GAUTENG PROVINCE
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GAUTENG DEPARTMENT OF EDUCATION

GAUTENGSE DEPARTEMENT VAN ONDERWYS

PROVINCIAL EXAMINATION

PROVINSIALE EKSAMEN

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PHYSICAL SCIENCES
FISIESE WETENSKAPPE

PAPER / *VRAESTEL 2*

MEMORANDUM

14 pages / *bladsye*

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PHYSICAL SCIENCES / *FISIESE WETENSKAPPE*
(Paper / *Vraestel 2*)

QUESTION 1: MULTIPLE-CHOICE QUESTIONS
VRAAG 1: MEERVOUDIGEKEUSE-VRAE

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

QUESTION 2 / *VRAAG 2*:

2.1 Intermolecular forces are the attraction forces between molecules.✓✓
Intermolekulêre kragte is die aantrekkingskrag tussen molekules.✓✓ (2)

2.2.1 Hydrogen bonds ✓
Waterstofbindings ✓ (1)

2.2.2 Dipole-dipole forces ✓
Dipool-dipool kragte ✓ (1)

2.2.3 The strength of the intermolecular forces increases as the molecular size increases. ✓✓ HI has a bigger molecular mass than HCℓ thus HI has a higher melting point. ✓✓ More energy is needed to break the stronger dipole-dipole forces in HI. ✓✓
Die krag van die intermolekulêre kragte verhoog soos die molekulêre grootte verhoog. ✓✓ *HI het 'n grooter molekulêre massa as die HCℓ dus het HI 'n hoër kookpunt.* ✓✓ *Meer energie is nodig om die sterker dipool – dipoolkragte in HI te breek.* ✓✓ (6)

2.2.4 Hydrogen iodide. ✓✓
Waterstofjodied. ✓✓ (2)

2.3.1 Boiling point is the temperature at which a liquid's vapor pressure is equal to its atmospheric pressure. ✓✓
Kookpunt is die temperatuur waarteen die dampdruk van 'n vloeistof gelyk is aan die atmosferiese druk. ✓✓ (2)

2.3.2 There are strong Hydrogen bonds between the molecules of the methanol ✓ and weak London forces (induced dipole forces) between the molecules of the methane. ✓ Thus more energy is needed to break the hydrogen bonds between the molecules of the methanol. ✓
Daar is sterk waterstofbindings tussen die molekules van die metanol ✓ *en swak London kragte (geïnduseerde dipool kragte) tussen die molekules van die metaan.* ✓ *Dus word meer energie benodig om die waterstofbindings tussen die metanol molekules te breek.* ✓ (3)

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QUESTION 3 / *VRAAG* 3:

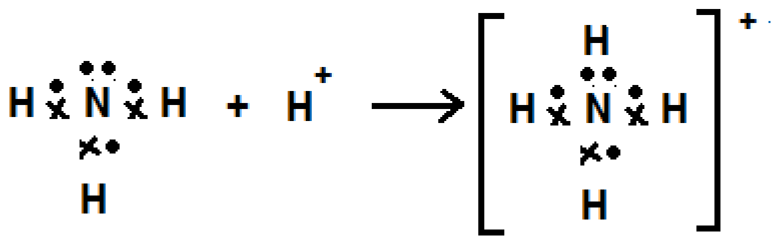
3.1 A way of representing atoms or molecules by showing valence electrons as **dots / crosses** surrounding the element symbol. ✓✓
*'n Manier om atome of molekules voor te stel deur die valensie-elektrone as **kolletjies / kruisies** om die simbool van die element te toon.* ✓✓ (2)

3.2.1 **NaCℓ –** Ionic bond ✓ / *Ioniese binding*
H_2O & NH_3 – polar covalent bond ✓/ *polêre kovalente binding*
H_2 – non-polar covalent bond ✓ / *nie-polêre kovalente binding* (3)

3.2.2 **NaCℓ –** ionic / not a molecule/ *ionies / nie 'n molekule*
H_2O – Angular / bent / *hoekig / gebuig* ✓
NH_3 – Pyramidal / *piramidaal* ✓
H_2 – linear / *linieêr* ✓ (3)

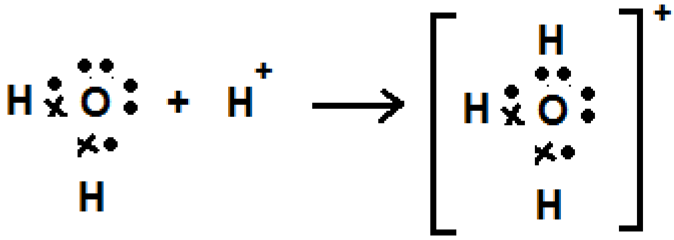
3.2.3 H_2O / water to form H_3O^+ / *water om H_3O^+ te vorm* ✓
and / *en*
NH_3 / ammonium / amoniak to form NH_4^+ / *NH_3 / ammonium / ammoniak om NH_4^+ te vorm* ✓ (2)

3.2.4



✓✓✓ (3)

OR / *OF*



✓✓✓

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QUESTION 4 / *VRAAG 4*:

4.1 Strong Hydrogen bonds ✓✓ /*Sterk waterstofbindings* (2)

4.2 Heat of vaporisation is the amount of heat required to make water evaporate. ✓✓
Verdampingshitte is die hoeveelheid hitte benodig om water te laat verdamp. ✓✓ (2)

4.3 **POLAR** ✓ Because of
1. The EN difference, H_2O $\Delta EN = 3,5 - 2,1 = 1,4$ ∴ polar covalent ✓ ∴O attract shared electron pair more than H ✓
2. Because of the non-symmetrical shape and two lone pairs on the oxygen. ✓ (4)

POLÊR ✓*omdat*
1. *H_2O $\Delta EN = 3,5 - 2,1 = 1.4$ ∴ polêr kovalent* ✓ *∴O trek die gedeelde elektronpaar meer as die waterstof.* ✓
2. *As gevolg van die nie-simmetriese vorm en die twee paar ongepaarde elektrone op die suurstof.* ✓

4.4 Molecular dipoles occur due to the unequal sharing of electrons ✓ between atoms in a molecule. Those atoms that are more electronegative pull the bonded electrons closer to themselves creating a positive and a negative side to the opposite sides of the molecule. ✓ (2)
'n Molekulêre dipool ontstaan wanneer daar 'n oneweredige verdeling van elektrone tussen die atome ✓in die molekule ontstaan a.g.v. 'n groot verskil in elektronegatiwiteit. Dit gee dan aanleiding tot die vorming van 'n positiewe en negatiewe lading aan die teenoorgestelde kante van die molekule. ✓

4.5 KCℓ ✓ (1)

4.6 KCℓ – forms an ionic bond and will be able to dissociate in water to form K^+ and $C\ell^-$ ions, ✓ where I_2 forms a non-polar bond and will not mix with the polar water molecules. ✓ (2)
KCℓ – vorm 'n ioniese binding wat in staat is om te dissosieer in water om K^+ en $C\ell^-$ ione te vorm, ✓*terwyl I_2 'n nie-polêre molekuul is en dus nie met die polêre watermolekules sal meng nie.* ✓

4.7 Capillary action ✓✓ – the adhesion forces between the molecules of different origin e.g. water and glass are bigger than the cohesion forces of the water molecules.✓ (3)
Kapillêre werking ✓✓ *– die adhesiekragte tussen die molekules van verskillende stowwe is groter as die adhesiekragte tussen die watermolekules.* ✓✓

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QUESTION 5 / *VRAAG 5*:

5.1 **Ideal gas:** It is a hypothetical gas that will obey all the gas laws under all conditions of pressure and temperature. ✓✓ (two marks or none) (2)
Ideale gas: *'n Hipotetiese gas wat al die gaswette nakom onder alle omstandighede van temperatuur en druk. ✓✓(twee of geen punte)*

5.2 Hydrogen gas (H_2) ✓✓OR Helium Gas (He) (2)
Waterstofgas (H_2) ✓✓*OF Heliumgas* (He)

5.3 Temperature ✓✓ (2)
Temperatuur ✓✓

5.4.1 **Dependent variable**: Volume of the gas ✓
Independent variable: Different temperatures of the water bath. ✓ (2)
Afhanklike veranderlike*: Volume van die gas* ✓
Onafhanklike veranderlike*: Verskillende temperature van die waterbaddens.* ✓

5.4.2 Charles's law✓✓ (2)
Charles se wet ✓✓

5.4.3 Type of gas
Mass of gas
Pressure of the gas (any two) ✓✓ (2)

Tipe gas
Massa van die gas
Druk van die gas (enige twee) ✓✓

5.4.4 58 – 60 cm^3 ✓✓ (2)

5.4.5 pV = nRT ✓

$p \times 7{,}5 \times 10^{-4}$ ✓ $= 12 \times 8{,}31 \times 298$ ✓

$$p = \frac{12 \times 8{,}31 \times 298}{7{,}5 \times 10^{-4}}$$

p = ?
$V = 750 \div (100)^3$
$= 7{,}5 \times 10^{-4}\ m^3$
T = 298 K
R = 8,31
n = 12 mol

p = 39622080 Pa / $3{,}96 \times 10^7$ Pa ✓ (4)

5.5.1 LOWER THAN ✓
MINDER AS ✓ (1)

5.5.2 1 mole of gas at the same temperature and pressure has the same volume (pV =nRT ∴ p α n)✓ ∴ if the pressure is ½ then the molar mass is less ✓ (2)
1 mol van enige gas teen dieselfde temperatuur en druk het dieselfde volume (pV =nRT ∴ p α n) ✓ *∴ dus as die druk ½ is, is die molêre massa minder*✓

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QUESTION 6 / *VRAAG 6:*

6.1.1 $\mathbf{Zn_{(s)} + 2\ HC\ell_{(aq)}}$ ✓ $\rightarrow$ $\mathbf{ZnC\ell_{2\ (s)} + H_{2\ (g)}}$ ✓ (2)

6.1.2

	$Zn_{(s)}$ +	$2\ HC\ell_{(aq)}$ $\rightarrow$	$ZnC\ell_{2(s)}$	+ $H_{2(g)}$
Mole ratio: *Mol verhouding:*	1	2	1	1
Initial mole *Aanvangs mol*	n = m / M = 45,5g / 65 = 0,7 mol ✓	= 50 / 36,5 = 1,37 mol ✓		
Change in mol *Verandering in mol*	Have enough. *Het genoeg Zn*	Mol ratio / *verhouding*: 1,37 ÷2 =0,685 mol ✓ ∴limiting reactant ✓ *Beperkende reagens*		

(4)

6.1.3

	$Zn_{(s)}$ +	$2\ HC\ell_{(aq)}$ $\rightarrow$	$ZnC\ell_{2\ (s)}$	+ $H_{2\ (g)}$
Change in mol *Verandering in mol*	Used 0,685 mol (mole ratio used / *mol verhouding gebruik)* ✓	If 1,37 mol used *gebruik*		
Mol left or formed at end *Mol oorgelaat of aan die einde gevorm*	0,7 – 0,685 = 0,015 mol ✓ m =n x M = 0,015 x 65 = 0,975 g ✓ Zn left / *Zn oor*			

(3)

6.1.4 **$Zn_{(s)}$ + $2\ HC\ell_{(aq)}$ → $ZnC\ell_{2\ (s)}$ + $H_{2\ (g)}$**

Change in mol *Verandering in mol*		0,137		0,685 mol (mole ratio used / *gebruik)* ✓
Mol left or formed at end *Mol oor / gevorm aan die einde*				n = V/V_m ✓ = 0,685 ÷ 22,4 = 15,34 dm^3 ✓

(3)

6.2.1 **CH_4 + $2\ O_2$ → CO_2 + $2\ H_2O$**

Mole ratio: *Mol verhouding:*	1	2	1	2
Initial mole *Aanvangs mol*	3	excess / *oortollig*	0	0
Change in mol *Verandering in mol*	If all used / *Indien alles gebruik* 3		Ratio 1:1 ✓ / *verhouding 1:1* ∴ 3 mole	
Mol left or formed at end *Mol oor / gevorm aan die einde*			m = n x M ✓ = 3 x (44) ✓ =132g ✓ CO_2 that can be produced *CO_2 wat geproduseer kan word*	

(4)

6.2.2 % Yield / *opbrengs* = $\frac{\text{actual yield / ware opbrengs}}{\text{Max possible yield / maks moontlike opbrengs}}$ ✓

$= \frac{87}{132} \times 100$ ✓

= 65,91% ✓ (3)

6.3

	C	H	O	
	39,9 g	6,7 g	53,4 g	= 100g
$\frac{m}{M}$ =	$\frac{39,9}{12}$	$\frac{6,7}{1}$	$\frac{53,4}{16}$	✓ row / *ry*
÷ smallest *kleinste*	$\frac{3,3}{3,3}$	$\frac{6,7}{3,3}$	$\frac{3,3}{3,3}$	✓ row / *ry*
Mol ratio:	1 :	2 :	1	✓ row / *ry*

IPF = CH_2O = M = 12 + 2 + 16
= 30 $g.mol^{-1}$ ✓

Molecular Formula / *Molekulêre formule* = 60 ÷ 30 = 2 x CH_2O

$C_2H_4O_2$ ✓ (6)

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QUESTION 7 / *VRAAG 7*:

7.1 $n = m/M$

$= \frac{12}{65}$

$= 0{,}1846$ mol ✓

But in each mole of **NaN_3** there are 3 moles of N

*Maar in elke mol **NaN_3** is daar 3 mol N*

$n_N = 0{,}1846 \times 3 = 0{,}554$ mol ✓

$n = \frac{No}{N_A}$ ✓

$0{,}554 = No \div 6{,}02 \times 10^{23}$ ✓

∴ No N atoms / *atome* = $3{,}45 \times 10^{23}$ atoms / *atome* ✓ (5)

7.2 **$2NaN_3$ (s)** ✓ → **2Na(s)** ✓ **+ $3N_2$(g)** ✓ (3)

7.3 **$2NaN_3$ (s) → 2Na(s) + $3N_2$(g)**

$n = \frac{V}{V_M}$ ✓

$= \frac{85}{22{,}4}$

$= 3{,}795$ mol ✓

Use mole ratio

Gebruik mol vehouding

2,53 mol ✓

∴ Mass **NaN_3** needed to fill bag:

∴ *Massa **NaN_3** benodig om sak te vul:*

$m = n \times M$

$= 2{,}53 \times 65$ ✓

$= 164{,}45$ g ✓ (5)

7.4 The chemical formula that shows the simplest ratio between the atoms of a compound. ✓✓ (2)

Die chemiese formule wat die eenvoudigste verhouding tussen die atome in 'n verbinding aantoon.

7.5

	Na		**N**	
%	35,39		64,61 ✓	= 100
$\frac{m}{M}$ =	$\frac{35,39}{23}$		$\frac{64,61}{14}$	
	1,549		4,615	
÷ smallest *kleinste*	$\frac{1,549}{1,549}$		$\frac{4,615}{1,549}$	
Mol ratio:	1	:	3	✓ row / *ry*

∴ IPF = $\mathbf{NaN_3}$ ✓
Empiriese formule = $\mathbf{NaN_3}$ (3)

7.6.1 DECREASE ✓✓ (2)
VERMINDER

7.6.2 p α T Pressure of a gas is directly proportional to temperature /
Druk van 'n gas is direk verwant aan die temperatuur daarvan
If the temperature decreases, the average kinetic energy of the gas molecules decreases ✓ and the pressure decreases. ✓ (3)
As die temperatuur van die gas afneem sal die gemiddelde kinetiese energie van al die deeltjies ook afneem en dus sal die druk verlaag.

[23]

QUESTION 8 / *VRAAG 8*:

8.1. Oxygen ✓✓ (2)
Suurstof

8.2 **$2KC\ell O_3$ ✓ → $2\ KC\ell$ ✓ + $3\ O_2$** ✓ ✓balancing / *balansering*
One for each correct formula / *Een punt vir elke korrekte formule*. (4)

8.3 n = m/M
$= \frac{16,2}{122,5}$
= 0,1322 mol ✓
In each mole of $KC\ell O_3$ there is 1 mol of K ✓
In elke mol $KC\ell O_3$ *is daar 1 mol K*
$n = \frac{No}{N_A}$
0,1322 = No ÷ 6,02 x 10^{23} ✓
∴ No K ions/ *ione* = 7,97 x 10^{22} ions/ *ione* ✓ (4)

8.4 **$2KC\ell O_3$ → $2\ KC\ell$ + $3\ O_2$**

If all off 16,2 g $KC\ell O_3$ decomposed
As 16,2 g $KC\ell O_3$ alles ontbind

n = m/M
$= \frac{16,2}{122,5}$
= 0,132 mol $KC\ell O_3$ → 0,132 $KC\ell$ (use ratio ✓ *gebruiksverhouding*)
m = n x M
= 0,132 x 74,5
= 9,83g ✓

% Purity = $\frac{\text{Actual yield}}{\text{Max yield}}$ x 100 ✓ *%Suiwerheid* = $\frac{\textit{ware opbrengs}}{\textit{maks moontlike opbrengs}}$ *x100*

$= \frac{7,2}{9,83}$ x 100 ✓

= 73,25 % ✓ (5)

[15]

Taxonomy Grid / *Taksonomietabel*

	Recall / *Onthou*		Comprehension / *Verstaan*		Analysis / *Analiseer*		Evaluation / *Evalueer*	
	Q no: / *Vr nr:*	**Mark / Punt**	**Q no: / *Vr nr:***	**Mark / Punt**	**Q no: / *Vr nr:***	**Mark / Punt**	**Q no: / *Vr nr:***	**Mark / Punt**
	1.1	2	1.3	2	1.7	2	8.1	4
	1.2	2	1.4	2	1.10	2	9.2	7
	2.1	2	1.5	2	3.3	4	9.3	3
	3.1	4	1.6	2	3.5	2		
	4.1	1	1.8	2	4.4	2		
	5.3.1	2	1.9	2	4.5	2		
	5.3.2	2	2.2	4	5.1	5		
	5.3.3	2	2.3	6	5.2	2		
	5.4	2	3.2	2	6.4	2		
	6.1	3	3.4	4	6.5	2		
	7.4.2	2	4.2	2	6.7	5		
			4.3	2	7.2	3		
			6.2	6	7.4.3	6		
			6.3	2	8.3	3		
			6.6	2	8.4	4		
			7.1	2	9.1	6		
			7.3	6				
			7.4.1	2				
			7.4.4	4				
			8.2	3				
Total mark / *Totale punte*	**16%**	**24**	**39,33%**	**59**	**34,67%**	**52**	**9,3 %**	**14**
Total / *Totaal* % / **100%**	**P1&2: 15%**		**P1:35%/P2:40%**		**P1:40%/P2:35%**		**P1&2: 10%**	

Correct application of Bloom's / Barrett's Taxonomy: / *Korrekte toepassing van Bloom / Barrett se taksonomie:*	
Level 1: *Vlak 1:*	Recall of information (what? which? when? list; label; name; define; give; describe) *Oproep van inligting (wat? watter? wanneer? lys; benoem; definieer; voorsien; beskryf)*
Level 2: *Vlak 2:*	Understanding and using information (summarise; classify; apply rules; discuss) Applying information (distinguish; specify; compare; design; explain; investigate; interpret; calculate; give your input) *Verstaan en gebruik inligting (som op klassifiseer); pas reëls toe; bespreek)*
Level 3: *Vlak 3:*	Analysis of information (classify; explain; identify; interpret; compare; give reasons; prove; give causes and effects) *Toepassing van inligting (onderskei; spesifiseer; vergelyk; ontwerp; verduidelik; ondersoek; interreteer; bereken; gee jou opinie)*
Level 4: *Vlak 4:*	Synthesize information (summarize; construct; argue; create; relate; design; formulate) Evaluate information (judge; assess; evaluate; choose; support; compare; estimate) *Sintetiseer inligting (som op; konstrueer; argumenteer; skep; formuleer)* *Evalueer inligting (beoordeel; assesseer; evalueer; kies; ondersteun; vergelyk; skat)*