DEPARTMENT OF EDUCATION
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PROVINSIALE VOORBEREIDENDE EKSAMEN/ PROVINCIAL PREPARATORY EXAMINATION

GRAAD/GRADE 12

FISIESE WETENSKAPPE/PHYSICAL SCIENCES

VRAESTEL/PAPER 2

CHEMIE/CHEMISTRY

SEPTEMBER 2024

PUNTE/MARKS: 150

TYD/TIME: 3 uur/hours

Hierdie vraestel bestaan uit 15 bladsye en 4 gegewensblaaie./ This question paper consists of 15 pages and 4 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name on the ANSWER BOOK.
2. This question paper consists of NINE questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your FINAL numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions, etc. where required.
11. You are advised to use the attached DATA SHEETS.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g. 1.11 E.

1.1 Which ONE of the following compounds is a ketone?

A $CH_3COCH_2CH_3$

B $CH_3COOCH_2CH_3$

C $CH_3CH_2CH_2CHO$

D $CH_3CH(OH)CH_2CH_3$ (2)

1.2 Consider the flow diagram below that represents an organic reaction:

Compound **X** $\xrightarrow{HBr}$ 2-bromo-3-methylbutane

The IUPAC name of compound **X** is:

A 2-methylbutane

B 3-methylbutane

C 2-methylbut-3-ene

D 3-methylbut-2-ene (2)

1.3 Which ONE of the following pairs of reactants can be used to prepare ethyl propanoate in the laboratory?

A Ethane and propanoic acid

B Propanol and ethanoic acid

C Ethanol and propanoic acid

D Ethene and propanol (2)

1.4 Which ONE of the following compounds will enable butan-2-ol to undergo an elimination reaction?

A Concentrated HCℓ

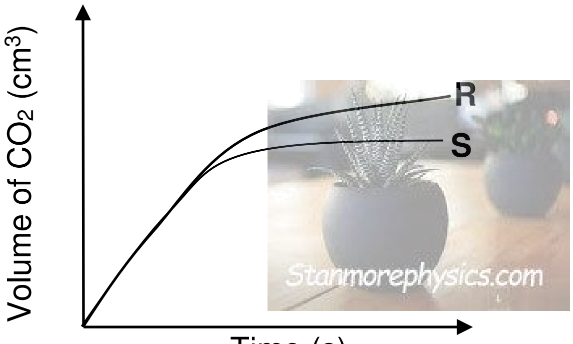
B Concentrated H_2SO_4

C Diluted HNO_3

D Diluted NaOH (2)

1.5 When zinc (II) carbonate reacts with excess hydrochloric acid, carbon dioxide is produced.

The graphs below were obtained under two different reaction conditions.



The change in the graph from **S** to **R** could be brought about by …

A decreasing the concentration of the acid.

B increasing the mass of the zinc (II) carbonate.

C decreasing the particle size of the zinc (II) carbonate.

D adding a catalyst. (2)

1.6 The reaction represented by the balanced equation below reaches equilibrium in a closed container.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g) \qquad \Delta H < 0$$

How will the equilibrium be affected if the volume of the container is increased at constant temperature and then the temperature is increased at constant volume?

	EFFECT OF INCREASE IN VOLUME	**EFFECT OF INCREASE IN TEMPERATURE**
A	No effect	Reverse reaction is favoured
B	Reverse reaction is favoured	Reverse reaction is favoured
C	No effect	Forward reaction is favoured
D	Reverse reaction is favoured	Forward reaction is favoured

(2)

1.7 Nitric acid is titrated with an ammonium hydroxide solution.

The EQUIVALENCE POINT is the point in the titration where …

A the concentration of the indicator changes.

B $n_{acid} = n_{base}$.

C $[H_3O^+] = [OH^-]$.

D the pH = 7. (2)

1.8 Consider the equation:

$$H_2O + \mathbf{A} \rightarrow OH^- + H_2SO_4$$

The reactant **A** represents a/an:

A base having the formula HSO_4^-

B acid having the formula HSO_4^-

C base having the formula SO_4^{2-}

D acid having the formula SO_4^{2-} (2)

1.9 Consider the following chemical reactions:

REACTION **X**: $Pb(s) \rightarrow Pb^{2+}(aq) + 2e^-$

REACTION **Y**: $4H^+(aq) + O_2(g) + 4e^- \rightarrow 2H_2O(\ell)$

Which ONE of the following combinations is CORRECT for reaction **X** and **Y**?

	REACTION X	**REACTION Y**
A	Pb is reduced	O_2 is oxidised
B	Pb is oxidised	H^+ is reduced
C	Pb is oxidised	O_2 is reduced
D	Pb is reduced	H^+ is oxidised

(2)

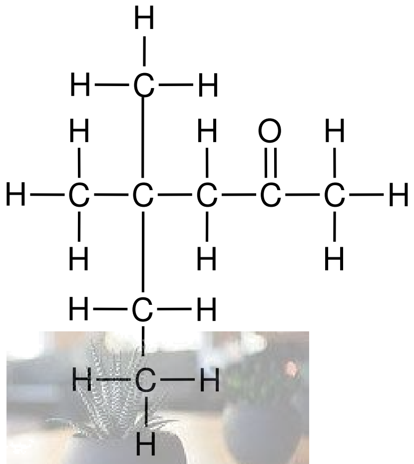
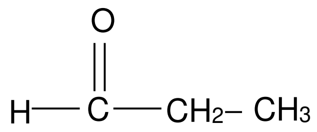
1.10 Which ONE of the following CORRECTLY shows the gases produced at the different electrodes during the electrolysis of a concentrated solution of sodium chloride?

	CATHODE	**ANODE**
A	Hydrogen gas	Chlorine gas
B	Chlorine gas	Water vapour
C	Oxygen gas	Chlorine gas
D	Chlorine gas	Hydrogen gas

(2)
[20]

QUESTION 2 (Start on a new page.)

The letters **A** to **F** in the table below represent six organic compounds.

A	$CH_3CH_2COOCH_3$	**D**	$CH_3CHCHCH_2CH_3$
B		**E**	
C	2-fluoro-3,4-dimethylhexane	**F**	Butanoic acid

Write down the:

2.1 LETTER of the compound that belongs to the halo-alkanes (1)

2.2 STRUCTURAL FORMULA of the functional group of compound **F** (1)

2.3 LETTER of the compound that represents an unsaturated hydrocarbon (1)

2.4 NAME of the functional group of compound **E** (1)

2.5 NAME of the inorganic acid needed to prepare compound **A** (1)

2.6 LETTER of the compound that represents an aldehyde (1)

2.7 Empirical formula of compound **A** (1)

2.8 STRUCTURAL FORMULA of compound **C** (3)

2.9 IUPAC NAME of compound **B** (2)

2.10 LETTERS of the compounds that are FUNCTIONAL isomers of each other (1)
[13]

QUESTION 3 (Start on a new page.)

An investigation was carried out to determine the relationship between the boiling point of different alkanes and one of their structural isomers.

The results obtained are shown in the table below:

	NAME	BOILING POINT (°C)		ISOMER	BOILING POINT (°C)
A	ethane	-88,5			
B	butane	-1	**E**	methyl propane	-12
C	pentane	34	**F**	2-methylbutane	28
D	hexane	68,7	**G**	2,3-dimethylbutane	58

3.1 Define the term *structural isomer.* (2)

3.2 What TYPE of isomerism is used during this investigation? (1)

3.3 Explain the difference in boiling points between butane and its isomer methyl propane. (3)

3.4 Consider compounds **A** to **D**.

For this part of the investigation, write down the:

3.4.1 Control variable (1)

3.4.2 Independent variable (1)

3.4.3 Which ONE of compounds **A** to **D** has the highest vapour pressure?

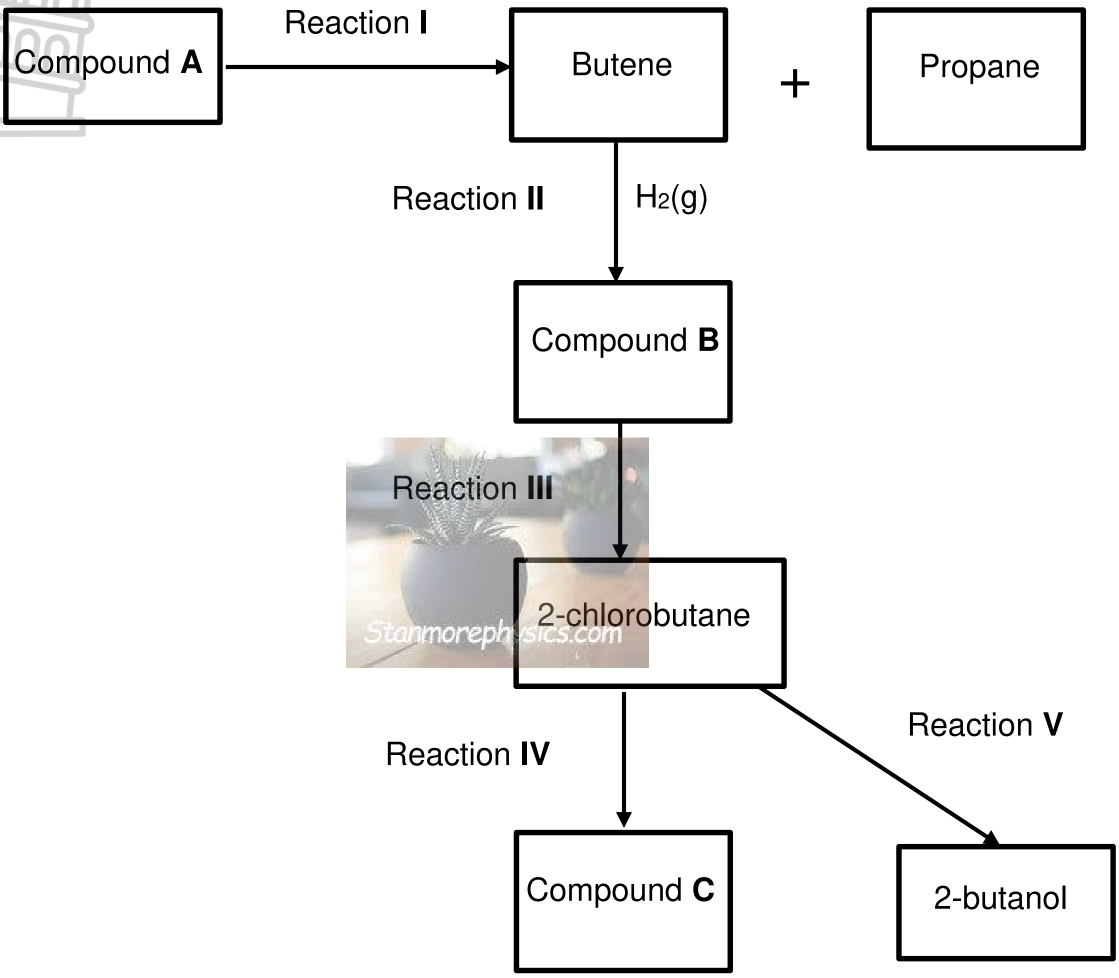
Explain the answer by referring to the intermolecular forces and the energy. (3)

3.5 Write down a conclusion for this investigation. (2)

3.6 Use molecular formulae to write down a balanced chemical equation for the combustion of pentane. (3)
[16]

QUESTION 4 (Start on a new page.)

Study the flow diagram of various organic reactions and answer the questions that follow.



4.1 For reaction **I**, write down the:

4.1.1 TYPE of the reaction (1)

4.1.2 IUPAC NAME of compound **A** (2)

4.2 Consider reaction **II** and write down the:

4.2.1 TYPE of the reaction (1)

4.2.2 IUPAC NAME of organic compound **B** (1)

4.2.3 NAME of a suitable catalyst (1)

4.3 Write down the TYPE of reaction represented by reaction **III**. (1)

4.4 Reaction **IV** is an elimination reaction. Write down the:

4.4.1 TYPE of elimination reaction (1)

4.4.2 Reaction conditions (2)

4.4.3 Balanced chemical equation for the formation of compound **C**, using STRUCTURAL FORMULAE (5)

4.5 Consider reaction **V**. Write down the:

4.5.1 NAME or FORMULA of the inorganic reactant needed (1)

4.5.2 Type of alcohol represented by 2-butanol

Choose from PRIMARY, SECONDARY or TERTIARY.

Give a reason for the answer. (2)
[18]

QUESTION 5 (Start on a new page.)

The reaction of magnesium (Mg) and EXCESS diluted hydrochloric acid (HCℓ) is used to investigate some factors affecting the reaction rate. The balanced equation for the reaction is:

$$Mg(s) + 2HC\ell(\ell) \rightarrow MgC\ell_2(aq) + H_2(g)$$

The table below summarises the reaction conditions.

EXPERIMENT	STATE of Mg	MASS of Mg	TEMPERATURE (°C)
1	ribbon	x	25
2	powder	x	25
3	powder	½x	20

5.1 Define the term *reaction rate.* (2)

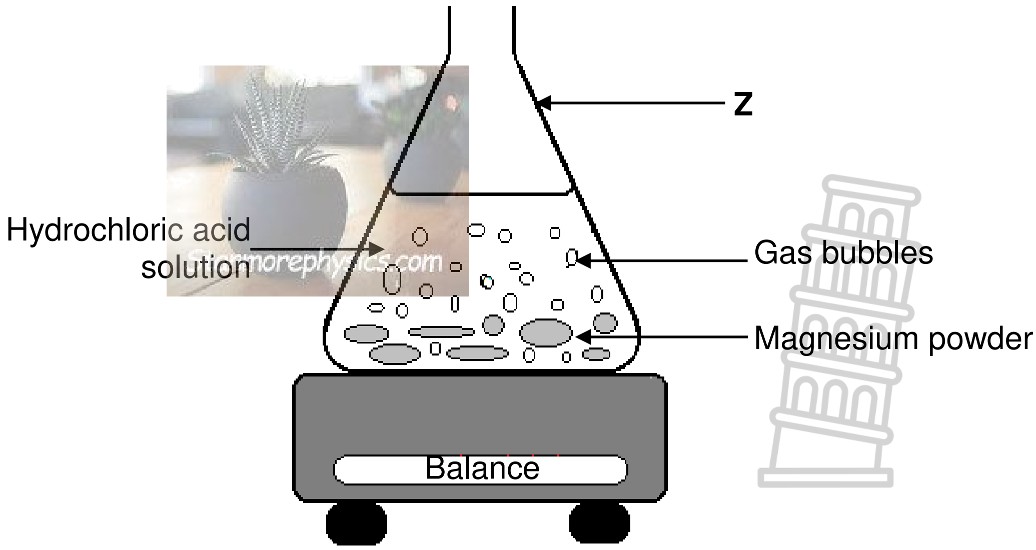
5.2 Which experiment will have the highest reaction rate?

Choose from EXPERIMENT 1, EXPERIMENT 2 or EXPERIMENT 3. (1)

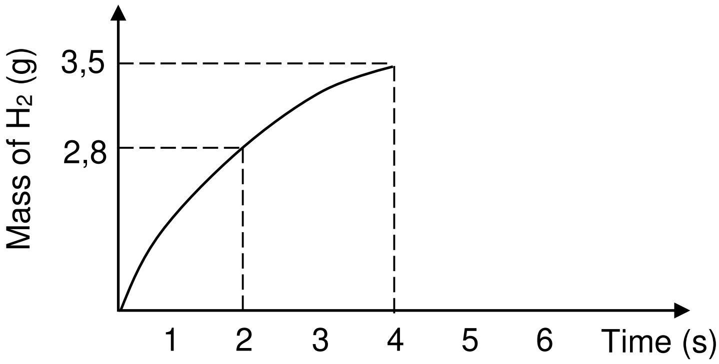
5.3 Use the collision theory to explain the answer to QUESTION 5.2. (2)

5.4 Besides temperature, write down ONE other way to increase the reaction rate in EXPERIMENT 2. (1)

The mass of gas produced in EXPERIMENT 2 is obtained by measuring the loss in mass of the flask and its contents at one-second intervals.



The results of this experiment is displayed in the graph below.



5.5 Write down the name of apparatus **Z**. (1)

5.6 Give a reason why this experimental setup cannot be classified as a closed system. (1)

5.7 Calculate the AVERAGE RATE (in $g \cdot s^{-1}$) of this reaction during the first four seconds. (2)

5.8 Write down the loss in mass of the flask and its contents. (1)

5.9 Use the graph to calculate the mass of magnesium powder (x) used in EXPERIMENT 2. (5)

5.10 Why is the magnesium in EXPERIMENT 2 the *limiting reagent*? (1)

5.11 Redraw the graph given in your ANSWER BOOK and name it Graph 2.

On the same set of axes, draw the graph for EXPERIMENT 3 and label this Graph 3. (2)
[19]

QUESTION 6 (Start on a new page.)

The table below shows the effect of temperature changes on the value of the equilibrium constant (K_c) when the following reaction takes place in a closed container of volume 500 cm^3.

$$2NO_2(g) \rightleftharpoons N_2O_4(g)$$
(brown gas) (colourless gas)

TEMPERATURE (K)	Equilibrium constant (K_c)
300	1×10^{1}
400	3×10^{-2}
500	1×10^{-3}
600	1×10^{-4}
700	$8,33 \times 10^{-5}$

6.1 Define the term *chemical equilibrium.* (2)

6.2 Which colour will be seen at 300 K?

Choose from BROWN, COLOURLESS or LIGHT BROWN. (1)

6.3 Is the forward reaction exothermic or endothermic?

Explain the answer. (3)

6.4 **X** g of NO_2 is sealed in the container at 300 K.

At equilibrium, the concentration of N_2O_4 was 3 $mol \cdot dm^{3}$.

Calculate **X**. (8)

6.5 How will an increase in the reactant (NO_2) at 700 K effect the rate of the reverse reaction?

Choose from INCREASES, DECREASES or STAYS THE SAME. (1)

6.6 The pressure on the system is increased by decreasing the volume of the container at 300 K.

How will this change affect the:

6.6.1 Value of K_C?

Choose from INCREASES, DECREASES or REMAINS THE SAME.

Give a reason for the answer. (2)

6.6.2 Concentration of the products?

Choose from INCREASES, DECREASES or REMAINS THE SAME.

Explain the answer using Le Chatelier's principle. (3)
[20]

QUESTION 7 (Start on a new page.)

7.1 Hydrofluoric acid (HF) is a weak acid.

7.1.1 Define the term *weak acid.* (2)

7.1.2 A sample of hydrofluoric acid has a pH of 4,5 at 25 °C.

Calculate the concentration of the hydronium ions ($H_3O^+(aq)$) in the sample. (3)

When hydrofluoric acid reacts with sodium hydroxide, sodium fluoride is formed.

7.1.3 Will the pH of the sodium fluoride solution be GREATER THAN 7, SMALLER THAN 7 or EQUAL TO 7?

Give a reason for the answer. (2)

7.2 In REACTION A, 3,5 g of pure $MgCO_3(s)$ reacted completely in 50 cm^3 of HCℓ. The balanced equation for the reaction is given below:

REACTION A: $MgCO_3 + 2HC\ell \rightarrow MgC\ell_2 + CO_2 + H_2O$

The EXCESS HCℓ neutralises exactly 20 cm^3 of a NaOH solution with a concentration of 1,2 $mol{\cdot}dm^{-3}$ in REACTION B.

REACTION B: $HC\ell + NaOH \rightarrow NaC\ell + H_2O$

7.2.1 Calculate the number of moles of HCℓ reacted in REACTION A. (3)

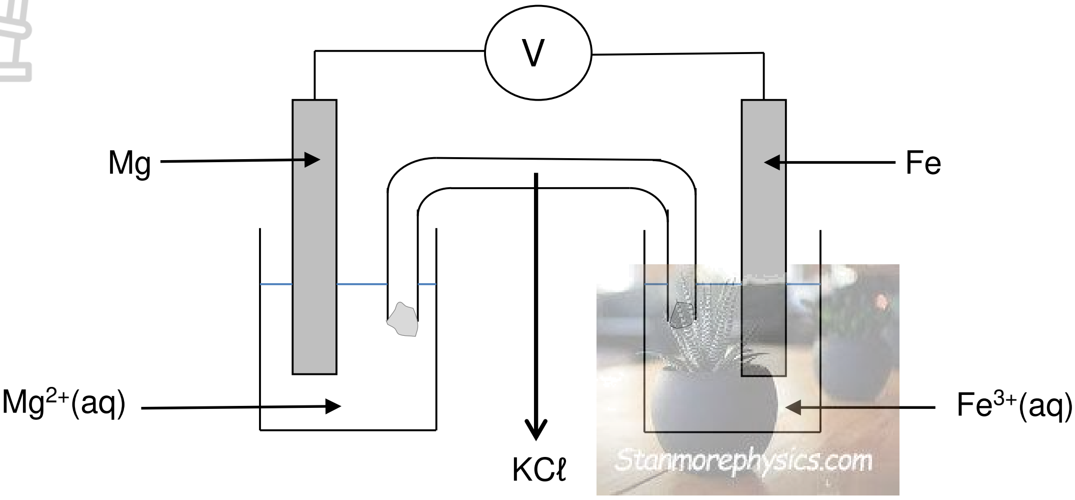
7.2.2 Calculate the concentration of the original solution of HCℓ. (6)

[16]

QUESTION 8 (Start on a new page.)

The diagram below represents a galvanic cell functioning under standard conditions with magnesium and iron as electrodes. The nett cell equation for this cell is:

$$2Fe^{3+}(aq) + 3Mg(s) \rightarrow 2Fe(s) + 3Mg^{2+}(aq)$$



8.1 For this cell, write down:

8.1.1 The energy conversion that takes place (1)

8.1.2 TWO standard conditions (2)

8.1.3 The electrode which acts as the CATHODE

Give a reason for the answer. (2)

8.1.4 The oxidation half-reaction (2)

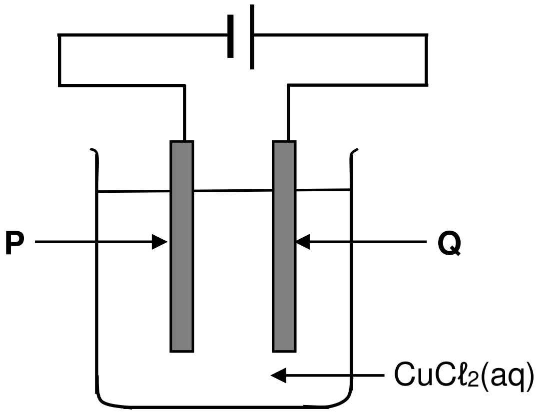
8.1.5 The cell notation (3)

8.1.6 The NAME of the component responsible for electrical neutrality of the half cells (1)

8.2 Calculate the initial EMF of the cell. (4)
[15]

QUESTION 9 (Start on a new page.)

In the electrolytic cell represented below, two CARBON RODS, **P** and **Q**, are used as electrodes and concentrated copper (II) chloride solution is used as electrolyte.



9.1 Define the term *electrolysis.* (2)

9.2 What observation can be made at electrode **P** while the cell is operating? (1)

9.3 Write down the half-reaction that takes place at electrode **Q**. (2)

9.4 Write down the NAME or FORMULA of the reducing agent in this reaction. (1)

9.5 What is the function of $CuC\ell_2$(aq) as electrolyte in this cell? (1)

This cell is now used for the refining of copper.

9.6 Which electrode (**P** or **Q**) will have to be replaced with pure copper during the refining process?

Give a reason for the answer. (2)

9.7 Explain why the concentration of the ions in the solution remains constant. (1)

9.8 Silver and platinum are formed at the bottom of the container during the refining process of impure copper.

Refer to the relative strength of the reducing agents to explain why these two metals do not form ions. (3)
[13]

TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)
GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 2 (CHEMIE)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Standard pressure *Standaarddruk*	p^{θ}	$1,013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22,4\ dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^{θ}	273 K
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}$ C
Avogadro's constant *Avogadro-konstante*	N_A	$6,02 \times 10^{23}\ mol^{-1}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at/*by* 298 K	
$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ / $E^{\theta}_{sel} = E^{\theta}_{katode} - E^{\theta}_{anode}$ or/*of* $E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ / $E^{\theta}_{sel} = E^{\theta}_{reduksie} - E^{\theta}_{oksidasie}$ or/*of* $E^{\theta}_{cell} = E^{\theta}_{oxidising\ agent} - E^{\theta}_{reducing\ agent}$ / $E^{\theta}_{sel} = E^{\theta}_{oksideermiddel} - E^{\theta}_{reduseermiddel}$	

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE

KEY/*SLEUTEL*

Atomic number / *Atoomgetal*: 29
Symbol / *Simbool*: Cu
Electronegativity / *Elektronegatiwiteit*: 1,9
Approximate relative atomic mass / *Benaderde relatiewe atoommassa*: 63,5

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1 H 1 2,1																	2 He 4
3 Li 7 1,0	4 Be 9 1,5											5 B 11 2,0	6 C 12 2,5	7 N 14 3,0	8 O 16 3,5	9 F 19 4,0	10 Ne 20
11 Na 23 0,9	12 Mg 24 1,2											13 Aℓ 27 1,5	14 Si 28 1,8	15 P 31 2,1	16 S 32 2,5	17 Cℓ 35,5 3,0	18 Ar 40
19 K 39 0,8	20 Ca 40 1,0	21 Sc 45 1,3	22 Ti 48 1,5	23 V 51 1,6	24 Cr 52 1,6	25 Mn 55 1,5	26 Fe 56 1,8	27 Co 59 1,8	28 Ni 59 1,8	29 Cu 63,5 1,9	30 Zn 65 1,6	31 Ga 70 1,6	32 Ge 73 1,8	33 As 75 2,0	34 Se 79 2,4	35 Br 80 2,8	36 Kr 84
37 Rb 86 0,8	38 Sr 88 1,0	39 Y 89 1,2	40 Zr 91 1,4	41 Nb 92	42 Mo 96 1,8	43 Tc 1,9	44 Ru 101 2,2	45 Rh 103 2,2	46 Pd 106 2,2	47 Ag 108 1,9	48 Cd 112 1,7	49 In 115 1,7	50 Sn 119 1,8	51 Sb 122 1,9	52 Te 128 2,1	53 I 127 2,5	54 Xe 131
55 Cs 133 0,7	56 Ba 137 0,9	57 La 139	72 Hf 179 1,6	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tℓ 204 1,8	82 Pb 207 1,8	83 Bi 209 1,9	84 Po 2,0	85 At 2,5	86 Rn
87 Fr 0,7	88 Ra 226 0,9	89 Ac															
				58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
				90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

TABLE 4A: STANDARD REDUCTION POTENTIALS
TABEL 4A: STANDAARD-REDUKSIEPOTENSIALE

Half-reactions/*Halfreaksies*			E^{θ} (V)
$F_2(g) + 2e^-$	⇌	$2F^-$	+ 2,87
$Co^{3+} + e^-$	⇌	Co^{2+}	+ 1,81
$H_2O_2 + 2H^+ + 2e^-$	⇌	$2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^-$	⇌	$Mn^{2+} + 4H_2O$	+ 1,51
$C\ell_2(g) + 2e^-$	⇌	$2C\ell^-$	+ 1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	⇌	$2Cr^{3+} + 7H_2O$	+ 1,33
$O_2(g) + 4H^+ + 4e^-$	⇌	$2H_2O$	+ 1,23
$MnO_2 + 4H^+ + 2e^-$	⇌	$Mn^{2+} + 2H_2O$	+ 1,23
$Pt^{2+} + 2e^-$	⇌	Pt	+ 1,20
$Br_2(\ell) + 2e^-$	⇌	$2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^-$	⇌	$NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^-$	⇌	$Hg(\ell)$	+ 0,85
$Ag^+ + e^-$	⇌	Ag	+ 0,80
$NO_3^- + 2H^+ + e^-$	⇌	$NO_2(g) + H_2O$	+ 0,80
$Fe^{3+} + e^-$	⇌	Fe^{2+}	+ 0,77
$O_2(g) + 2H^+ + 2e^-$	⇌	H_2O_2	+ 0,68
$I_2 + 2e^-$	⇌	$2I^-$	+ 0,54
$Cu^+ + e^-$	⇌	Cu	+ 0,52
$SO_2 + 4H^+ + 4e^-$	⇌	$S + 2H_2O$	+ 0,45
$2H_2O + O_2 + 4e^-$	⇌	$4OH^-$	+ 0,40
$Cu^{2+} + 2e^-$	⇌	Cu	+ 0,34
$SO_4^{2-} + 4H^+ + 2e^-$	⇌	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + e^-$	⇌	Cu^+	+ 0,16
$Sn^{4+} + 2e^-$	⇌	Sn^{2+}	+ 0,15
$S + 2H^+ + 2e^-$	⇌	$H_2S(g)$	+ 0,14
$2H^+ + 2e^-$	**⇌**	**$H_2(g)$**	**0,00**
$Fe^{3+} + 3e^-$	⇌	Fe	– 0,06
$Pb^{2+} + 2e^-$	⇌	Pb	– 0,13
$Sn^{2+} + 2e^-$	⇌	Sn	– 0,14
$Ni^{2+} + 2e^-$	⇌	Ni	– 0,27
$Co^{2+} + 2e^-$	⇌	Co	– 0,28
$Cd^{2+} + 2e^-$	⇌	Cd	– 0,40
$Cr^{3+} + e^-$	⇌	Cr^{2+}	– 0,41
$Fe^{2+} + 2e^-$	⇌	Fe	– 0,44
$Cr^{3+} + 3e^-$	⇌	Cr	– 0,74
$Zn^{2+} + 2e^-$	⇌	Zn	– 0,76
$2H_2O + 2e^-$	⇌	$H_2(g) + 2OH^-$	– 0,83
$Cr^{2+} + 2e^-$	⇌	Cr	– 0,91
$Mn^{2+} + 2e^-$	⇌	Mn	– 1,18
$A\ell^{3+} + 3e^-$	⇌	$A\ell$	– 1,66
$Mg^{2+} + 2e^-$	⇌	Mg	– 2,36
$Na^+ + e^-$	⇌	Na	– 2,71
$Ca^{2+} + 2e^-$	⇌	Ca	– 2,87
$Sr^{2+} + 2e^-$	⇌	Sr	– 2,89
$Ba^{2+} + 2e^-$	⇌	Ba	– 2,90
$Cs^+ + e^-$	⇌	Cs	– 2,92
$K^+ + e^-$	⇌	K	– 2,93
$Li^+ + e^-$	⇌	Li	– 3,05

Increasing strength of oxidising agents/*Toenemende sterkte van oksideermiddels* (↑)

Increasing strength of reducing agents/*Toenemende sterkte van reduseermiddels* (↓)

TABLE 4B: STANDARD REDUCTION POTENTIALS
TABEL 4B: STANDAARD-REDUKSIEPOTENSIALE

Increasing strength of oxidising agents/*Toenemende sterkte van oksideermiddels* ↓

Half-reactions/*Halfreaksies*			E^θ (V)
$Li^+ + e^-$	⇌	Li	– 3,05
$K^+ + e^-$	⇌	K	– 2,93
$Cs^+ + e^-$	⇌	Cs	– 2,92
$Ba^{2+} + 2e^-$	⇌	Ba	– 2,90
$Sr^{2+} + 2e^-$	⇌	Sr	– 2,89
$Ca^{2+} + 2e^-$	⇌	Ca	– 2,87
$Na^+ + e^-$	⇌	Na	– 2,71
$Mg^{2+} + 2e^-$	⇌	Mg	– 2,36
$A\ell^{3+} + 3e^-$	⇌	$A\ell$	– 1,66
$Mn^{2+} + 2e^-$	⇌	Mn	– 1,18
$Cr^{2+} + 2e^-$	⇌	Cr	– 0,91
$2H_2O + 2e^-$	⇌	$H_2(g) + 2OH^-$	– 0,83
$Zn^{2+} + 2e^-$	⇌	Zn	– 0,76
$Cr^{3+} + 3e^-$	⇌	Cr	– 0,74
$Fe^{2+} + 2e^-$	⇌	Fe	– 0,44
$Cr^{3+} + e^-$	⇌	Cr^{2+}	– 0,41
$Cd^{2+} + 2e^-$	⇌	Cd	– 0,40
$Co^{2+} + 2e^-$	⇌	Co	– 0,28
$Ni^{2+} + 2e^-$	⇌	Ni	– 0,27
$Sn^{2+} + 2e^-$	⇌	Sn	– 0,14
$Pb^{2+} + 2e^-$	⇌	Pb	– 0,13
$Fe^{3+} + 3e^-$	⇌	Fe	– 0,06
$2H^+ + 2e^-$	**⇌**	**$H_2(g)$**	**0,00**
$S + 2H^+ + 2e^-$	⇌	$H_2S(g)$	+ 0,14
$Sn^{4+} + 2e^-$	⇌	Sn^{2+}	+ 0,15
$Cu^{2+} + e^-$	⇌	Cu^+	+ 0,16
$SO_4^{2-} + 4H^+ + 2e^-$	⇌	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + 2e^-$	⇌	Cu	+ 0,34
$2H_2O + O_2 + 4e^-$	⇌	$4OH^-$	+ 0,40
$SO_2 + 4H^+ + 4e^-$	⇌	$S + 2H_2O$	+ 0,45
$Cu^+ + e^-$	⇌	Cu	+ 0,52
$I_2 + 2e^-$	⇌	$2I^-$	+ 0,54
$O_2(g) + 2H^+ + 2e^-$	⇌	H_2O_2	+ 0,68
$Fe^{3+} + e^-$	⇌	Fe^{2+}	+ 0,77
$NO_3^- + 2H^+ + e^-$	⇌	$NO_2(g) + H_2O$	+ 0,80
$Ag^+ + e^-$	⇌	Ag	+ 0,80
$Hg^{2+} + 2e^-$	⇌	$Hg(\ell)$	+ 0,85
$NO_3^- + 4H^+ + 3e^-$	⇌	$NO(g) + 2H_2O$	+ 0,96
$Br_2(\ell) + 2e^-$	⇌	$2Br^-$	+ 1,07
$Pt^{2+} + 2e^-$	⇌	Pt	+ 1,20
$MnO_2 + 4H^+ + 2e^-$	⇌	$Mn^{2+} + 2H_2O$	+ 1,23
$O_2(g) + 4H^+ + 4e^-$	⇌	$2H_2O$	+ 1,23
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	⇌	$2Cr^{3+} + 7H_2O$	+ 1,33
$C\ell_2(g) + 2e^-$	⇌	$2C\ell^-$	+ 1,36
$MnO_4^- + 8H^+ + 5e^-$	⇌	$Mn^{2+} + 4H_2O$	+ 1,51
$H_2O_2 + 2H^+ + 2e^-$	⇌	$2H_2O$	+1,77
$Co^{3+} + e^-$	⇌	Co^{2+}	+ 1,81
$F_2(g) + 2e^-$	⇌	$2F^-$	+ 2,87

Increasing strength of reducing agents/*Toenemende sterkte van reduseermiddels* ↑

DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS
LEFAPHA LA THUTO
ISEBE LEZEMFUNDO

PROVINCIAL PREPARATORY EXAMINATION/
PROVINSIALE VOORBEREIDENDE EKSAMEN

GRADE/*GRAAD 12*

PHYSICAL SCIENCES: CHEMISTRY
FISIESE WETENSKAPPE: CHEMIE

PAPER/*VRAESTEL 2*

SEPTEMBER 2024

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

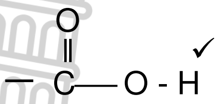
These marking guidelines consist of 14 pages./
Hierdie nasienriglyne bestaan uit 14 bladsye.

QUESTION 1/*VRAAG 1*

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

QUESTION 2/VRAAG 2

2.1 C ✓ (1)

2.2  (1)

2.3 D ✓ (1)

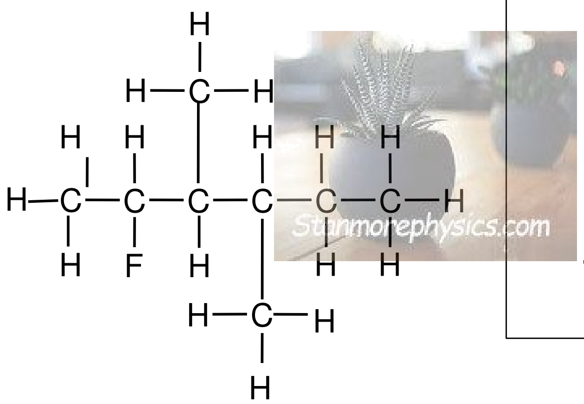
2.4 Formyl (group) ✓/*Formiel (groep)* (1)

2.5 (Concentrated) sulphuric acid ✓/(*Gekonsentreerde*) *swawelsuur* (1)

2.6 E ✓ (1)

2.7 C_2H_4O ✓ (1)

2.8



Marking criteria/*Nasienkriteria*
- Fluoro substituent ✓
  Fluorosubstituent
- 2 methyl substituents✓
  2 metiel substituente
- Whole structure correct✓
  Hele struktuur korrek

IF/*INDIEN*: H-atom/bond omitted/
H-atoom/binding uitgelaat. -1

(3)

2.9 4,4 – dimethyl hexan-2-one/*4,4 – dimetielheksan-2-oon*
4,4 – dimetiel-2-hexanone/*4.4 – dimetiel-2-heksanoon*

Marking criteria/*Nasienkriteria*
- Correct chain length, ie. hex ✓
  Korrekte kettinglengte, bv. heks
- Everything else correct:
  IUPAC name completely correct including numbering, sequence, hyphens and comma. ✓
  Alles verder korrek:
  IUPAC name volledig korrek insluitend nomering, volgorde, koppeltekens en kommas.

(2)

2.10 A and/*en* F✓ (1)
[13]

QUESTION 3/VRAAG 3

3.1 **Marking criteria/*Nasienriglyn***

If any of the underlined key words/phrases in the correct context is omitted deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

Compounds with the same molecular formula, but different structural formula.✓✓
Verbindings met dieselfde molekulêre formule, maar verskillende struktuur formules. (2)

3.2 Chain(isomerism) ✓/*Ketting (isomerie)* (1)

3.3 ***Marking Guidelines/Nasienriglyne***

- Compare the structures/*Vergelyk die strukture*
- Compare strengths of IMF/*Vergelyk die sterkte van IMK*
- Compare energy needed to overcome/break IMF/*Vergelyk die energie nodig om kragte te oorkom/breek*
- Butane (B) (is a straight chain molecule and thus) has a greater surface area ✓ than methyl propane (E) / *Betaan(B) is `n reguitketting molekule met n groter kontakoppervlakte as metielpropaan(E).*
- Butane thus has stronger intermolecular forces ✓ than methyl propane./ *Butaan het dus sterker intermolekulêre kragte as metielpropaan.*
- More energy is needed to overcome the IMF in butane/ *Meer energie is dus nodig om die IMK in butaan te oorkom*

OR

- Methyl propane(E) has (a side chain and therefore) a smaller surface area than butane (B) / *Metielpropaan(E) het `n syketting en dus `n kleiner kontakoppervlakte as butaan(B).*
- Methyl propane has weaker intermolecular forces than butane / *Metielpropaan het swakker intermolekulëre kragte as butaan.*
- Less energy is needed to overcome the intermolecular forces in methyl propane/ *Minder energie is nodig om die intermolekulëre kragte in metielpropaan te oorkom.*

(3)

3.4

3.4.1 Homologous series/*homoloë reeks* ✓
Functional group / funksionele groep (1)

3.4.2 Number of carbons / chain length✓/ surface area / molecular mass
Aantal koolstofatome / kettinglengte / kontak oppervlakte / molekulêre massa (1)

3.4.3 A / ethane✓/*etaan*
It has (the lowest boiling point and thus) the weakest intermolecular force/ London forces✓ therefore the least energy is needed to overcome the forces.✓/
Dit het (die laagste kookpunt en het dus) die swakste intermolekulëre krag/ Londonkragte, wat die minste energie vereis om dit te oorkom. (3)

3.5

> **Marking criteria/*Nasienriglyne***
> - Dependent and independent variable identified
>   *Afhanklike en onafhanklike veranderlikes korrek geïdentifiseer*
> - Correct relationship between dependant and independent variables stated
>   *Korrekte verwantskap tussen die afhanklike en onafhanklike gestel*
>
> **IF/*INDIEN*:** Directly proportional/*Direk eweredig* (Max/*Maks* $\frac{1}{2}$)

The longer the chain length the higher the boiling point. ✓✓/The greater the surface area the higher the boiling point.
Hoe langer die koolstofketting hoe groter die kookpunt./Hoe groter die oppervlakte area hoe groter die kookpunt.

Or / of

The shorter the chain length / more branched, the lower the boiling point / Less surface area equals a lower boiling point.
Hoe korter die koolstofketting, meer vertak hoe laer die kookpunt / Kleiner reaksie oppervlak lei tot laer kookpunt. (2)

3.6 $C_5H_{12} + 8O_2$ ✓→ $5CO_2 + 6H_2O$ ✓ (Bal)✓

> **Marking criteria/*Nasienriglyne***
>
> Reactants✓
> Products✓
> Balancing✓

(3)
[16]

QUESTION 4/VRAAG 4

4.1

4.1.1 Cracking ✓/*Kraking* / Elimination/ *Eliminasie* (1)

4.1.2 Heptane ✓✓/*Heptaan* (2)

4.2

4.2.1 Addition/Hydrogenation✓
Addisie/Hidrogenasie (1)

4.2.2 Butane✓/*Butaan* (1)

4.2.3 Platinum /Pt ✓ or Palladium /Pd or Nickel /Ni (1)

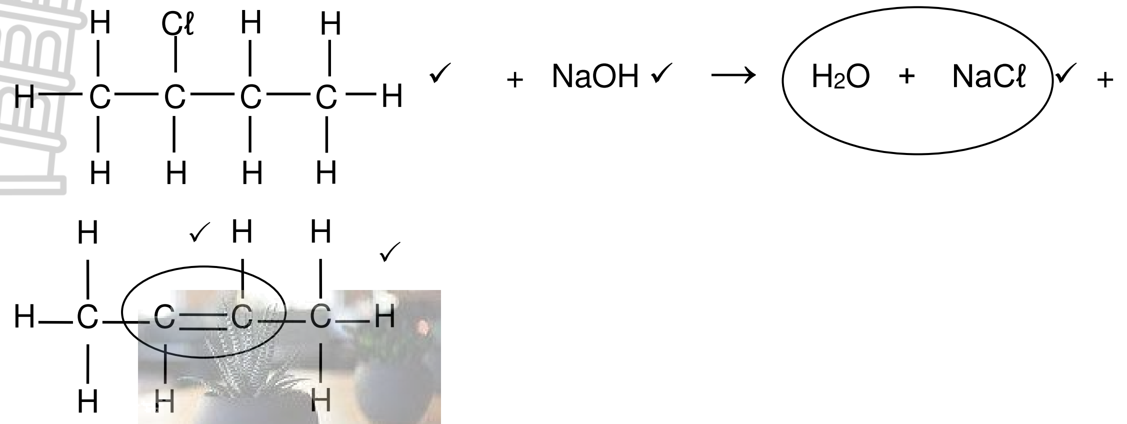
4.3 Substitution✓/halogenation/chlorination
Substitusie/halogenering/chlorinering (1)

4.4

4.4.1 Dehydrohalogenation✓or dehydrochlorination/
Dehidrohalogenering of diehidrochlorinering (1)

4.4.2 Concentrated strong base(NaOH etc), ✓heat ✓/
Gekonsentreerde sterk basis(NaOH, etc), hitte (2)

4.4.3



Note: Functional group carries a mark regardless the position/
Funksionelegroep kry`n punt ongeag die posisie (5)

4.5
4.5.1 H_2O / water✓or dilute sodium hydroxide (NaOH / KOH / LiOH) / verdunde (1)

4.5.2 Secondary ✓/*Sekondêr*
The C-atom to which the hydroxyl group /OH-group is attached, is attached to two other C-atoms. ✓
Die C-atoom waaraan die hidroksielgroep verbind is, is aan twee ander C-atome verbind. (2)
[18]

QUESTION 5/VRAAG 5

5.1

NOTE/*LET WEL*
Give the mark for <u>per unit time</u> only if in context of reaction rate. *Gee die punt vir <u>per eenheidtyd</u> slegs indien in konteks met reaksietempo.*

<u>ANY ONE/*ENIGE EEN*</u>

- <u>Change in concentration</u> ✓ of products/reactants <u>per (unit) time</u>. ✓
  <u>Verandering in konsentrasie</u> van produkte/reaktanse <u>per (eenheid) tyd</u>.
- <u>Change in amount/number of moles/volume/mass</u> of products or reactants <u>per (unit) time</u>.
  <u>Verandering in hoeveelheid/getal mol/volume/massa</u> van produkte of reaktanse <u>per (eenheid) tyd</u>.
- <u>Amount/number of moles/volume/mass of products formed/reactants used per (unit) time</u>.
  <u>Hoeveelheid/getal mol/volume/massa van produkte gevorm / reaktanse gebruik per eenheids tyd</u>.
- <u>Rate of change in concentration/amount/number of moles/volume/mass</u>.
  <u>Tempo van verandering in konsentrasie/hoeveelheid/getal mol/ volume/massa</u>. ✓✓ **(2 or/*of* 0)** (2)

5.2 Experiment 2✓ (1)

5.3 Larger surface area (state of division). ✓ More effective collisions per unit time/ per second. ✓
Groter reaksie oppervlakte (toestand van verdeeldheid). Meer effektiewe botsings per eenheidstyd en die reaksie tempo verhoog. (2)

5.4 Increase the concentration of HCℓ / *verhoog die gekonsetrasie van HCℓ*✓ *or* (1)
Catalyst / Katalisator

5.5 Conical flask / Erlenmeyer flask✓
Koniese fles / Erlenmeyerfles (1)

5.6 (Hydrogen) gas is escaping✓/ (*Waterstofgas) ontsnap* ***or***
The flask is open / die fles is oop (1)

5.7
$$\text{rate}/\textit{tempo} = \frac{\Delta m}{\Delta t}$$
$$= \frac{3{,}5 - 0}{4 - 0} \checkmark$$
$$= 0{,}875\ (0{,}88)\ (\text{g.s}^{-1}) \checkmark$$
(2)

5.8 3,5 g ✓ (1)

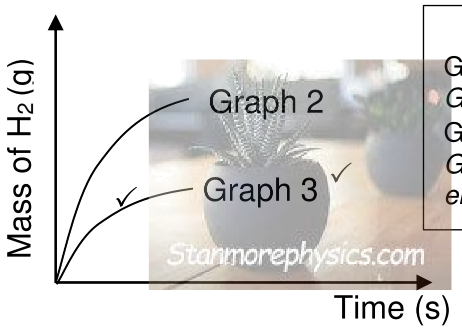
5.9
$$n(H_2) = \frac{m}{M} \checkmark$$
$$= \frac{3{,}5}{2} \checkmark$$
$$= 1{,}75 \text{ mol}$$

$n(Mg) = n(H_2) = 1{,}75$ mol ✓

$m(Mg) = nM$
$= (1{,}75)(24)$ ✓
$= 42$ g ✓
(5)

5.10 The hydrochloric acid was in excess /all the magnesium reacted. ✓
Die soutsuur was in oormaat /al die magnesium het gereageer. (1)

5.11



Marking criteria/ Nasienkriteria
Graph 3 has a smaller gradient✓
Grafiek 3 het 'n kleiner gradiënt
Graph 3 forms half of the H_2 compared to exp 2✓
Grafiek 3 vorm helfte van H_2 in vergelyking met eksp. 2

(2)
[19]

QUESTION 6/VRAAG 6

6.1 The stage in a chemical reaction when the rate of forward reaction equals the rate of reverse reaction. ✓✓ **(2 or 0)**
Die stadium in 'n chemiese reaksie wanneer die tempo van die voorwaartse reaksie is gelyk aan die tempo van die terugwaarste reaksie. ✓✓ ***(2 of 0)***

OR/*OF*

The stage in a chemical reaction when the concentrations /quantities of reactants and products remain constant.
Die stadium in 'n chemiese reaksie wanneer die konsentrasies/hoeveelhede van reaktanse en produkte konstant bly. (2)

6.2 Light brown✓/*Ligbruin* (1)
ACCEPT: colourless/**AANVAAR:** kleurloos

6.3 Exothermic ✓
- Kc decreases with an increase in temperature✓
- The reverse reaction is favoured✓

Eksotermies
- *Kc neem af met 'n toename in temperatuur*
- *Die terugwaartse reaksie word bevoordeel* (3)

6.4 **OPTION 1/*OPSIE 1***
CALCULATIONS USING MOLES
Marking guidelines/*Nasienriglyne*:
(a) $n(N_2O_4)$ at equilibrium = cV = (3)(0,5) = 1,5 mol
(b) Using ratio ✓/*Gebruik van verhouding*
(c) $n(NO_2)$ at equilibrium = initial $n(NO_2)$ – used $n(NO_2)$ ✓
(d) Division of equilibrium moles of NO_2 with 0,5 to get equilibrium concentration✓
(e) Correct K_c expression)✓/*Korrekte Kc uitdrukking*
(f) Substitution of Kc as 10 ✓/*Substitusie van Kc as 10*
(g) Substitution of concentrations into K_c expression✓
(h) Final answer/*finale antwoord*: 150,6 g ✓

	$2NO_2(g)$	$N_2O_4(g)$
Molar ratio *Molêre verhouding*	2	1
Initial mol *Aanvanklike mol(mol)*	$\frac{X}{46}$	-
Change in mol. *Verandering in mol*(mol)	3	1,5 (b) ✓
Equilibrium amount (mol) *Ewewig hoeveelheid(mol)*	$\frac{X}{46} - 3$ ✓(c)	1,5✓(a)
Equilibrium concentration *Konsentrasie by ewewig* (mol·dm^{-3})	$\frac{\frac{X}{46} - 3}{0,5}$ ✓(d)	3 (given)

$K_c = \frac{[N_2O_4]}{[NO_2]^2}$ ✓ (e)

10✓ (f) $= \frac{3}{[\frac{\frac{X}{46} - 3}{0,5}]^2}$ ✓ (g)

$X = 150,6$ g ✓ (h)

OR

	$2NO_2(g)$	**$N_2O_4(g)$**
Molar ratio *Molêre verhouding*	2	1
Initial mol *Aanvanklike mol(mol)*	n	-
Change in mol. *Verandering in mol*(mol)	3	1,5 (b) ✓
Equilibrium amount (mol) *Ewewig hoeveelheid(mol)*	n - 3 ✓(c)	1,5✓(a)
Equilibrium concentration *Konsentrasie by ewewig* $(mol \cdot dm^{-3})$	$\frac{n-3}{0,5}$✓(d)	3 (given)

$K_c = \frac{[N_2O_4]}{[NO_2]^2}$ (e) ✓

10✓ (f) $= \frac{3}{[\frac{n-3}{0,5}]^2}$ ✓ (g)

$n = 3,274$ mol

$m_X = nM$

$= (3,274)(46)$

$= 150,6$ g ✓ (h)

OPTION 2/*OPSIE 2*

CALCULATIONS USING CONCENTRATION

Marking guidelines/Nasienriglyne:

(a) $n(N_2O_4)$ at equilibrium = change in c
(b) Using ratio/*Gebruik van verhouding*
(c) $n(NO_2)$ at equilibrium = initial $n(NO_2)$ – used $n(NO_2)$
(d) Correct Kc expression/*Korrekte Kc uitdrukking*
(e) Substitution of Kc as 10/*Substitusie van Kc as 10*
(f) Substitution of concentrations into Kc expression
(g) The concentration of $x(NO_2)$ solving Kc = 6,548 $mol{\cdot}dm^{-3}$
(h) Final answer/*finale antwoord*: 150,6 g

	$2NO_2(g)$	$N_2O_4(g)$
Molar ratio *Molêre verhouding*	2	1
Initial concentration *Aanvanklike konsentrasie ($mol{\cdot}dm^{-3}$)*	c	-
Change in concentration. *Verandering in konsentrasie ($mol{\cdot}dm^{-3}$)*	6 (b) ✓	3 (a) ✓
Equilibrium concentration *Konsentrasie by ewewig* ($mol{\cdot}dm^{-3}$)	c-6 (c)✓	3 (given)

$K_c = \frac{[N_2O_4]}{[NO_2]^2}$ (d) ✓

10✓ (e) $= \frac{3}{[x-6]^2}$ ✓ (f)

$[NO_2] = 6,548\ mol{\cdot}dm^{-3}$✓ (g)

$m_X = cMV$

$= (6,548)(46)(0,5)$

$= 150,6$ g (h) ✓

OPTION 3/*OPSIE 3*

CALCULATIONS USING CONCENTRATION

Marking guidelines/*Nasienriglyne*:

(a) $n(N_2O_4)$ and $n(NO_2)$ at equilibrium = cV ✓
(b) Using ratio ✓/*Gebruik van verhouding*
(c) initial $n(NO_2)$ = used $n(NO_2)$ + $n(NO_2)$ at equilibrium ✓
(d equilibrium concentration of NO_2 from Kc calculation✓
(e) Correct K_c expression)✓/*Korrekte Kc uitdrukking*
(f) Substitution of Kc as 10 ✓/*Substitusie van Kc as 10*
(g) Substitution of concentrations into K_c expression✓
(h) Final answer/*finale antwoord*: 150,6 g ✓

	$2NO_2(g)$	$N_2O_4(g)$
Molar ratio *Molêre verhouding*	2	1
Initial moles *Aanvanklike konsentrasie (mol)*	3 + 0,27 (c) ✓	0
Change in mole. *Verandering in mol (mol)*	3 (b) ✓	1,5
Equilibrium amount (mole) *Ewewigs hoeveelheid* (mol)	0.27 (a)	1,5(a) ✓
Equilibrium concentration *Konsentrasie by ewewig* (mol·dm^{-3})	0,548 (d)	3 (given)

$K_c = \frac{[N_2O_4]}{[NO_2]^2}$ (e) ✓

10✓ (f) = $\frac{3}{[[NO_2]]^2}$ ✓ (g)

$[NO_2]$ = 0,548 mol·dm^{-3} ✓ (d)

m_X = nM
= (3,27)(46)
= 150,6 g ✓ (h) (8)

6.5 Decrease ✓/*Neem af* (1)

6.6
6.6.1 Stays the same, ✓ only temperature affects the K_c value ✓/
Bly dieselfde, slegs temperatuur affekteer die K_c waarde (2)

6.6.2 Increase✓
- Higher pressure favours the reaction that forms less moles✓
- The forward reaction is favoured ✓

Verhoog
- *Hoër druk bevoordeel die reaksie wat minder mol vorm*
- *Die voorwaartse reaksie word bevoordeel* (3)

[20]

QUESTION 7/VRAAG 7

7.1.1 An acid ionises incompletely in water✓ to form a low concentration of H_3O^+. ✓
'n Suur ioniseer onvolledig in water om 'n lae konsentrase H_3O^+ te vorm. (2)

7.1.2 **OPTION 1**
$pH = -\log[H_3O^+]$✓
4,5✓ $= -\log[H_3O^+]$
$= 3,16 \times 10^{-5}$ mol.dm^{-3} ✓

OPTION 2
$[H_3O^+] = 10^{-pH}$ ✓
$= 10^{-4.5}$ ✓
$= 3,16 \times 10^{-5}$ mol.dm^{-3} ✓ (3)

7.1.3 Greater than 7 ✓
A strong base (NaOH) reacts with a weak acid (HF) ✓/*'n Sterk basis (NaOH) reageer met 'n swak suur (HF)* (2)

7.2.1 $n(MgCO_3) = \frac{m}{M}$
$= \frac{3,5}{84}$ ✓
$= 0,042$ mol

$n(HC\ell) = 2n(MgCO_3) = (2)(0,042)$ ✓
$= 0,084$ mol ✓ (3)

7.2.2 POSITIVE MARKING FROM QUESTION 7.2.1

$n(NaOH) = cV$ ✓
$= \underline{(1,2)(0,02)}$ ✓
$= 0,024$ mol

$n(HC\ell)_{excess} = n(NaOH) = 0,024$ mol ✓

$n(HC\ell)_{initial} = n_{(reacted)} + n_{(excess)}$
$= 0,084 + 0,024$ ✓
$= 0,108$ mol

$c(HC\ell) = \frac{n}{V}$
$= \frac{0,108}{0,05}$ ✓
$= 2,16$ mol·dm^{-3} ✓

Range (2,08 – 2,16) (6)

[16]

QUESTION 8/VRAAG 8

8.1

8.1.1 Chemical to electrical✓/*Chemies na elektries* (1)

8.1.2 Concentration/*Konsentrasie* – 1 mol·dm^{-3} ✓
Temperature/*Temperatuur* - 25°C / 298 K✓ (2)

8.1.3 Fe ✓
Reduction takes place at this electrode ✓/*Reduksie vind plaas by hierdie elektrode*.
OR
Fe^{3+} is a stronger oxidizing agent than Mg^{2+} / Fe^{3+} is 'n sterker oksideermiddel as Mg^{2+}.
OR
Decrease in oxidation number of Fe^{3+} / Afname in oksidasiegetal van Fe^{3+} (2)

8.1.4 $Mg \rightarrow Mg^{2+} + 2e^{-}$ ✓✓ (2)

8.1.5 Mg(s) I Mg^{2+}(aq) ✓II ✓ Fe^{3+}(aq) I Fe(s)✓
NOTE: Ignore phases/**NOTA:** Ignoreer fases (3)

8.1.6 Salt bridge ✓/*Soutbrug* (1)

8.2 $E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ ✓
= - 0,06 ✓ - (-2,36)✓
= 2,3 V✓ (4)
[15]

QUESTION 9/VRAAG 9

9.1 **ANY ONE/*ENIGE EEN:***

- The chemical process in which electrical energy is converted to chemical energy. ✓✓ **(2 or 0)**
Die chemiese proses waarin elektriese energie omgeskakel word na chemiese energie.

- The use of electrical energy to produce a chemical change.
Die gebruik van elektriese energie om 'n chemiese verandering te weeg te bring.

- Decomposition of an ionic compound by means of electrical energy.
Ontbinding van 'n ioniese verbinding met behulp van elektriese energie.

- The process during which and electric current passes through a solution/ionic liquid/molten ionic compound.
Die proses waardeur 'n elektriese stroom deur 'n oplossing/ioniese vloeistof/gesmelte ioniese verbinding beweeg. (2)

9.2 Red brown deposit/ copper deposit / mass increase / change in colour✓
Rooibruin neerslag/ koper neerslag / toename in massa / kleur verander (1)

9.3 $2C\ell^- \rightarrow C\ell_2 + 2e^-$ ✓✓ (2)

9.4 Chloride ion ✓/*Chloorioon* ($C\ell^-_{(ag)}$) (1)

9.5 It conducts electricity through the movement of ions ✓
Dit gelei elektrisiteit deur middel van bewegende ione. (1)

9.6 P✓
Pure copper forms through reduction of Cu^{2+} at the cathode✓
Suiwer koper vorm deur reduksie van Cu^{2+} by die katode (2)

9.7 The rate of reduction is equal to the rate of oxidation✓
Die tempo van reduksie is gelyk aan die tempo van oksidasie. (1)

9.8 Ag and Pt is weaker reducing agents ✓than Cu ✓and will not be oxidised✓
OR
Cu is a stronger reducing agent than Ag and gets oxidised

Ag en Pt is swakker reduseermiddels as Cu en word dus nie geoksideer nie.
OF
Cu is 'n sterker reduseermiddel as Ag en word dus geoksideer (3)
[13]

GRAND TOTAL/*GROOTTOTAAL*: 150