GAUTENG PROVINCE
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GAUTENG DEPARTMENT OF EDUCATION /

GAUTENGSE DEPARTEMENT VAN ONDERWYS

PROVINCIAL EXAMINATION / *PROVINSIALE EKSAMEN*

2019

GRADE / *GRAAD* 11

PHYSICAL SCIENCES
FISIESE WETENSKAPPE

PAPER 2 / *VRAESTEL 2*

MARKING GUIDELINES /
NASIENRIGLYNE

14 pages / *bladsye*

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

VRAAG 1: MEERVOUDIGEKEUSE-VRAE

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

QUESTION 2 / *VRAAG 2*:

2.1 The bond energy of a compound is the energy needed to break one mole of its molecules into separate atoms. ✓✓

OR

The energy needed to break the bonds in a molecule. ✓✓ (2)

Die energie benodig om een mol van 'n substans op te breek in atome. ✓✓

OF

Die energie benodig om 'n binding te breek. ✓✓

2.2 -426 $kJ.mol^{-1}$ ✓ (1)

2.3 Bond length is the average distance between the nuclei of two bonded atoms.
Bindingslengte is die afstand tussen die kerne van die twee atome wat gebind is. ✓✓ (2)

2.4 74×10^{-12} m ✓ (1)

2.5 At point 3 the force of attraction between the nucleus of the one atom and the electrons of the other atom balances out with the force of repulsion between the two nuclei, ✓therefore making it more stable ✓ (Potential energy is at the lowest).
At point 4 the repulsion force between the nuclei is much stronger ✓ than the attraction force between the nucleus of the one atom and the electrons of the other atom. ✓ (Increased potential energy). (4)

By punt 3 is die aantrekkingskrag tussen die kern van die een atoom en die elektrone van die ander atoom in balans met die afstotingskragte tussen die twee kerne. ✓*Dus is die binding meer stabiel.* ✓*(Potensiële energie is op sy laagste).*
By punt 4 is die afstotingskragte tussen die twee kerne van die twee atome baie groter ✓*as die aantrekkingskragte tussen die kern van die een atoom en die elektrone van die ander atoom.* ✓*(Potensiële energie is verhoog).*

[10]

QUESTION 3 / *VRAAG 3:*

3.1 Electronegativity is a measure of the tendency of an atom in a molecule to attract bonding electrons. ✓✓

OR

A measure of an atom's attractive force on bonding electrons to form a molecule. ✓✓ (2)

Elektronegatiwiteit is 'n aanduiding van die geneigdheid van 'n atoom om die bindingselektrone van 'n molekule aan te trek. ✓✓

OF

'n Aanduiding van die atoom se aantrekkingskrag op die verbindingselektrone van 'n molekule. ✓✓

3.2 Aℓ EN = 1,5
S EN = 2,5 ✓

$\therefore$ S has a higher EN and will thus form the negative ion ✓

$\therefore$ *S het die hoogste EN en sal dus die negatiewe ioon vorm.* (2)

3.3.1 O EN = 3,5
Mg EN = 1,2 ✓

Δ EN = 2,3 $\therefore$ ionic bond ✓

$\therefore$ *ioonbinding* (2)

3.3.2 Cℓ EN = 3,0
H EN = 2.1 ✓

Δ EN = 0,9 $\therefore$ polar covalent ✓

$\therefore$ *polêr kovalent* (2)

3.3.3 P EN = 2,1
H EN = 2.1 ✓

Δ EN = 0 $\therefore$ non-polar covalent / pure covalent ✓

$\therefore$ *nie-polêr kovalent / suiwer kovalent* (2)

3.4 Valence electrons are the electrons in the highest energy level of an atom. ✓✓

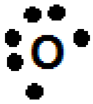
OR

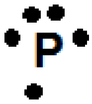
The electrons in the outer most orbital of the atom.✓✓ (2)

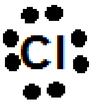
Valenselektrone is die elektrone wat in die hoogste energievlak van die atoom voorkom. ✓✓

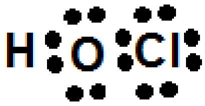
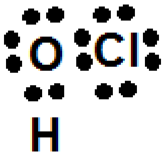
OF

Die elektrone in die buitenste orbitaal van die atoom.✓✓

3.5.1  ✓✓ (2)

3.5.2  ✓✓ (2)

3.5.3  ✓✓ (2)

3.5.4  ✓✓ **OR / *OF***  ✓✓ (2)

3.6 THREE / 3 ✓✓ (2)

DRIE

3.7.1 Tetrahedral ✓✓ (2)

Tetraëdries

3.7.2 Trigonal planar ✓✓ (2)

Trigonaal planêr

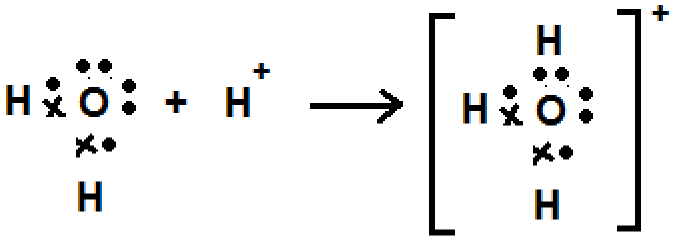
3.7.3 Bent / Angular ✓✓ (2)

Hoekig / gebuig

3.8.1 Dative covalent bond / Coordinate bond ✓✓ (2)

Datief kovalente binding / koördinatiewe binding

3.8.2 ✓ ✓ ✓ (3)



[33]

QUESTION 4 / *VRAAG 4:*

4.1.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓✓ (2)

Kookpunt is die temperatuur waneer die dampdruk van 'n vloeistof gelyk is aan die atmosferiese druk. ✓✓

4.1.2 There are strong hydrogen bonds between the water molecules. ✓

There are weaker dipole – dipole forces between $CH_3Cℓ$ molecules. ✓

Hydrogen bonds are stronger than dipole – dipole forces

Therefore more energy is needed to overcome these forces and the boiling point is higher. ✓ (3)

Daar is sterk waterstofbindings tussen die molekules van die water ✓ *en swak dipool-dipool kragte tussen die* $CH_3Cℓ$ *molekules .* ✓

Dus is meer energie nodig om die waterstofbindings tussen die watermolekules te breek. ✓

4.1.3 Benzene and chloroform have weak London forces between their molecules. ✓ Benzene has a larger surface area therefore stronger intermolecular forces and thus a higher boiling point. ✓

OR

Chloroform has a smaller surface area therefore weaker London forces and a lower boiling pont. (2)

Daar is swak Londonkragte (geïnduseerde dipoolkragte) tussen die molekules van die chloroform en die bensien ✓ maar die molekulêre massa van die bensien is baie hoër as die van die chloroform, dus is bensien se kookpunt hoër. ✓

OF

Chloroform het 'n kleiner oppervlakarea en dus het dit swakker Londonkragte en *'n laer kookpunt.*

4.2.1 $MgCl_2$ ✓✓ (1)

4.2.2 Cl_2 ✓ and / *en* CO_2 ✓ (2)

4.2.3 H_2O ✓ and / *en* HF ✓ (2)

4.2.4 HCl ✓✓ (1)

4.2.5 $MgCl_2$ ✓✓ (1)

4.3.1 Non-polar ✓✓ (2)

Nie-polêr

4.3.2 Polar ✓✓ (2)

Polêr

4.3.3 Non-polar ✓✓ (2)

Nie-polêr

4.4.1 Vapour pressure is the pressure exerted by a vapour at equilibrium with its liquid in a closed system. ✓✓ (2)

Dampdruk is die druk van gasmolekules van 'n stof wat in kontak is met sy vloeistof, in ewewig, in 'n geslote sisteem. ✓✓

4.4.2 PH_3 has a higher vapour pressure. ✓

PH_3 has London forces between its molecules. ✓

NH_3 has hydrogen bonds between its molecules. ✓

Hydrogen bonds are stronger than London forces, thus less energy is required to weaken the London forces in PH_3 ✓ (4)

PH_3 het 'n hoër dampdruk. ✓

PH_3 het Londonkragte tussen die molekules. ✓

NH_3 het waterstofbindings tussen die molekules. ✓

Waterstofbindings is sterker as Londonkragte, dus word minder energie benodig om die swak Londonkragte in PH_3 te breek. ✓

[26]

QUESTION 5 / VRAAG 5:

5.1 Oil is a non-polar molecule and water is a polar molecule. ✓

Oil is less dense than water. ✓ (2)

Olie is ŉ nie-polêre molekule waar water polêr is. ✓

Olie is minder dig as water. ✓

5.2 Density is the number of molecules per unit volume. ✓✓ (2)

Digtheid: die aantal molekules per volume eenheid. ✓✓

5.3.1 London forces / dispersion forces. ✓✓ (2)

Londonkragte / dispersiekragte ✓✓

5.3.2 Electrostatic (Ionic bond) ✓✓ (2)

Ioonbindings (Elektrostatiese aantrekkingskragte)

5.3.3 Water ✓✓ (2)

5.3.4 Water is polar and has hydrogen bonds (dipole – dipole forces) between molecules. ✓

$KMnO_2$ is an ionic solid. ✓

Water and $KMnO_4$ therefore have intermolecular forces of similar strength ✓, so $KMnO_4$ can dissociate in the water, turning it purple. ✓ (4)

Water is polêr en het waterstofbindings (sterk dipool-dipoolkragte) tussen die molekules. ✓

$KMnO_2$ is ŉ ioniese vastestof. ✓

Water en $KMnO_4$ het dus dieselfde sterkte intermolekulêre kragte ✓, dus kan $KMnO_4$ in water dissosieer om dit pers te kleur. ✓

[14]

QUESTION 6 / VRAAG 6:

6.1.1 **ANY THREE (3) OF THE FOLLOWING**: ✓✓✓

- Particles are all identical.
- 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.
- Collision is perfectly elastic, with no loss of total energy of the molecules.
- Obey gas laws in all temperatures and pressures. (3)

ENIGE DRIE (3) VAN DIE VOLGENDE: ✓✓✓

- *Alle molekules / deeltjies is identies.*
- *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, of tussen die deeltjies en die wande van die houer nie behalwe gedurende botsings.*
- *Botsings tussen deeltjies is volkome elasties met geen verlies aan die totale energie van die molekules nie.*
- *Gehoorsaam gaswette in alle temperature en druk.*

6.1.2 High Temperatures ✓

Low pressures ✓ (2)

Hoë Temperature

Lae druk

6.2.1 Boyle's Law apparatus ✓ (1)

Apparaat vir Boyle se Wet

6.2.2 The pressure of certain mass of an enclosed gas is inversely proportional to the volume it occupies at a constant temperature. ✓✓ (2)

Die druk van 'n sekere massa van 'n ingeslote gas is omgekeerd eweredig aan die volume, by 'n konstante temperatuur.

6.2.3.1 Pressure ✓ (1)

Druk

6.2.3.2 Volume ✓ (1)

Volume

6.2.3.3 Mass ✓

Temperature ✓ (2)

Massa

Temperatuur

6.2.4 120 kPa ✓✓ (2)

6.2.5 The shape would be the same ✓ but it would be higher up ✓ on the graph (Higher volume at higher pressure). (2)

Die vorm van die grafiek sal dieselfde bly, maar dit sal hoër op beweeg / hoër op die grafiek lê (Hoër volume teen 'n hoër druk). ✓✓

6.3.1 $\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$ ✓

$\frac{(101{,}3)(6)}{295}$ ✓ $= \frac{(120)V_2}{282}$ ✓

$V_2 = 4{,}84\ dm^3 / \ell$ ✓

(5)

6.3.2 t = T – 273

= 282 – 273 ✓

= 9^o C ✓ (2)

6.3.3 His lungs will expand / might burst. ✓
As the pressure decreases and the temperature increases ✓the volume will increase, as $V \propto {}^1/P$ and $V \propto T$. ✓ (3)

Sy longe sal uitsit en mag dalk selfs bars ✓aangesien die volume van 'n ingeslote gas verhoog soos die druk verminder. Die volume sal dus drasties toeneem aangesien $V \propto {}^1/P$ en $V \propto T$. ✓

[26]

QUESTION 7 / VRAAG 7:

7.1.1 $6H_2O$ ✓ + $Al_2S_3 \rightarrow 3H_2S$ ✓ + $2Al(OH)_3$ ✓ (3)

7.1.2 $M(Al(OH)_3) = 27 + 3(16 + 1)$

$= 78\ g.mol^{-1}$

$n(Al(OH)_3 = \frac{m}{M}$

$= \frac{10}{78}$ ✓

= 0,1282 … mol

$\therefore n\ (Al_2S_3) = 0{,}1282 \ldots \times \frac{1}{2}$ ✓

= 0,0641 … mol

m = nM

= (0,0641 …)[1(27)+3(32)] ✓

= 7,88 g✓ (4)

7.1.3 $\%O = \frac{3(16)✓}{78\ ✓} \times 100 = 61{,}54\%$ ✓ (3)

7.2.1 n(HCl) = cV ✓

= (0,4)(0,2) ✓

= 0,08 mol

$n(CaCO_3) = \frac{m}{M}$ ✓

$= \frac{20}{100}$ ✓

= 0,2 mol

HCl : $CaCO_3$

2 : 1

0,08 : 0,04

OR / *OF*

0,4 : 0,2 ✓

Therefore $CaCO_3$ is in excess ✓ $\therefore$ *$CaCO_3$ is in oormaat* (6)

7.2.2 $n(CaCl_2) = 0{,}08 \times ½$ ✓

$= 0{,}04$ mol

✓

$m = nM$

$= (0{,}04)(40 + 2(35{,}5))$

$= 4{,}44$ g ✓ (3)

7.2.3 $\%\,\text{yield} = \frac{\text{actual}}{\text{theoretical}} \times 100$ / $\%\,opbrengs = \frac{re\ddot{e}l}{teoreties} \times 100$ (2)

$= \frac{4}{4{,}44} \times 100$ ✓

$= 90{,}09\%$ ✓

[21]

Taxonomy Grid

	Recall		Comprehension		Analysis		Evaluation	
	Q no:	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**
	1.1.	2	1.2. & 1.3.	4	1.4.	2		
			1.5. – 1.7	6	1.8	2		
			1.9 & 1.10	4				
	2.1.	2	2.2.	1	2.5.	4		
	2.3.	2	2.4.	1				
	3.1.	2	3.3.	6	3.2.	2		
	3.4.	2	3.5.	8	3.6.	2		
	3.8.1.	2	3.7.	6				
			3.8.2.	3				
	4.1.1.	2			4.1.2.	3	4.1.3.	2
	4.4.1.	2	4.3.	6	4.2.	7		
					4.4.2	4		
	5.2.	2	5.1.	2	5.3.4.	4		
			5.3.	6				
	6.1.1.	3	6.1.2.	2	6.2.4.	2	6.3.3.	3
	6.2.1.	1	6.2.3.	4	6.2.5.	2		
	6.2.2.	2	6.3.2.	2	6.3.1	5		
			7.1.	2	7.2.	5	7.3.	3
					7.4.2.	3	7.4.1.	6
							7.4.3.	2
Total mark		**24**		**63**		**47**		**16**
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)