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| **NATIONAL**  **SENIOR CERTIFICATE/**  ***NASIONALE SENIOR SERTIFIKAAT*** | | | | |
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|  | | **GRADE/*GRAAD* 11** |  | |
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| **NOVEMBER 2019** | | | | |
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| **PHYSICAL SCIENCES P2**  ***FISIESE WETENSKAPPE V2***  **(CHEMISTRY/*CHEMIE*)**  **MARKING GUIDELINE/*NASIENRIGLYN*** | | | | |
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| **MARKS/*PUNTE*:** | **150** | | | |
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|  | This marking guideline consists of 11 pages./  *Hierdie nasienriglyn bestaan uit 11 bladsye*. | | |  |

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| **QUESTION 1 / *VRAAG* 1** | | |  |
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| 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]** |
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| **QUESTION 2 / *VRAAG* 2** | | |  |
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| 2.1 | | A group of two or more atoms covalently bonded and it functions as a  unit. ✓✓  *ŉ Groep van twee of meer atome wat kovalent gebind en as ŉ eenheid funksioneer.* | (2) |
|  | |  |  |
| 2.2.1 | | Tetrahedral ✓  *Tetraëdries* | (1) |
|  | |  |  |
| 2.2.2 | | Trigonal bipyramidal ✓  *Trigonaal bipiramidaal* | (1) |
|  | |  |  |
| 2.3.1 | | O F ✓✓  F | (2) |
|  | |  |  |
| 2.3.2 | | H C N ✓✓ | (2) |
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| 2.4 | | The nitrogen (N) atom in NH3 contains a lone pair electrons.  ✓  No lone pair in CCℓ4.  Nitrogen (N) atom in NH3 can donate its lone pair into the vacant orbital of H+✓  *Die stikstof (N) atoom in NH 3 bevat ŉ alleenpaar elektrone.*  *Geen enkelpaar elektrone in CCℓ 4 nie*  *Stikstof (N) atoom in NH 3 kan sy alleenpaar elektrone in die vakante wentelbaan van H +  skenk* | (2) |

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| 2.5 | Polar. ✓   * 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 H2S molecule has an asymmetrical bent/angular shape. ✓   *Polêr.*   * *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 ŉ gedeeltelik negatiewe lading en waterstofatoom het ŉ gedeeltelik positiewe lading.* * *Die H2S-molekule het ŉ asimmetriese buiging / hoekige vorm.* | (4) |
|  |  | **[14]** |
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| **QUESTION 3/*VRAAG 3*** | |  |
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| 3.1 | The temperature at which the vapour pressure of a liquid is equal to the external (atmospheric) pressure. ✓✓  *Die temperatuur waarteen die dampdruk van ŉ vloeistof gelyk is aan die eksterne (atmosferiese) druk.* | (2) |
|  |  |  |
| 3.2 | Boiling point. Accept answers in the range (180 to 190) ✓ (K)  *Kookpunt. Aanvaar antwoorde tussen (180 tot 190)    (K)* | (1) |
|  |  |  |
| 3.3 | * 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 ✓ * *Groep 4 waterstofhidriede het London-/ verspreiding / geïnduseerde-dipool kragte* * *Waterstofhaliede het dipool-dipool kragte* * *Die dipool-dipoolkragte is sterker as die London-/verspreidingskragte/ geïnduseerde-dipool kragte.* * *Meer energie sal benodig word om die dipool-dipool / intermolekulêre kragte in waterstofhaliede te oorkom* | (4) |
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| 3.4 | HF has hydrogen bonds ✓✓  *HF het waterstofbindings* | (2) |
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| 3.5 | GeH4 ✓.It has a lower boiling point. ✓  *GeH4 .Dit het die laagste kookpunt* | (2) |
|  |  | **[11]** |

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| **QUESTION 4/*VRAAG 4*** | |  |
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| 4.1.1 | Boyle’s (law /*wet*) | (1) |
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| 4.1.2 | What effect will a (change in) pressure have on the volume of a fixed amount gas at constant temperature? ✓✓  *Watter effek sal ŉ (verandering in) druk op die volume van ŉ vasgestelde gas by konstante temperatuur hê?* | (2) |
|  |  |  |
| 4.1.3 | Temperature. ✓ *Accept* mass / number of moles of gas  *Temperatuur. Aanvaar massa / aantal mol gas* | (1) |
|  |  |  |
| 4.1.4 | * According to the Kinetic Molecular Theory, the pressure exerted by a gas depends on the number of collisions per unit time per unit area. ✓ * The same number of particles in a smaller volume (area) leads to an increase in the number of collisions per unit volume (area) ✓ * The more collisions per unit volume (area) results in an increase in pressure. ✓ * *Volgens die Kinetiese Molekulêre Teorie hang die druk wat ŉ gas uitoefen af van die aantal botsings per tydseenheid per eenheidsarea.* * *Dieselfde aantal deeltjies in ŉ kleiner volume (oppervlakte) lei tot ŉ toename in die aantal botsings per eenheid volume (oppervlakte)* * *Meer botsings per eenheid volume (oppervlakte) lei tot ŉ toename in druk.* | (3) |
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| 4.2.1 | **Experiment 2**. ✓   * The product of pressure and volume (pV) is higher for the same amount of gas. ✓ * pVT ✓   ***Eksperiment 2****.*   * *Die produk van druk en volume (pV) is hoër vir dieselfde hoeveelheid gas.* * pVT | (3) |
|  |  |  |
| 4.2.2 | * The intermolecular forces thus increase and the gas liquifies. ✓ * The volume becomes constant at extreme pressure. ✓ * *Die intermolekulêre kragte neem dus toe en die gas word 'n vloeistof.* * *Die volume word konstant by uiterste druk.* | (2) |
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| 4.3.1 | Guy-Lussac (law/ *wet*) ✓ | (1) |

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| 4.3.2 | ✓  ✓ (V1 =V2)  = 112,86 kPa ✓ | (4) |
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| 4.3.3 | 100 °C✓ or/*of* 373 K | (1) |
|  |  | **[18]** |
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| **QUESTION 5/*VRAAG 5*** | |  |
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| 5.1 | Ideal ✓ (gas)  *Ideale (gas)* | (1) |
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| 5.2 | pV = nRT ✓  (100103)(31,98) ✓ = n (8,31)(23 + 273) ✓  n = 1300,12 mol  M = m/n✓  M = (2600)/(1300,12) ✓  M = 2 g·mol-1 ✓  H2 ✓ | (7) |
|  |  | **[8]** |

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| **QUESTION 6/*VRAAG 6*** | |  |
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| 6.1 | Minimum energy required to start a chemical reaction ✓✓  *Minimum energie benodig om ŉ chemiese reaksie te begin.* | (2) |
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| 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.  *Eksotermies*  *Die totale potensiële energie van die produkte is minder as die totale potensiële energie van die reaktante*  ***OF***  *Meer energie word vrygestel as die energie wat ingeneem word*  ***OF***  *Die reaksiewarmte is minder as nul / negatief.* | (2) |
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| 6.3 | 679,1 kJ·mol-1 ✓  The energy needed to break all the bonds✓✓ / Activation energy  *Die energie wat benodig word om al die bindings te breek / Aktiveringsenergie* | (3) |
|  |  |  |
| 6.4 | Bond formation*/Bindingsvorming* = 184,7 + 679,1✓  Bond formation*/Bindingsvorming* = 863,8 kJ·mol-1  863,8 kJ·mol-1 is the energy released for two HCℓ molecules/*is die energie wat vrygestel word vir twee HCℓ- molekules*  Bond energy for each/ *Bindingsenergie vir elke* HCℓ = 863,8 / 2 ✓  Bond energy for each/ *Bindingsenergie vir elke* HCℓ = 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 ✓  *Geen effek.*  *Katalisator het slegs ŉ invloed op die aktiveringsenergie en het geen invloed op die hitte van die reaksie nie.* | (2) |
|  |  | **[12]** |

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| **QUESTION 7/*VRAAG 7*** | | | |  |
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| 7.1 | **OPTION 1/ *OPSIE 1*** | | | (7) |
| ✓  ✓ | ✓ | ✓ |
| ✓  Ratio/*Verhouding* = 1:2:1  Empirical formula/ *Empiriese formule*: CCℓ2F  Relative formula mass/ *Relatiewe formulemassa* = 12 +2(35,5) + 19 = 102  Ratio/*Verhouding* = 204/102 = 2✓  Molecular formula/ *Molekulêre formule*: C2Cℓ4F2✓(Order of elements not important/ *Volgorde van elemente nie belangrik nie*) | | |
|  | | |
| **OPTION 2/*OPSIE 2*** | | |
| m(C) = ✓= 24,05 g  m(Cℓ)= = 141,92 g  m(F) = ✓= 38,03 g  n(C) = = 2 mol✓  n(Cℓ) = = 4 mol✓  n(F) = = 2 mol✓  Molecular formula/ *Molekulêre formule*: C2Cℓ4F2✓ (Order of elements not important/*Volgorde van elemente nie belangrik nie*) | | |
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| 7.2.1 | Limiting reagent is the substance that is completely used up during a chemical reaction ✓✓  *Die beperkende reagens is die stof wat tydens ŉ chemiese reaksie volledig opgebruik word.* | | | (2) |

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| 7.2.2 | ✓  ✓ | | (6) |
| Stoichiometri ratio = ✓  Available ratio = ✓  Therefore Li is limiting reagent✓  *Daarom is Li die beperkende reagens* | n(N2) required if ALL 1,76 mol of Li react.  *n (N2) benodig as AL 1,76 mol Li reageer*  n(N2) =✓ required/*benodig*  1,2 mol is available ✓  *1,2 mol is beskikbaar*  Therefore Li is the limiting reagent ✓  *Daarom is Li die beperkende reagens* |
| n(Li) required if ALL 1,20 mol of N2 react.  n(N2) = ✓ required/*benodig*  Only 1,76 mol is available ✓  Therefore Li is the limiting reagent ✓  *Slegs 1,76 mol is beskikbaar*  *Daarom is Li die beperkende reagens* |
|  |  | |  |
|  | **Positive marking from 7.2.2/ *Positiewe nasien vanaf 7.2.2*** | |  |
| 7.2.3 | Theoretical yield/*Teoretiese opbrengs*  n(Li) : n (Li3N)  6 : 2 ✓  n(Li3N) = ✓  n(Li3N) = 0,59 mol  ✓  m = 20,65 g  %yield/*opbrengs* = ✓  %yield/ *opbrengs* = 28,52 % ✓ | | (5) |
|  |  | | **[20]** |

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| **QUESTION 8/*VRAAG 8*** | |  |
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| 8.1.1 | Acid is a substance that donates protons (H+)  *‘n Suur is ‘n stof wat protone (H+) skenk* | (2) |
|  |  |  |
| 8.1.2 | Base. ✓  It accepts protons (H+) in both reactions ✓  *Basis.*  *Dit aanvaar protone (H + ) in albei reaksies* | (2) |
|  |  |  |
| 8.1.3 | HSO4-✓✓ | (2) |
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| 8.1.4 | H2SO4 + 2 NaHCO3 ✓→ Na2SO4 + 2 H2O + 2 CO2 ✓ (✓ Balanced/ *Gebalanseerd*)  *Accept/Aanvaar* H2SO4 + NaHCO3 → NaHSO4 + H2O + CO2 | (3) |
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| 8.2.1 | A standard solution is a solution of which the concentration is exactly  known. ✓✓  *ŉ Standaardoplossing is ŉ oplossing waarvan die konsentrasie presies bekend is .* | (2) |
|  |  |  |
| 8.2.2 | Reaction 2/ *Reaksie 2*  n(NaOH) = cv ✓  n(NaOH) = (0,968)(0,025) ✓  n(NaOH) = 0,0242 mol  Mole Ratio/*Verhouding* CH3COOH : NaOH  1 : 1  n(CH3COOH) = 0,0242 mol ✓  Original/*Oorspronlik* (CH3COOH)  n(CH3COOH) = cv  n(CH3COOH) = (0,5)(0,25) ✓  n(CH3COOH) =0,125 mol  n(reacted) = 0,125-0,0242 ✓  n(reacted) = 0,1008 mol  Reaction 1/*Reaksie*  Mole Ratio CH3COOH : CaCO3  2 : 1 ✓  n(CaCO3) = 0,1008/2✓  n(CaCO3) = 0,0504 mol  m(CaCO3) = nM  m(CaCO3) = (0,0504)(100) ✓  m(CaCO3) = 5,04 g  % purity / *suiwerhede*= ✓  %purity/ *suiwerhede* = 9%✓ | (10) |
|  |  | **[21]** |

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| **QUESTION 9/*VRAAG 9*** | |  |
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| 9.1 | Oxidation is the loss in electrons ✓✓ *Oksidasie is die verlies in elektrone* | (2) |
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| 9.2 | W Cℓ- ✓✓ | (2) |
|  |  |  |
| 9.3 | Mg ✓  Mg oxidation number increases from 0 ✓ to +2 ✓  *Mg oksidasiegetal neem toe vanaf 0 na +2* | (3) |
|  |  |  |
| 9.4 | 2 H+(aq) + 2 e- → H2 (g) ✓✓ | (2) |
|  |  |  |
| 9.5 | 6✓ (Fe2+ → Fe3+ + e-) ✓  14H+✓+ Cr2O72- + 6e- ✓→ 2 Cr3+✓ + 7 H2O ✓  6 Fe2+ + 14 H+ + Cr2O72- → 6 Fe3+ + 2 Cr3+ + 7 H2O ✓ |  |
|  | **Marking guideline/*Nasienriglyne***   * Correct oxidation half reaction/ *Korrekte oksidasie-halfreaksie* * 7 H2O in the reduction half reaction/*reduksie-halfreaksie* * 14 H+ in the reduction half reaction/*reduksie-halfreaksie* * 2 Cr3+ balancing the Cr3+ ions/*Balansering van die Cr3+ ione* * 6e- in reduction half reaction/ *reduksie-halfreaksie* * 6 the oxidation half reaction/ *oksidasie-halfreaksie* * Correct final balanced equation/*Korrekte finale gebalanseerde vergelyking* | (7) |
|  |  | **[16]** |

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| **QUESTION 10/*VRAAG 10*** | |  |
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| 10.1 | Witwatersrand ✓ | (1) |
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| 10.2 | Redox reaction ✓  Oxidation number of gold changes from 0 to +1 ✓  **OR**  Oxidation number of oxygen decreases from 0 to -2.  *Redoksreaksie*  *Oksidasiegetal van goud verander vanaf 0 na +1*  ***OF***  *Oksidasiegetal van suurstof verminder vanaf 0 to -2.* | (2) |
|  |  |  |
| 10.3 | Zinc ✓✓  *Sink* | (2) |
|  |  |  |
| 10.4 | Activated carbon ✓✓  *Geaktiveerde koolstof* | (2) |
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| 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. ✓  *Proses Z is die smeltproses van goud.*  *Goud het ŉ baie hoë kookpunt.*  *ŉ Groot hoeveelheid energie is nodig om die fase van goud te verander.* | (3) |
|  |  | **[10]** |
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|  | **TOTAL/*TOTAAL:*** | **150** |