HILLCREST HIGH SCHOOL

PHYSICAL SCIENCE

GRADE 11

PAPER 2- Chemistry

NOVEMBER 2021 MEMO

TIME: 2 HRS

Total 100

Section A

Question 1

1.1 B

1.2 C

1.3 B

1.4 C

1.5 C

1.6 B

[12]

Question 2

2.1	Limiting reagent is the substance that is completely used up during a chemical reaction ✓✓ *Die beperkende reagens is die stof wat tydens 'n chemiese reaksie volledig opgebruik word.*		(2)
2.2	Lithium nitride		(1)
2.3	$n(Li) = \frac{m}{M}$ ✓ $n(Li) = \frac{12,3}{7}$ ✓ $n(Li) = 1,76\ mol$	$n(N_2) = \frac{m}{M}$ $n(N_2) = \frac{33,6}{28}$ ✓ $n(N_2) = 1,20\ mol$	
	Stoichiometri ratio = $\frac{6\ mol\ Li}{1\ mol\ N_2}$ ✓ Available ratio = $\frac{1,76}{1,2} = \frac{1,47}{1}$ ✓ Therefore Li is limiting reagent ✓ *Daarom is Li die beperkende reagens*	$n(N_2)$ required if ALL 1,76 mol of Li react. *n (N_2) benodig as AL 1,76 mol Li reageer* $n(N_2) = 1,76 \times \frac{1}{6} = 0,29\ mol$ ✓ 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 N_2 react. $n(N_2) = 1,20 \times \frac{6}{1} = 7,2\ mol$ ✓ required/*benodig*	(6)

		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 2.3		
2.4	Theoretical yield/*Teoretiese opbrengs* n(Li) : n (Li_3N) 6 : 2 ✓ $n(Li_3N) = 1{,}76 \times \frac{2}{6}$ ✓ $n(Li_3N) = 0{,}59$ mol $n = \frac{m}{M}$ $0{,}59 = \frac{m}{35}$ ✓ m = 20,65 g %yield/*opbrengs* = $\frac{5{,}89}{20{,}65} \times 100\ \%$ ✓ %yield/ *opbrengs* = 28,52 % ✓		(5)
			[14]

Question 3

3.1 Increase ✓the concentration of sulphuric acid ✓

Increase ✓surface area of phosphate rock ✓

Decrease particle size of phosphate rock √

Any ONE fact, including INCREASE for one mark only (1)

3.2 The shaded areas in the distribution curves represent the number of molecules with sufficient kinetic energy to overcome the activation energy ✓. An increase in the temperature of the system results in a greater number of particles with sufficient kinetic energy to overcome the activation energy of the reaction ✓. This results in more effective collisions per unit time OR a higher chance of an effective collision occurring, resulting in a higher reaction rate (2)

3.3.1 Change in concentration of products/ reactants✓ per (unit) time✓
Verandering in konsentrasie van produkte/reaktante per tydseenheid (2)

OR/OF

Change in amount/number of moles/volume/mass of products or reactants per (unit) time
Verandering in die hoeveelheid/aantal mol/volume/massa van produkte/reaktante per tydseenheid

3.3.2 Average rate $= -\frac{\Delta [H_2O_2]}{\Delta t}$

$= -\frac{0.0131-0,020}{400-(0)}$ ✓ ✓

$= 1,73 \times 10^{-5}$ mol·dm^{-3} s^{-1}✓ (3)

MARK ALLOCATION/*PUNTETOEKENNING*

- $c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$ or/*of* $n = \frac{m}{M}$ ✓
- Substitute/*vervang* (0,0200 – 0,0106) and/en 50 x 10^3 ✓
- $n(O_2) = ½(H_2O_2)$ ✓
- Using/*gebruik* M = 32 in m = Mn or/*of* n = cMV or/*of* ratio calculation/*verhouding berekening* ✓
- Answer/*antwoord:* 7,52 x 10^{-3} g/ 0,008 g/ 0,01 g ✓

3.3.3

OPTION 1/*OPSIE 1*

$c = \frac{n}{V}$ ✓

$(0{,}0200 - 0{,}0106) = \frac{n}{50 \times 10^{-3}}$ ✓

$n(O_2) = 1/2\ n(H_2O_2) = 1/2(4{,}7 \times 10^{-4})$ ✓

$= 2{,}35 \times 10^{-4}$ mol

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

$2{,}35 \times 10^{-4} = m/32$ ✓

$m = 7{,}52 \times 10^{-3}$ g ✓

OPTION 2/*OPSIE 2*

$\Delta c\ [H_2O_2] = 0{,}0200 - 0{,}0106$

$= 0{,}094$

$\Delta c(O_2) = 1/2(H_2O_2)$

$= 1/2(0{,}0094)$ ✓

$= 0{,}0047$ ✓

$C = \frac{m}{MV}$ ✓

$\Delta m(O_2) = cMV$

$= (0{,}0047)(32)$ ✓ (50×10^{-3})

$= 7{,}52 \times 10^{-3}$ g

$= 0{,}008$ g

$= 0.01$ g✓ (5)

[13]

Question 4

4.1.1 $2HNO_3 + Na_2CO_3$✓ → $2NaNO_3$✓ + $CO_2 + H_2O$✓ ✓(balancing) **(4)**

4.1.2 Equivalence point ✓ **(1)**

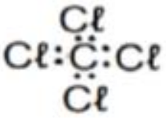
4.1.3 methyl orange (**not phenolphthalein**) ✓ **(1)**

4.2.1	Base. ✓	(1)
4.2.2	HSO_4^-✓	(1)
4.3.1	A standard solution is a solution of which the <u>concentration is</u> exactly <u>known</u>. ✓✓ *'n Standaardoplossing is 'n oplossing waarvan die <u>konsentrasie</u> presies <u>bekend is</u> .*	(2)

4.3.2

CaCO3	Excess 2CH3COOH	
Step 5 0,1008 mol ÷ 2 x 1✓ = 0,0504 mol Step 6 m = n.M✓ = 0,0504 (100) ✓ = 5,04 g Step 7 % purity = $\frac{pure}{Total}$ x 100 = $\frac{5,04}{56}$ x 100✓ = 9%✓	C = 0,5 V = 0,25 dm^3 Step 3 n = c.V = 0,5(0,25) ✓ = 0,125 mol *Remember that you can not do mole ratio with amounts that are in excess (or amounts are impure) Step 4 Reacted amount = Given – left over = 0,125 – 0,0242✓ = 0,1008 mol	
NaOH	CH3COOH	
V = 0,025 dm3 C =0,968 **Step 1** n = c.V✓ = 0,968(0,025) ✓ = 0,0242 mol	Step 2 This is now the left over from reaction 1 0,0242 ÷ 1 x 1 ✓ = 0,0242 mol	

Question 5

5.1  ✓✓

(2)

5.2 **CCl_4:** tetrahedral ✓ (2)

5.3 Van der Waals, London forces✓ (1)

5.4 CH_4 ✓ and CO_2 ✓ (2)

5.5 NH_3 ✓ (1)

5.6.1 Energy absorbed = (4 x 413) ✓ + 2(1 x 498) ✓ = 2648 $kJ.mol^{-1}$

Energy released = (2 x 804) ✓+ (2 x 2 x 463) ✓ = 3460 $kJ.mol^{-1}$

Since Energy released > Energy absorbed✓
Net energy is released in this reaction ✓ (6)

5.6.2 540 $kJ.mol^{-1}$✓

Question 6

6.1 $P \propto \frac{1}{V}$ ✓ (1)

6.2 Temperature ✓ and amount of gas ✓ ONE mark for either of these answers (1)

6.3 $P_1 = 100$ kPa ; $\frac{1}{V_1} = x$ dm^{-3}

$P_2 = 120$ kPa ; $\frac{1}{V_2} = 3,5$ dm^{-3} $\therefore V_2 = \frac{1}{3,5} = 0,29\ dm^3$

$$P_1V_1 = P_2V_2 \checkmark$$

$$100 \checkmark \times V_1 = 120 \checkmark \times 0,29 \checkmark$$

$$\therefore V_1 = 0,35 \text{ dm}^3 \checkmark$$

$$x = \frac{1}{V_1} = \frac{1}{0,35} = 2,86 \text{ dm}^{-3} \checkmark$$

(6)

[8]

Question 7

7.1 Oxidation is the loss of electrons. √ (1)

7.2 SO_2 : +4 √

SO_3 : +6 √ (2)

.3 Reducing agent. √ (1)

[4]

Question 8

8.1 Mg^{2+} √ (1)

8.2 $Pb^{2+}_{(aq)} + 2e^- \rightarrow Pb_{(s)}$ **(2)**

8.3 $E^o_{cell} = E^o_{cathode} - E^o_{anode}$ √ $= -0.13$ √ $- (-2.36)$ √ $= 2.23V$ √ **(4)**

8.4 Maintain electrical neutrality / complete the circuit √ (1)

8.5 Chemical energy to electrical energy √ (1)

[9]

Question 9

9.1 - no salt bridge

- only one container, not two
- battery instead of voltmeter
- only one electrolyte solution √√ (any TWO) (2)

9.2 negative √ (1)

9.3 A solution / liquid / / dissolved substance that conducts electricity through the movement of ions. / *'n Oplossing / vloeistof /opgeloste stof wat elektrisiteit gelei deur die beweging van ione.* ✓✓ (2)

9.4 Ag (1)

[6]

Total 100