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

QUESTION 2 / *VRAAG 2*

2.1 Boiling point is the temperature when a liquid's vapour pressure is equal to its atmospheric pressure.✓✓

Kookpunt is die temperatuur wanneer die dampdruk van 'n vloeistof gelyk is aan die atmosferiese druk.✓✓ (2)

2.2.1 He ✓ (1)

2.2.2 NH_3 ✓ (1)

2.2.3 NaCℓ ✓ (1)

2.2.4 $CCℓ_4$ ✓ (1)

2.3 2.3.1 London / dispersion forces✓✓

London / dispersiekragte.✓✓ (2)

2.3.2 Dipole – dipole forces ✓✓

Dipool – dipoolkragte ✓✓ (2)

2.3.3 Ionic bonds ✓✓

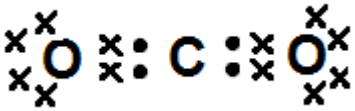
Ioniese kragte ✓✓ (2)

[12]

QUESTION 3 / *VRAAG 3*

3.1 3.1.1 The sharing of one or more pairs of electrons between two non-metals to form a molecule.✓✓
Die deel van een of meer elektronpare, tussen twee nie-metale om 'n molekule te vorm.✓✓ (2)

3.1.2 A measure of an atom's attractive force on bonding electrons to form a molecule ✓✓
'n Aanduiding van die atoom se aantrekkingskrag op die verbindingselektrone van 'n molekule (2)

3.2  ✓✓ (2)

3.3 The ∆EN between C and H is 2,5 -2,1 = 0,4 which gives it a polar bond, ✓✓ but the shape of the molecule is symmetrical ∴ non-polar molecule.✓✓
Die ∆EN tussen C en H is 2,5 -2,1 = 0,4 wat polêre binding is, ✓✓*maar die vorm van die molekule is simmetries ∴ nie-polêre molekule.*✓✓ (4)

3.4 3.4.1 Ammonia / NH_3 ✓
Ammoniak / NH_3 ✓ (1)

3.4.2 Methane / CH_4 ✓
Metaangas / CH_4 ✓ (1)

3.4.3 Sulphur dioxide / SO_2 ✓
Swaeldioksied / SO_2 ✓ (1)

3.4.4 Carbon dioxide / CO_2 ✓
Koolstofdioksied / CO_2 ✓ (1)

3.5 Ammonia / NH_3 ✓ – polar substance will ionise in a polar liquid.✓
Ammoniak / NH_3 ✓*– 'n polêre molekule sal ioniseer in 'n polêre vloeistof.*✓ (2)

[16]

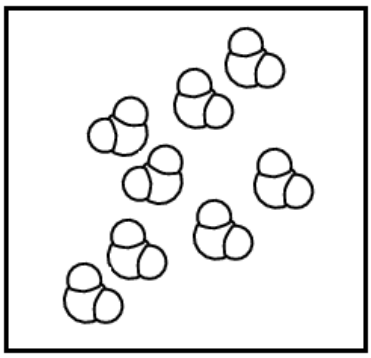
QUESTION 4 / *VRAAG 4*

4.1 H_2O (1)

4.2

H_2O $\Delta EN = 3,5 - 2,1 = 1,4$ ✓∴ polar covalent ✓ ∴O attract shared electron pair more than Hydrogen

H_2O $\Delta EN = 3,5 - 2,1 = 1.4$ ✓∴ polêr kovalent ✓ ∴O trek die gedeelde elektronpaar meer as die Waterstof. (2)

4.3 

Big spaces between molecules ✓
Positive side of one molecule aligned with negative side of next molecule✓

Groot spasies tussen molekules ✓
Positiewe kant van een molekule georiënteer met negatiewe kant van volgende molekule.✓ (2)

4.4 Ice has a very regular pattern with the molecules rigidly apart from one another, connected by the hydrogen bonds that form a crystalline lattice.✓
These crystals have a number of open regions and pockets making ice less dense than liquid water.✓
Watermolekules in ys het 'n presiese, rigiede patroon in 'n kristallyne vorm.✓
Die kristallyne vorm het 'n groot aantal oop ruimtes wat ys minder dig as water maak.✓ (2)

4.5 As water evaporates from leaves, it tugs on the water molecules below
-Cohesion and adhesion pull water up and replace missing water molecules ✓
Capillarity: Water molecules will "tow" each other along when in a thin tube. ✓
Soos wat die water deur die blare verdamp, trek dit die watermolekules op in die plant in deur middel van kohesie en adhesiekragte om die watermolekules te vervang. ✓
Kapillêre kragte: watermolekules trek mekaar aan beweeg op in 'n dun buisie.✓ (2)

[9]

QUESTION 5 / *VRAAG 5*

5.1

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad ✓$$

$$\frac{102 \times 31,8}{302} \; ✓ \; ✓ = \frac{75 \times 34.5}{T_2} \; ✓$$

T_2 = 240,91 K also accept / *aanvaar ook* - 32,09 ° C ✓ (5)

5.2 As the temperature decreases the average kinetic energy of the molecule decreases.✓ ∴pressure of the molecule on each other and on the sides of the container decreases as there will be fewer collisions.✓

Soos die temperatuur verlaag sal die gemiddelde kinetiese energie van die molekules afneem ✓∴ die druk wat die molekules op mekaar en op die wande van die houer uitoefen sal verminder aangesien daar minder botsing sal wees.✓

(2)

5.3 5.3.1 It is a hypothetical gas that will obey all the gas laws under all conditions of pressure and temperature.✓✓ (Two marks or none)

'n Hipotetiese gas wat al die gaswette nakom onder alle omstandighede van temperatuur en druk.✓✓(Twee of geen punte) (2)

5.3.2

- Particles are in continual 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.

Any 3
Enige 3

- *Deeltjies is konstant in beweging in alle rigtings.*
- *Deeltjies dra nie by tot die volume van die gas nie.*
- *Daar bestaan geen kragte tussen die deeltjies onderling en die wande van die houer nie, behalwe gedurende botsings.*
- *Botsings is volkome elasties met geen verlies aan die totale energie van die molekules nie.*

- *Alle molekules is identies.*
- *Die temperatuur van die gas is 'n maatstaf vir die gemiddelde kinetiese energie van die deeltjies.*
- *Botsings van deeltjies op die oppervlak veroorsaak druk.*
- *Daar is geen beweging en dus ook geen druk by 0 K.*

(3)

5.3.3 At high temperatures and low pressures✓✓

Teen hoë temperature en lae druk. ✓✓ (2)

5.4 22,4 dm^3 at STP ✓✓

22,4 dm^3 by STP ✓✓ (2)

[16]

QUESTION 6 / *VRAAG 6*

6.1 Gay Lussac's Law: ✓ The pressure of an enclosed gas is directly proportional to its temperature if the amount of a gas is at a constant volume.✓✓
Gay Lussac se wet: ✓Die verwantskap tussen druk en temperatuur van 'n spesifieke hoeveelheid gas is direk eweredig aan mekaar mits die volume konstant gehou word.✓✓ (3)

6.2 6.2.1 Pressure ✓✓
Druk ✓✓ (2)

6.2.2 Temperature ✓✓
Temperatuur ✓✓ (2)

6.2.3 Volume ✓✓
Volume ✓✓ (2)

6.3 What is the relationship between the temperature and the pressure of an enclosed gas of a spesific volume?
Wat is die verwantskap tussen die temperatuur en die volume van 'n ingeslote gas by 'n spesifieke volume?

Criteria for investigative Question / *Kriteria vir ondersoekende vraag:*	**Mark/ *Punt***
The dependent and independent variables are stated. *Die afhanklike en onafhanklike veranderlikes is genoem*.	✓
Ask a question about the relationship between dependent and independent variables. *Vra 'n vraag oor die verwantskap tussen die afhanklike en onafhanklike veranderlikes.*	✓

(2)

6.4 According to the graph the temperature is directly porportional to the pressure of the enclosed gas.✓✓ (As temperature increases, pressure increases.)
Volgens die grafiek is die temperatuur en die druk van 'n ongeslote gas direk verwant.✓✓(Soos die temperatuur styg sal die druk ook toeneem.) (2)

6.5 Extrapolate the line: At zero pressure temp = ± 273 K. ✓✓
Ekstrapoleer die lyn van die grafiek: By 'n druk van Nul kPa sal die temperatuur = ± 273 K wees. ✓✓ (2)

6.6 Absolute Zero ✓✓
Absolute zero / nul ✓✓ (2)

6.7 $\frac{P_i}{T_i} = \frac{P_f}{T_f}$ ✓

$\frac{500}{298}$ ✓ = $\frac{P_f}{313}$ ✓

P_f = 527,17 kPa ✓

T_i = 25 °C + 273
= 298 K
T_f = 40°C +273
= 313 K
P_i =500 kPa
P_f = ?

Yes, ✓he will reach his destination safely as the final pressure is less than the maximum pressure. ✓
Ja, ✓ hy sal sy bestemming veilig bereik aangesien die finale druk kleiner is as die maksimum toegelate druk. ✓ (6)

[23]

QUESTION 7 / *VRAAG 7*

7.1 Sodium carbonate ✓✓
Natriumkarbonaat ✓✓ (2)

7.2 $c = \frac{m}{MV}$ ✓

$0,25 ✓ = \frac{m}{106 ✓ \text{ x } 5x10^{-1}}$ ✓

m = 13,25 g ✓ (4)

M = Na_2CO_3
= 2(23) + 12 + (16 x 3)
= 106 $g \cdot mol^{-1}$

7.3 $n = \frac{m}{M}$ ✓

$= \frac{13,25}{106}$ ✓

= 0,125 mole of Na_2CO_3 ✓

Positive marking from 7.2
Positiewe nasien vanaf 7.2

But in every 1 mole of Na_2CO_3 = 2 mole of Na ✓ /
Maar in elke 1 mol Na_2CO_3 = 2 mol Na ✓

∴ 0,125 x 2 = 0,25 mole Na ions / *mol Na ione* ✓
∴

$c = \frac{n}{V}$

$= \frac{0,25}{0,5}$

= 0,5 mol . dm^{-3} (6)

7.4.1 $Na_2SO_4 + CaCO_3 + \mathbf{2}✓C \rightarrow Na_2CO_3 + \mathbf{2}✓CO_2 + CaS$ (2)

7.4.2 The substance that will be used up first ✓✓
Die reagens wat eerste opgebruik sal word ✓✓ (2)

7.4.3

Na_2SO_4	$CaCO_3$	2C	Na_2CO_3	$2CO_2$	CaS
1	1	2	1	2	1✓
52,54 g	45 g				
n = $\frac{m}{M}$ **=** $\frac{52,54}{142}$✓ **= 0,37 mole / *mol***	n = $\frac{m}{M}$ ✓ = $\frac{\mathbf{45}}{\mathbf{100}}$✓ = 0,45 mole / *mol*✓				
But ratio : 1	1				
∴ Limiting reactant / *Beperkende reagens* ✓	excess / *oortollig*				

(6)

7.4.4 **Na_2CO_3** M = (23 x 2) + (12) + (16 x 3) = 106 g·mol^{-1}

Mole ratio / *Molverhouding*: 1 **Na_2SO_4** : 1 **Na_2CO_3** ✓

n = $\frac{m}{M}$ ✓

0,37 = m / 106 ✓

m Na_2CO_3 = 39,22 g ✓

(4)

[26]

QUESTION 8 / *VRAAG 8*

8.1. $2LiOH(s) + CO_2(g) \rightarrow Li_2CO_3(s) + H_2O(l)$

✓ ✓ ✓ ✓ (4)

8.2 n = $\frac{m}{M}$ ✓

= $\frac{800}{24}$ ✓

n = 33,33 mole / *mol* ✓ (3)

8.3 From balanced equation: LiOH : CO_2 ✓

Vanaf gebalanseerde vergelyking:

Mole ratio / *molverhouding* 2 : 1 ✓

∴ 33,33 mole / *mol* : 16,67 mole / *mol* CO_2 ✓ (3)

Positive marking from 8.2
Positiewe nasien vanaf 8.2

8.4 n = $\frac{m}{M}$ ✓

16,67 ✓ = $\frac{m}{44}$ ✓

m = 733,48 g ✓ (4)

Positive marking from 8.3
Positiewe nasien vanaf 8.3

[14]

QUESTION 9 / *VRAAG 9*

9.1 $n = \frac{m}{M}$

$= \frac{12}{342}$ ✓

n = 0,035 mole / *mol* ✓

In one mole of $Al_2(SO_4)_3$: 12 mole of O atoms✓ /

In een mol van $Al_2(SO_4)_3$: 12 mol van O atome✓

∴ 0,035 mole / *mol* x 12

= 0,42 mole / *mol* O ✓

$N_{atoms} = n \times N_A$ ✓

$N_{atome} = 0,42 \times 6,02 \times 10^{23}$

$= 2,53 \times 10^{23}$ O atoms / *atome* ✓ (6)

9.2

Al		S
36%	∴	64 % ✓
$\frac{36g}{27}$		$\frac{64g}{32}$ ✓
$\frac{1,33}{1,33}$		$\frac{2}{1,33}$ ✓
1	:	1,5 ✓
X2 2		3 ✓

∴ Emperical formula: Al_2S_3

Empiriese formule (5)

9.3 $6\ H_2O + Al_2S_3 \rightarrow 3\ H_2S + 2\ Al(OH)_3$

✓ ✓ ✓ (3)

[14]

TOTAL / *TOTAAL*: 150

Taxonomy Grid

	Recall		Comprehension		Analysis		Evaluation	
	Q no:	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**
	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	**16%**	**24**	**39,33%**	**59**	**34,67%**	**52**	**9,3 %**	**14**
Total % / **100%**	**P1&2: 15%**		**P1:35% / P2:40%**		**P1:40% / P2:35%**		**P1&2: 10%**	

Correct application of Bloom's / Barrett's Taxonomy:

Level 1: Recall of information (what? which? when? list ; label; name; define; give; describe)

Level 2: Understanding and using information (summarize; classify; apply rules; discuss)
Applying information (distinguish; specify; compare; design; explain; investigate; interpret; calculate; give your input)

Level 3: Analysis of information (classify; explain; identify; interpret; compare; give reasons; prove; give causes and effects)

Level 4: Synthesize information (summarize; construct; argue; create; relate; design; formulate)
Evaluate information (judge; assess; evaluate; choose; support; compare; estimate)