- *Daar bestaan geen kragte tussen die onderlinge deeltjies of tussen die deeltjies en die wande van die houer behalwe tydens botsings.*
- *Botsings tussen deeltjies is volkome elasties met geen verlies aan totale energie van molekules nie.*
- *Alle molekules/ deeltjies is identies.*
- *Die temperatuur van die gas is 'n aanduiding van die gemiddelde kinetiese energie van die deeltjies.*
- *Botsings van deeltjies op die oppervlak veroorsaak druk.*
- *Daar is geen beweging en dus geen druk by 0 K. 0 K word ook absoluut zero genoem*. (ENIGE 2) (2)

10.2 At low pressures✓ and high temperatures. ✓
By lae druk en hoë temperatuur (2)

10.3 $\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$ ✓ [273 + 10 = 283K] [273 + 25 = 289K]

$\frac{150)(5)}{(273+10)}$ ✓ = $\frac{(101,3)V_2}{(273+25)}$ ✓

$V_2 = 7,796$

$V_2 = 7,80\ cm^3$ ✓ (4)

10.4 Standard temperature and pressure/*Standaard temperatuur en druk* (1)

10.5.1 $pV = nRT$ ✓

$(285x10^3)(12x10^{-3})$ ✓$= n\ (8,31)(273+55)$ ✓ [273 + 55 = 328]

$n = \frac{(285x10^3)(12x10^{-3})}{(8,31)(273+55)}$

$n = 1,25$ mol ✓ (4)

10.5.2 $n = \frac{m}{M}$ ✓

$1,25 = \frac{35}{M}$ ✓

$M = 28\ g\cdot mol^{-1}$ $(27.89\ g\cdot mol^{-1})$ ✓ (3)

10.5.3 $N_2(g)$/Nitrogen/stikstof ✓ (1)

[17]

GRAND TOTAL / GROOT TOTAAL: [150]