



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE/
NASIONALE SENIOR
SERTIFIKAAT**


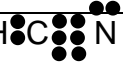
GRADE/GRAAD 11

NOVEMBER 2019

**PHYSICAL SCIENCES P2
FISIESE WETENSKAPPE V2
(CHEMISTRY/CHEMIE)
MARKING GUIDELINE/NASIENRIGLYN**

MARKS/PUNTE: 150

This marking guideline consists of 11 pages./
Hierdie nasienriglyn bestaan uit 11 bladsye.

QUESTION 1 / VRAAG 1		
1.1	C ✓✓	(2)
1.2	B ✓✓	(2)
1.3	B ✓✓	(2)
1.4	A ✓✓	(2)
1.5	C ✓✓	(2)
1.6	C ✓✓	(2)
1.7	D ✓✓	(2)
1.8	B ✓✓	(2)
1.9	C ✓✓	(2)
1.10	B ✓✓	(2)
		[20]
QUESTION 2 / VRAAG 2		
2.1	A group of two or more atoms covalently bonded and it functions as a unit. ✓✓ <i>'n Groep van twee of meer atome wat kovalent gebind en as 'n eenheid funksioneer.</i>	(2)
2.2.1	Tetrahedral ✓ <i>Tetraëdries</i>	(1)
2.2.2	Trigonal bipyramidal ✓ <i>Trigonaal bipyramidaal</i>	(1)
2.3.1	 ✓✓	(2)
2.3.2	 ✓✓	(2)
2.4	The nitrogen (N) atom in NH ₃ contains a lone pair electrons. ✓ } No lone pair in CCl ₄ . Nitrogen (N) atom in NH ₃ can donate its lone pair into the vacant orbital of H ⁺ ✓ <i>Die stikstof (N) atoom in NH₃ bevat 'n alleenpaar elektrone. Geen enkelpaar elektrone in CCl₄ nie Stikstof (N) atoom in NH₃ kan sy alleenpaar elektrone in die vakante wentelbaan van H⁺ skenk</i>	(2)

2.5	<p>Polar. ✓</p> <ul style="list-style-type: none"> • Sulphur atoms more electronegative than the hydrogen atom } ✓ • Sulphur atom pulls the bonding electrons more towards itself. } • (The change in electronegative is $2,5 - 2,1 = 0,4$) • The sulphur atom has a partial negative charge and hydrogen atom has a partial positive charge. ✓ • The H_2S molecule has an asymmetrical bent/angular shape. ✓ <p><i>Polêr.</i></p> <ul style="list-style-type: none"> • Swawelatome is meer elektronegatief as die waterstofatoom • Swawelatoom trek die bindingselektrone meer na hom toe. • (Die verskil in elektronegatief is $2,5 - 2,1 = 0,4$) • Die swawelatoom het 'n gedeeltelik negatiewe lading en waterstofatoom het 'n gedeeltelik positiewe lading. • Die H_2S-molekule het 'n asimmetriese buiging / hoekige vorm. 	(4)
		[14]
QUESTION 3/VRAAG 3		
3.1	<p>The temperature at which the vapour pressure of a liquid is equal to the external (atmospheric) pressure. ✓✓</p> <p><i>Die temperatuur waarteen die dampdruk van 'n vloeistof gelyk is aan die eksterne (atmosferiese) druk.</i></p>	(2)
3.2	<p>Boiling point. Accept answers in the range (180 to 190) ✓ (K)</p> <p><i>Kookpunt. Aanvaar antwoorde tussen (180 tot 190) (K)</i></p>	(1)
3.3	<ul style="list-style-type: none"> • Group 4 hydrogen hydrides have London /dispersion/induced-dipole forces ✓ • Hydrogen halides have dipole-dipole forces ✓ • The dipole-dipole forces are stronger than the London/dispersion/induced-dipole forces ✓ • More energy will be required to overcome the dipole-dipole/ intermolecular forces in hydrogen halides ✓ <ul style="list-style-type: none"> • <i>Groep 4 waterstofhidriede het London-/ verspreiding / geïnduseerde-dipool kragte</i> • <i>Waterstofhaliede het dipool-dipool kragte</i> • <i>Die dipool-dipoolkragte is sterker as die London-/verspreidingskragte/ geïnduseerde-dipool kragte.</i> • <i>Meer energie sal benodig word om die dipool-dipool / intermolekulêre kragte in waterstofhaliede te oorkom</i> 	(4)
3.4	<p>HF has <u>hydrogen bonds</u> ✓✓</p> <p><i>HF het <u>waterstofbindings</u></i></p>	(2)
3.5	<p>GeH_4 ✓. It has a lower boiling point. ✓</p> <p><i>GeH_4. Dit het die laagste kookpunt</i></p>	(2)
		[11]

QUESTION 4/VRAAG 4		
4.1.1	Boyle's (law / wet)	(1)
4.1.2	What effect will a (change in) pressure have on the volume of a fixed amount gas at constant temperature? ✓✓ <i>Watter effek sal 'n (verandering in) druk op die volume van 'n vasgestelde gas by konstante temperatuur hê?</i>	(2)
4.1.3	Temperature. ✓ Accept mass / number of moles of gas <i>Temperatuur. Aanvaar massa / aantal mol gas</i>	(1)
4.1.4	<ul style="list-style-type: none"> • According to the Kinetic Molecular Theory, <u>the pressure exerted by a gas depends on the number of collisions per unit time per unit area.</u> ✓ • <u>The same number of particles in a smaller volume (area) leads to an increase in the number of collisions per unit volume (area)</u> ✓ • <u>The more collisions per unit volume (area) results in an increase in pressure.</u> ✓ • <i>Volgens die Kinetiese Molekulêre Teorie hang die druk wat 'n gas uitoefen af van die aantal botsings per tydseenheid per eenheidsarea.</i> • <i>Dieselfde aantal deeltjies in 'n kleiner volume (oppervlakte) lei tot 'n toename in die aantal botsings per eenheid volume (oppervlakte)</i> • <i>Meer botsings per eenheid volume (oppervlakte) lei tot 'n toename in druk.</i> 	(3)
4.2.1	Experiment 2. ✓ <ul style="list-style-type: none"> • The product of pressure and volume (pV) is higher for the same amount of gas. ✓ • $pV \propto T$ ✓ Eksperiment 2. <ul style="list-style-type: none"> • <i>Die produk van druk en volume (pV) is hoër vir dieselfde hoeveelheid gas.</i> • $pV \propto T$ 	(3)
4.2.2	<ul style="list-style-type: none"> • The intermolecular forces thus increase and the gas liquifies. ✓ • The volume becomes constant at extreme pressure. ✓ • <i>Die intermolekulêre kragte neem dus toe en die gas word 'n vloeistof.</i> • <i>Die volume word konstant by uiterste druk.</i> 	(2)
4.3.1	Guy-Lussac (law/ wet) ✓	(1)

4.3.2	$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2} \checkmark$ $\frac{(101)}{(25+273)} \checkmark = \frac{p_2}{(60+273)} \checkmark \quad (V_1=V_2)$ $p_2 = 112,86 \text{ kPa} \checkmark$	(4)
4.3.3	100 °C ✓ or/of 373 K	(1)
		[18]
QUESTION 5/VRAAG 5		
5.1	Ideal ✓ (gas) <i>Ideale (gas)</i>	(1)
5.2	$pV = nRT \checkmark$ $(100 \times 10^3)(31,98) \checkmark = n (8,31)(23 + 273) \checkmark$ $n = 1300,12 \text{ mol}$ $M = m/n \checkmark$ $M = (2600)/(1300,12) \checkmark$ $M = 2 \text{ g} \cdot \text{mol}^{-1} \checkmark$ $\text{H}_2 \checkmark$	(7)
		[8]

QUESTION 6/VRAAG 6		
6.1	Minimum energy required to start a chemical reaction ✓✓ <i>Minimum energie benodig om 'n chemiese reaksie te begin.</i>	(2)
6.2	Exothermic ✓ The total potential energy of the products is less than the total potential energy of the reactants. ✓ OR More energy is released than the energy taken in. OR The heat of the reaction is less than zero/negative. <i>Eksotermies</i> <i>Die totale potensiële energie van die produkte is minder as die totale potensiële energie van die reaktante</i> OF <i>Meer energie word vrygestel as die energie wat ingeneem word</i> OF <i>Die reaksiewarmte is minder as nul / negatief.</i>	(2)
6.3	679,1 kJ·mol ⁻¹ ✓ The energy needed to break all the bonds ✓✓ / Activation energy <i>Die energie wat benodig word om al die bindings te breek /</i> <i>Aktiveringsenergie</i>	(3)
6.4	Bond formation/ <i>Bindingsvorming</i> = 184,7 + 679,1 ✓ Bond formation/ <i>Bindingsvorming</i> = 863,8 kJ·mol ⁻¹ 863,8 kJ·mol ⁻¹ is the energy released for two HCl molecules/ <i>is die energie wat vrygestel word vir twee HCl- molekules</i> Bond energy for each/ <i>Bindingsenergie vir elke HCl</i> = 863,8 / 2 ✓ Bond energy for each/ <i>Bindingsenergie vir elke HCl</i> = 431,9 kJ·mol ⁻¹ ✓	(3)
6.5	No effect. ✓ Catalyst only has an effect on the activation energy and no effect on the heat of the reaction ✓ <i>Geen effek.</i> <i>Katalisator het slegs 'n invloed op die aktiveringsenergie en het geen invloed op die hitte van die reaksie nie.</i>	(2)
		[12]

QUESTION 7/VRAAG 7					
7.1	<p>OPTION 1/ OPSIE 1</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; border-right: 1px solid black; padding: 5px;"> $n = \frac{m}{M} \checkmark$ $n = \frac{11,79}{12} \checkmark$ $n = 0,9825 \text{ mol}$ </td> <td style="width: 33%; border-right: 1px solid black; padding: 5px;"> $n = \frac{m}{M}$ $n = \frac{69,57}{35,5} \checkmark$ $n = 1,9597 \text{ mol}$ </td> <td style="width: 33%; padding: 5px;"> $n = \frac{m}{M}$ $n = \frac{18,64}{19} \checkmark$ $n = 0,9811 \text{ mol}$ </td> </tr> </table> <p> $\frac{0,9825}{0,9811} = \frac{1,9597}{0,9811} = \frac{0,9811}{0,9811} \checkmark$ </p> <p> Ratio/Verhouding = 1:2:1 Empirical formula/ Empiriese formule: CCl_2F Relative formula mass/ Relatiewe formulemassa = $12 + 2(35,5) + 19 = 102$ Ratio/Verhouding = $204/102 = 2 \checkmark$ Molecular formula/ Molekulêre formule: $\text{C}_2\text{Cl}_4\text{F}_2 \checkmark$ (Order of elements not important/ Volgorde van elemente nie belangrik nie) </p>	$n = \frac{m}{M} \checkmark$ $n = \frac{11,79}{12} \checkmark$ $n = 0,9825 \text{ mol}$	$n = \frac{m}{M}$ $n = \frac{69,57}{35,5} \checkmark$ $n = 1,9597 \text{ mol}$	$n = \frac{m}{M}$ $n = \frac{18,64}{19} \checkmark$ $n = 0,9811 \text{ mol}$	
$n = \frac{m}{M} \checkmark$ $n = \frac{11,79}{12} \checkmark$ $n = 0,9825 \text{ mol}$	$n = \frac{m}{M}$ $n = \frac{69,57}{35,5} \checkmark$ $n = 1,9597 \text{ mol}$	$n = \frac{m}{M}$ $n = \frac{18,64}{19} \checkmark$ $n = 0,9811 \text{ mol}$			
	<p>OPTION 2/OPSIE 2</p> <p> $m(\text{C}) = 204 \times \frac{11,79}{100} \checkmark = 24,05 \text{ g}$ $m(\text{Cl}) = 204 \times \frac{69,57}{100} \checkmark = 141,92 \text{ g}$ $m(\text{F}) = 204 \times \frac{18,64}{100} \checkmark = 38,03 \text{ g}$ </p> <p> $n(\text{C}) = \frac{24,05}{12} = 2 \text{ mol} \checkmark$ $n(\text{Cl}) = \frac{141,92}{35,5} = 4 \text{ mol} \checkmark$ $n(\text{F}) = \frac{38,03}{19} = 2 \text{ mol} \checkmark$ </p> <p> Molecular formula/ Molekulêre formule: $\text{C}_2\text{Cl}_4\text{F}_2 \checkmark$ (Order of elements not important/ Volgorde van elemente nie belangrik nie) </p>	(7)			
7.2.1	<p>Limiting reagent is the substance that is completely used up during a chemical reaction $\checkmark \checkmark$</p> <p><i>Die beperkende reagens is die stof wat tydens 'n chemiese reaksie volledig opgebruik word.</i></p>	(2)			

7.2.2	$n(\text{Li}) = \frac{m}{M} \checkmark$ $n(\text{Li}) = \frac{12,3}{7} \checkmark$ $n(\text{Li}) = 1,76 \text{ mol}$	$n(\text{N}_2) = \frac{m}{M}$ $n(\text{N}_2) = \frac{33,6}{28} \checkmark$ $n(\text{N}_2) = 1,20 \text{ mol}$	
	<p>Stoichiometri ratio = $\frac{6 \text{ mol Li}}{1 \text{ mol N}_2} \checkmark$</p> <p>Available ratio = $\frac{1,76}{1,2} = \frac{1,47}{1} \checkmark$</p> <p>Therefore Li is limiting reagent \checkmark <i>Daarom is Li die beperkende reagens</i></p>	<p>n(N₂) required if ALL 1,76 mol of Li react. <i>n (N₂) benodig as AL 1,76 mol Li reageer</i></p> <p>$n(\text{N}_2) = 1,76 \times \frac{1}{6} = 0,29 \text{ mol} \checkmark$ <i>required/benodig</i></p> <p>1,2 mol is available \checkmark <i>1,2 mol is beskikbaar</i></p> <p>Therefore Li is the limiting reagent \checkmark <i>Daarom is Li die beperkende reagens</i></p> <hr/> <p>\checkmarkn(Li) required if ALL 1,20 mol of N₂ react. <i>n(Li) benodig as AL 1,20 mol N₂ reageer</i></p> <p>$n(\text{Li}) = 1,20 \times \frac{6}{1} = 7,2 \text{ mol} \checkmark$ <i>required/benodig</i></p> <p>Only 1,76 mol is available \checkmark <i>Slegs 1,76 mol is beskikbaar</i></p> <p>Therefore Li is the limiting reagent \checkmark <i>Daarom is Li die beperkende reagens</i></p>	(6)
	Positive marking from 7.2.2/ Positiewe nasien vanaf 7.2.2		
7.2.3	<p>Theoretical yield/Teoretiese opbrengs $n(\text{Li}) : n(\text{Li}_3\text{N})$ $6 : 2 \checkmark$</p> <p>$n(\text{Li}_3\text{N}) = 1,76 \times \frac{2}{6} \checkmark$ $n(\text{Li}_3\text{N}) = 0,59 \text{ mol}$</p> <p>$n = \frac{m}{M}$ $0,59 = \frac{m}{35} \checkmark$ $m = 20,65 \text{ g}$</p> <p>$\% \text{yield/opbrengs} = \frac{5,89}{20,65} \times 100 \% \checkmark$ $\% \text{yield/ opbrengs} = 28,52 \% \checkmark$</p>		(5)
			[20]

QUESTION 8/VRAAG 8		
8.1.1	Acid is a substance that donates protons (H ⁺) <i>'n Suur is 'n stof wat protone (H⁺) skenk</i>	(2)
8.1.2	Base. ✓ It <u>accepts protons</u> (H ⁺) in both reactions ✓ <i>Basis.</i> <i>Dit <u>aanvaar protone (H⁺)</u> in albei reaksies</i>	(2)
8.1.3	HSO ₄ ⁻ ✓✓	(2)
8.1.4	H ₂ SO ₄ + 2 NaHCO ₃ ✓ → Na ₂ SO ₄ + 2 H ₂ O + 2 CO ₂ ✓ (✓ Balanced/ <i>Gebalanseerd</i>) <i>Accept/Aanvaar</i> H ₂ SO ₄ + NaHCO ₃ → NaHSO ₄ + H ₂ O + CO ₂	(3)
8.2.1	A standard solution is a solution of which the <u>concentration is exactly known</u> . ✓✓ <i>'n Standaardoplossing is 'n oplossing waarvan die <u>konsentrasie presies bekend is</u>.</i>	(2)
8.2.2	Reaction 2/ <i>Reaksie 2</i> n(NaOH) = cv ✓ n(NaOH) = (0,968)(0,025) ✓ n(NaOH) = 0,0242 mol Mole Ratio/ <i>Verhouding</i> CH ₃ COOH : NaOH $1 : 1$ n(CH ₃ COOH) = 0,0242 mol ✓ Original/ <i>Oorspronlik</i> (CH ₃ COOH) n(CH ₃ COOH) = cv n(CH ₃ COOH) = (0,5)(0,25) ✓ n(CH ₃ COOH) = 0,125 mol n(reacted) = 0,125 - 0,0242 ✓ n(reacted) = 0,1008 mol Reaction 1/ <i>Reaksie</i> Mole Ratio CH ₃ COOH : CaCO ₃ $2 : 1 ✓$ n(CaCO ₃) = 0,1008/2 ✓ n(CaCO ₃) = 0,0504 mol m(CaCO ₃) = nM m(CaCO ₃) = (0,0504)(100) ✓ m(CaCO ₃) = 5,04 g % purity / <i>suiwerhede</i> = $\frac{5,04}{56} \times 100\%$ ✓ %purity/ <i>suiwerhede</i> = 9% ✓	(10)
		[21]

QUESTION 9/VRAAG 9		
9.1	Oxidation is the <u>loss in electrons</u> ✓✓ <i>Oksidasie is die <u>verlies in elektrone</u></i>	(2)
9.2	Cl ✓✓	(2)
9.3	Mg ✓ Mg oxidation number increases from 0 ✓ to +2 ✓ <i>Mg oksidasiegetal neem toe vanaf 0 na +2</i>	(3)
9.4	$2 \text{H}^+_{(\text{aq})} + 2 \text{e}^- \rightarrow \text{H}_{2(\text{g})}$ ✓✓	(2)
9.5	6✓ ($\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$) ✓ $14\text{H}^+ \checkmark + \text{Cr}_2\text{O}_7^{2-} + 6\text{e}^- \checkmark \rightarrow 2 \text{Cr}^{3+} \checkmark + 7 \text{H}_2\text{O} \checkmark$ <u>$6 \text{Fe}^{2+} + 14 \text{H}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow 6 \text{Fe}^{3+} + 2 \text{Cr}^{3+} + 7 \text{H}_2\text{O}$</u> ✓	
	<u>Marking guideline/Nasienriglyne</u> <ul style="list-style-type: none"> • Correct oxidation half reaction/ <i>Korrekte oksidasie-halfreaksie</i> • 7 H₂O in the reduction half reaction/<i>reduksie-halfreaksie</i> • 14 H⁺ in the reduction half reaction/<i>reduksie-halfreaksie</i> • 2 Cr³⁺ balancing the Cr³⁺ ions/<i>Balansering van die Cr³⁺ ione</i> • 6e⁻ in reduction half reaction/ <i>reduksie-halfreaksie</i> • ×6 the oxidation half reaction/ <i>oksidasie-halfreaksie</i> • Correct final balanced equation/<i>Korrekte finale gebalanseerde vergelyking</i> 	(7)
		[16]

QUESTION 10/VRAAG 10		
10.1	Witwatersrand ✓	(1)
10.2	Redox reaction ✓ Oxidation number of gold changes from 0 to +1 ✓ OR Oxidation number of oxygen decreases from 0 to -2. <i>Redoksreaksie</i> <i>Oksidasiegetal van goud verander vanaf 0 na +1</i> OF <i>Oksidasiegetal van suurstof verminder vanaf 0 to -2.</i>	(2)
10.3	Zinc ✓✓ <i>Sink</i>	(2)
10.4	Activated carbon ✓✓ <i>Geaktiveerde koolstof</i>	(2)
10.5	Process Z is the smelting process of gold. ✓ Gold has a very high boiling point. ✓ Large amount of energy is needed for gold to change state. ✓ <i>Proses Z is die smeltproses van goud.</i> <i>Goud het 'n baie hoë kookpunt.</i> <i>'n Groot hoeveelheid energie is nodig om die fase van goud te verander.</i>	(3)
		[10]
	TOTAL/TOTAAL:	150