education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY (P2)

SEPTEMBER 2025

MARKS: 150

TIME: 3 hours

This question paper consists of 14 pages and 4 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space 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 the 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 represents the GENERAL FORMULA for the alcohol?

A C_nH_{2n}

B C_nH_{2n+2}

C $C_nH_{2n}O$

D $C_nH_{2n+2}O$ (2)

1.2 Which ONE of the following organic compounds has the STRONGEST intermolecular forces?

A CH_4

B CH_3CH_2OH

C CH_3COOCH_3

D $CH_3CH_2CH_2CH_3$ (2)

1.3 Which ONE of the following represents the reaction of ethane with chlorine gas?

A Addition reaction

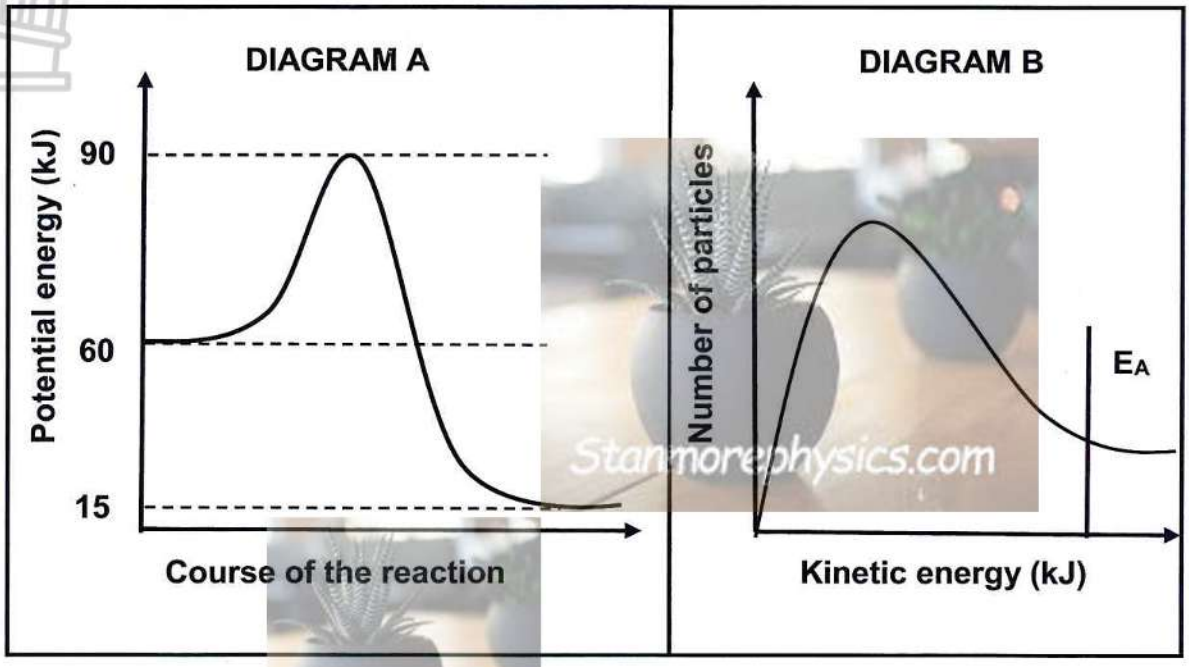
B Hydration reaction

C Hydrolysis reaction

D Substitution reaction (2)

1.4 Consider the following energy diagrams (not drawn to scale) for the reaction between magnesium and hydrochloric acid to investigate the factors affecting the rate of reaction.

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



The numerical value represented by the line **E_A** on the diagram **B** is …

A 30 kJ

B 45 kJ

C 60 kJ

D 90 kJ (2)

1.5 Consider the following hypothetical reaction in a closed container.

$$A2(g) + 3B2(g) \rightleftharpoons 2AB3(g)$$

Which ONE of the following combinations is CORRECT, when the concentration of the reactants increase?

	RATE OF REACTION	EQUILIBRIUM CONSTANT (K_c)
A	Increases	increases
B	Increases	Remain constant
C	Decreases	Decreases
D	Decreases	Increases

(2)

1.6 Consider the following chemical reaction at equilibrium in a closed container:

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The pressure is increased by decreasing the volume of the container while keeping the temperature constant.

Which ONE of the following statements CORRECTLY describes the disturbance above?

A The forward reaction is favoured to decrease the pressure

B The forward reaction is favoured to increase the pressure

C The reverse reaction is favoured to increase the pressure

D The reverse reaction is favoured to decrease the pressure (2)

1.7 The aqueous solution of sodium carbonate, $Na_2CO_3(aq)$, turns red litmus blue.

Consider the following statements:

(i) The $[H^+]$ increases.
(ii) The $[OH^-]$ increases.
(iii) CO_3^{2-} reacts with water.

Which of the above statement(s) is/are TRUE?

A (i) only

B (i) and (ii) only

C (i) and (iii) only

D (ii) and (iii) only (2)

1.8 10 cm^3 of hydrochloric acid of concentration 0,01 $mol \cdot dm^{-3}$ is added to 10 cm^3 ammonium hydroxide of equal concentration according to the following equation:

$$HC\ell(aq) + NH_4OH(aq) \longrightarrow NH_4C\ell(aq) + H_2O(\ell)$$

The pH of the final solution will ...

A not change.

B be equal to 7.

C be lower than 7.

D be greater than 7. (2)

1.9 Which ONE of the following reactions, when used in a voltaic cell, will give an emf of 2,00 V?

A $Sn^{2+}(aq) + Ni(s) \longrightarrow Ni^{2+}(aq) + Sn(s)$

B $Zn(s) + Cu^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cu(s)$

C $2A\ell(s) + 3Cu^{2+}(aq) \longrightarrow 2A\ell^{3+}(aq) + 3Cu(s)$

D $2Cr^{3+}(aq) + 2I^{-}(aq) \longrightarrow 2Cr^{2+}(aq) + I_2(s)$ (2)

1.10 Which ONE of the half reactions below will be the reaction at the CATHODE during the electrolysis of CONCENTRATED SOLUTION of sodium chloride, $NaC\ell(aq)$?

A $Na(s) \longrightarrow Na^{+}(aq) + e^{-}$

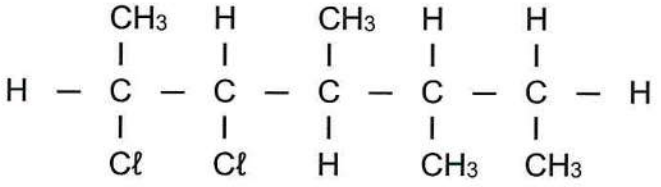
B $Na^{+}(aq) + e^{-} \longrightarrow Na(s)$

C $C\ell_2(g) + 2e^{-} \longrightarrow 2C\ell^{-}(aq)$

D $H_2O(\ell) + 2e^{-} \longrightarrow H_2(g) + OH^{-}(aq)$ (2)
[20]

QUESTION 2 (Start on a new page.)

The letters **A** to **G** in the table below represent seven organic compounds.

A	$CH_3CH_2COOCH_3$	**B**	C_3H_8O
C		**D**	3,3-diflourohexane
E		**F**	$CH_3(CH)_2CH_2CH_3$
G	3-methylbutan-2-one		

2.1 Define the term *functional group.* (2)

2.2 Write down the STRUCTURAL FORMULA of the FUNCTIONAL GROUP to which compound **A** belongs. (1)

2.3 Write down the:

2.3.1 Letter that represents an UNSATURATED hydrocarbon (1)

2.3.2 IUPAC name of compound **C** (2)

2.3.3 IUPAC name of compound **E** (3)

2.3.4 STRUCTURAL FORMULA of compound **G** (2)

2.3.5 STRUCTURAL FORMULA of compound **D** (2)

2.4 **B** has two STRUCTURAL ISOMERS.

2.4.1 Define the term *structural isomers.* (2)

2.4.2 Write down the IUPAC names of these compounds. (2)

2.5 Write down the NAMES of any two HOMOLOGOUS SERIES that can be FUNCTIONAL ISOMERS. (2)

[19]

QUESTION 3 (Start on a new page.)

The boiling point of four straight chain organic compounds are shown in the table below.

	COMPOUND	MOLECULAR MASS ($g \cdot mol^{-1}$)	BOILING POINT (°C)
A	CH_3COOH	60	118
B	CH_3CH_2COOH	74	141
C	$CH_3CH_2CH_2COOH$	88	163
D	$CH_3CH_2CH_2CH_2COOH$	102	185

3.1 Define the term *boiling point*. (2)

3.2 Write down the:

3.2.1 Name of the HOMOLOGOUS SERIES to which the compounds belong (1)

3.2.2 Type of Van der Waals forces responsible for the higher boiling point of the organic compounds (1)

3.3 What is the trend of the boiling points of the compounds?

Fully explain the difference in the boiling points of the compounds. (4)

3.4 Which ONE of the compounds, **A**, **B** or **C**, has the lowest vapour pressure?

Explain the answer. (2)

3.5 Write down the IUPAC name of compound **D**. (2)

3.6 The boiling point of compound **D** is compared with an ESTER with the same number of carbon atoms.

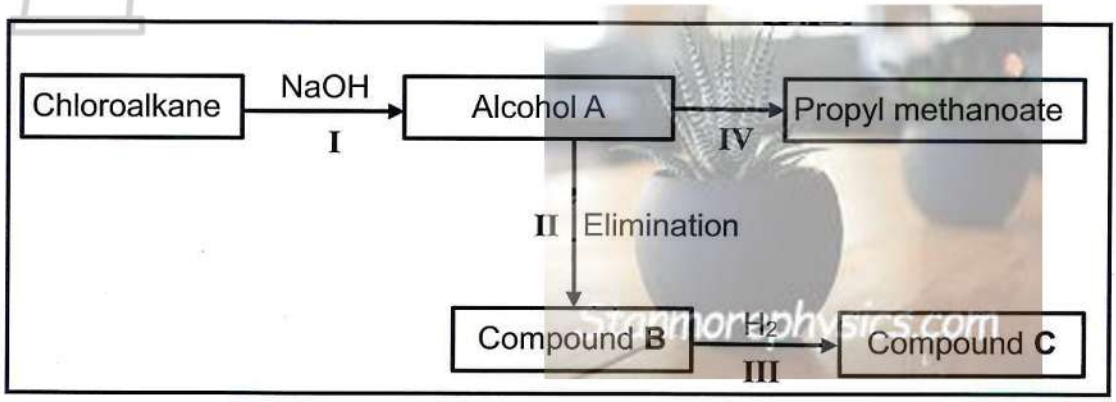
Fully explain the difference in the boiling points of these compounds. (4)
[16]

QUESTION 4 (Start on a new page.)

The flow diagram below shows how a chloroalkane can be used to prepare other organic compounds.

A, B and **C** represent organic compounds.

I, II, III and **IV** represent four organic reactions.



Consider the reaction **I**.

4.1 Write down the:

4.1.1 TYPE of reaction (1)

4.1.2 IUPAC name of the chloroalkane (2)

4.2 Is alcohol **A** primary, secondary or tertiary?

Explain the answer. (3)

Reaction **II** is an elimination reaction.

4.3 Write down the:

4.3.1 TYPE of elimination reaction (1)

4.3.2 Balanced equation using CONDENSED STRUCTURAL FORMULAE for the reaction (3)

4.4 Write down the IUPAC name of Compound **C** formed in reaction **III.** (2)

Consider reaction **IV**.

4.5 Write down the:

4.5.1 NAME or FORMULA of the catalyst used (1)

4.5.2 Balanced equation using STRUCTURAL FORMULAE (4)

[17]

QUESTION 5 (Start on a new page.)

Two experiments, **I** and **II**, are conducted to investigate one of the factors that affects the rate of reaction using the reaction between potassium, K(s) and EXCESS oxygen $O_2(g)$ at a certain temperature.

The balanced equation for the reaction is:

$$4K(s) + O_2(g) \rightarrow 2K_2O(s)$$

The reaction conditions used for each experiment are as follows:

EXPERIMENT **I**

6,92 g of potassium granules react with 4,28g oxygen at 30 °C.

EXPERIMENT **II**

6,92 g of potassium powder react with 4,28g oxygen at 30 °C.

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

5.2 Write down the independent variable for the reaction. (1)

5.3 In which experiment is the reaction rate higher?

Write only Experiment **I** or Experiment **II**. (1)

5.4 Use the COLLISION THEORY to explain the answer in QUESTION 5.3. (3)

7,36 g of potassium oxide is produced when the reaction reaches its completion in EXPERMENT **II** in 5,2 s.

5.5 Calculate the:

5.5.1 Average rate of production of potassium oxide in $g \cdot s^{-1}$ (3)

5.5.2 Percentage purity of potassium (6)

5.6 Is ΔH for the experiments POSITIVE or NEGATIVE?

Explain the answer. (2)
[18]

QUESTION 6 (Start on a new page.)

The nitrogen dioxide, $NO_2(g)$ decomposes to form Nitric oxide, NO(g) and oxygen, $O_2(g)$ at 330 °C in a 2 dm^3 container.

The reaction reaches equilibrium according to the balanced equation:

$$2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$$
brown colourless

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

When the container is cooled down, the reaction mixture turns brown.

6.2 Is the forward reaction EXOTHERMIC or ENDOTHERMIC? (2)

6.3 Use Le Chatelier's principle to explain the answer to QUESTION 6.2. (3)

Initially x moles of $NO_2(g)$ is introduced into the container. At equilibrium the concentration of $NO_2(g)$ is found to be 0,3 $mol \cdot dm^{-3}$. The equilibrium constant, K_c, for the reaction at 330 °C is 0,48.

6.4 Calculate the initial number of moles of $NO_2(g)$. (8)
[15]

QUESTION 7 (Start on a new page.)

7.1 A learner prepares a standard solution by dissolving 4 g of sodium hydroxide, NaOH in 500 cm^3 of water.

7.1.1 Define the term *standard solution*. (2)

7.1.2 Calculate the concentration of the sodium hydroxide solution. (4)

The learner uses the above standard solution to find the concentration of hydrochloric acid.

In one of the titrations exactly 30 cm^3 of sodium hydroxide, NaOH neutralises 35 cm^3 of hydrochloric acid, HCℓ.

The balanced equation for the reaction is:

$$HC\ell(aq) + NaOH(aq) \longrightarrow NaC\ell(aq) + H_2O(\ell)$$

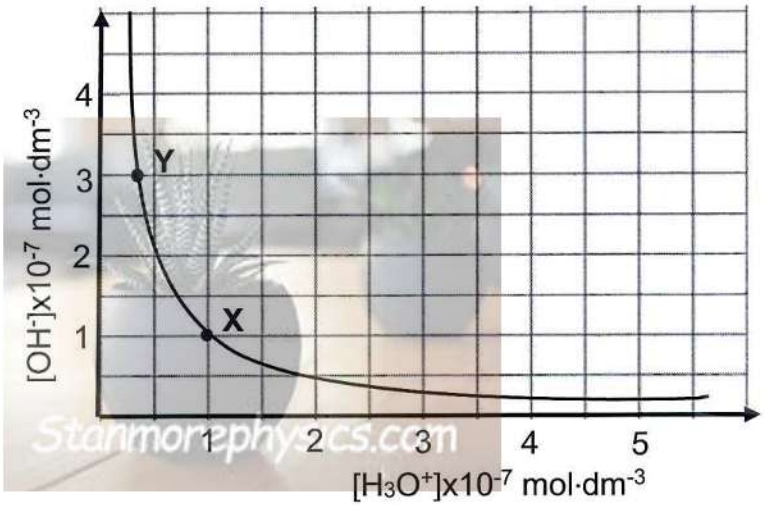
7.1.3 Calculate the concentration of HCℓ. (4)

7.1.4 Will the salt formed in the above reaction undergo HYDROLYSIS?

Write YES or NO.

Give a reason for the answer. (2)

7.2 The graph below shows pairs of $H_3O^+(aq)$ and $OH^-(aq)$ ion concentrations that can exist together at equilibrium in water at 25 °C.



7.2.1 Is the compound at point **X**, ACIDIC, BASIC or NEUTRAL?

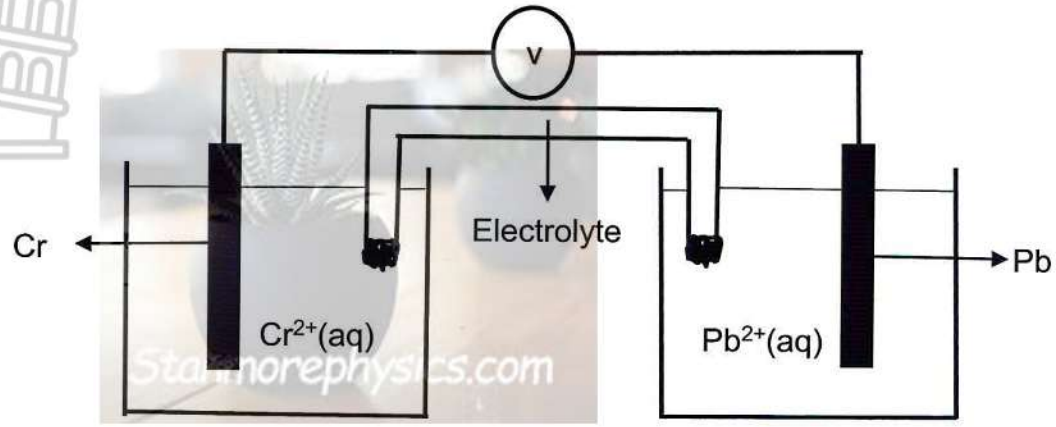
Give a reason for the answer. (2)

7.2.2 Calculate the pH of the compound at point **Y**. (5)

[19]

QUESTION 8 (Start on a new page.)

The electrochemical cell is set up under standard conditions using two half cells. The simplified diagram of the cell is shown below.



8.1 State the standard conditions under which the cell functions. (2)

8.2 Write down the NAME or FORMULA for the electrolyte used in the salt bridge. (1)

8.3 Define the term *cathode*. (2)

8.4 Write down the half reaction that takes place at the CATHODE. (2)

8.5 Calculate the initial emf of the cell. (4)

8.6 Write down the cell notation of the above cell. (3)

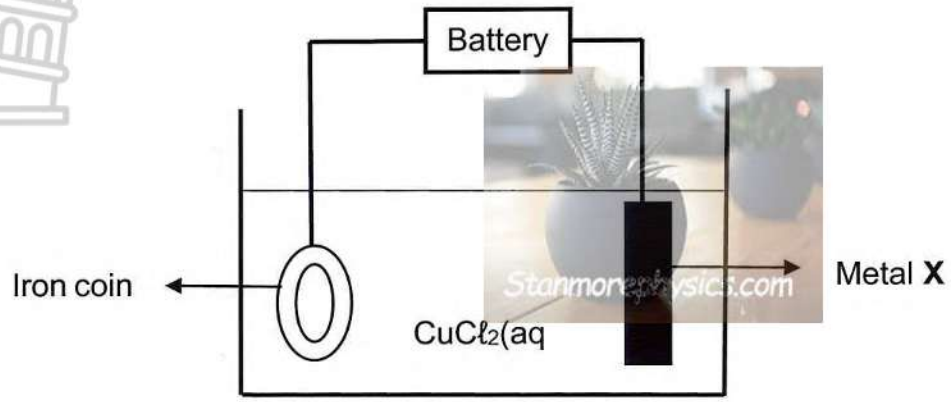
8.7 How will the concentration of Cr^{2+} be affected as the cell goes flat.

Choose from INCREASE, DECREASE or REMAIN THE SAME.

Give a reason for the answer. (2)
[16]

QUESTION 9 (Start on a new page.)

The simplified diagram below represents the cell used for electroplating the iron coin with metal **X**.



9.1 Define the term *electrolytic cell*. (2)

9.2 Write down the NAME or FORMULA of metal **X**. (1)

9.3 Which electrode is POSITIVE?

Write only X or coin. (2)

Give a reason for the answer. (2)

9.4 Write down the half reaction that takes place at the iron coin. (2)

The two electrodes in the above electrolytic cell are replaced with carbon electrodes.

9.5 Write down the balanced equation for the reaction that takes place in the new cell. (3)
[10]

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* $E^{\theta}_{cell} = E^{\theta}_{oxidising\,agent} - E^{\theta}_{reducingagent}$ / $E^{\theta}_{sel} = E^{\theta}_{oksideermiddel} - E^{\theta}_{reduseermiddel}$		

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

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)
2,1 **H** 1																	**He** 2
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	**Ne** 20
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	**Ar** 40
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80	**Kr** 84
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	**Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127	**Xe** 131
0,7 **Cs** 133	0,9 **Ba** 137	**La** 139	1,6 **Hf** 179	**Ta** 181	**W** 184	**Re** 186	**Os** 190	**Ir** 192	**Pt** 195	**Au** 197	**Hg** 201	1,8 **Tℓ** 204	1,8 **Pb** 207	1,9 **Bi** 209	2,0 **Po**	2,5 **At**	**Rn**
0,7 **Fr**	0,9 **Ra** 226	**Ac**															

Ce 140	**Pr** 141	**Nd** 144	**Pm**	**Sm** 150	**Eu** 152	**Gd** 157	**Tb** 159	**Dy** 163	**Ho** 165	**Er** 167	**Tm** 169	**Yb** 173	**Lu** 175
Th 232	**Pa**	**U** 238	**Np**	**Pu**	**Am**	**Cm**	**Bk**	**Cf**	**Es**	**Fm**	**Md**	**No**	**Lr**

KEY/*SLEUTEL*

Atomic number
Atoomgetal

29
Cu
1,9
63,5

Electronegativity
Elektronegatiwiteit

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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

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

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

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

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

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

Increasing strength of oxidising agents/Toenemende sterkte van oksideermiddels ↓

Increasing strength of reducing agents/Toenemende sterkte van reduseermiddels ↑

education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

PHYSICAL SCIENCES: CHEMISTRY (P2)
FISIESE WETENSKAPPE: CHEMIE (V2)

MARKING GUIDELINES/*NASIENRIGLYNE*

SEPTEMBER 2025

MARKS/*PUNTE*: 150

These marking guidelines consist of 13 pages
Hierdie nasienriglyne bestaan uit 13 bladsy

QUESTION/*VRAAG* 1

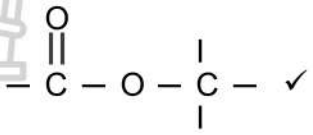
1.1.	D	✓✓	(2)
1.2	B	✓✓	(2)
1.3	D	✓✓	(2)
1.4	A	✓✓	(2)
1.5	B	✓✓	(2)
1.6	A	✓✓	(2)
1.7	D	✓✓	(2)
1.8	C	✓✓	(2)
1.9	C	✓✓	(2)
1.10	D	✓✓	(2)

[20]

QUESTION/*VRAAG* 2

2.1. A bond or an atom or a group of atoms that determine(s) the physical and chemical properties of a group of organic compounds. ✓✓ (2 or 0)
'n Chemiese binding of 'n atom of 'n groep atome wat die fisiese en chemiese eienskappe van 'n groep organiese verbindings bepaal. (2 of 0) (2)

2.2



✓ (1)

2.3

2.3.1 F ✓ (1)

2.3.2 Butanal/*Butanaal* ✓✓ (2)

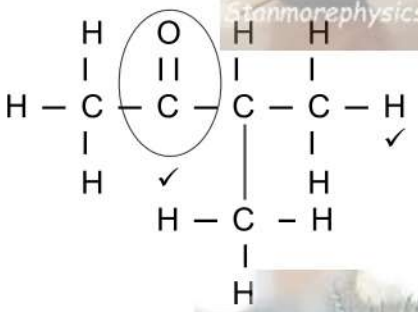
2.3.3 2,3-dichloro-4,5-dimethylheptane✓✓✓
2,3-dichloro-4,5-dimetielheptaan

Marking criteria/*Nasienkriteria:*

- Correct stem i.e. heptane.✓
- All substituents (dichloro and dimethyl) correctly identified.✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓
- *Korrekte stam d.i heptaan* ✓
- *Alle sunstituente (dichloro en dimetiel) korrek geïndentifiseer*
- *IUPAC naam heeltemal korrek insluitende nommering, volgorde, koppeltekens en kommas.*

(3)

2.3.4



✓ ✓

Marking criteria/*Nasienkriteria*

- Functional group✓
- Whole strucure corect✓
- Funksionele groep ✓
- Hele struktuur korrek ✓

(2)

2.3.5

✓ ✓

Marking criteria/*Nasienkriteria*

- Flourines on C_3 ✓
- Whole strucure correct ✓
- *Fluore op C_3* ✓
- *Hele struktuur korrek* ✓

(2)

2.4.1 Organic molecules with the same molecular formula, ✓but different structural formulae ✓
Organiese molekules met dieselfde molekulêre formule, maar verskillende struktuurformules ✓ (2)

2.4.2 Propan-1-ol/ 1-propanol ✓ and Propan-2-ol/ 2-propanol✓
Propan-1-ol/ 1-propanol en Propan-2-ol/ 2-propanol ✓ (2)

2.5 Aldehyde✓and ketone ✓**OR** carboxylic acid and ester
*Aldehied ✓en ketoon ✓**OF** karboksielsuur en ester* (2)
[19]

QUESTION/*VRAAG* 3

3.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure✓✓
Die temperatuur waarby die dampdruk van 'n stof gelyk is aan die atmosferiese druk.

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

(2)

3.2

3.2.1 Carboxylic acid/*Karboksielsuur*✓ (1)

3.2.2 Hydrogen bond or dipole-dipole bond.✓
Waterstofbinding of dipool-dipool binding (1)

3.3 From A to D boiling point increases✓

- **Structure:**
  The chain length/number of carbon atoms/molar mass/ surface area/ contact area increases ✓ from compound A to D.
- **Intermolecular forces:**
  The strength of the London forces/induced dipole/Van der Waals/ intermolecular forces increase. ✓
- **Energy:**
  More energy needed to overcome/break the intermolecular forces from A to D.✓

OR

Boiling point decrese from D to A ✓

- **Structure:**
  The chain length/number of carbon atoms/molar mass/ surface area/ contact area decreases from compound D to A.✓
- **Intermolecular forces:**
  The strength of the intermolecular forces/London forces decrease from D to A ✓
- **Energy:**
  Lesser energy needed to weaken/overcome/break the intermolecular forces from D to A.✓

Van A na D neem die kookpunt toe

- ***Struktuur:***
  Die kettinglengte/aantal koolstowwe/molêre massa/reaksieoppervlak/kontakarea neem toe van verbinding A na D.
- ***Intermolekulêre kragte:***
  Die sterkte van die Londonkragte/geïnduseerde dipoolkragte/Van der Waalskragte neem toe.
- ***Energie:***
  Meer energie benodig om intermolekulêre kragte te oorkom/breek van A na D.

Van D na A neem die kookpunt af

- ***Struktuur:***
  Die kettinglengte/ aantal koolstowwe/molêre massa/reaksieoppervlak/kontakarea neem af van verbinding D na A..
- ***Intermolekulêre kragte:***
  Die sterkte van die Londonkragte/geïnduseerde dipoolkragte/Van der Waalskragte neem af.
- ***Energie:***
  Minder energie benodig om intermolekulêre kragte te oorkom/breek van D na A. (4)

3.4 C/butanoic acid ✓it has the highest/higher boiling point✓
C/butanoësuur ✓ dit het die hoogste/hoër kookpunt ✓ (2)

3.5 Pentanoic acid/*Pentanoësuur* ✓✓ (2)

3.6
- Compound D/Pentanoic acid/carboxylic acid has two sites for hydrogen bond ✓
- Esters has dipole-dipole forces✓
- Intermolecular forces in compound D/pentanoic acid are stronger than Intermolecular forces in esters ✓
  OR
  Intermolecular forces in ester are weaker than in compound D
- Less energy needed to overcome/break the intermolecular forces in ester than in compound D/pentanoic acid.✓
  OR
  More energy needed to overcome/break the intermolecular forces in D than in ester.

- *Verbinding D/Pentanoësuur/carboksielsuur het twee plekke vir waterstofbinding* ✓
- *Ester het dipool-dipoolkragte*✓
- *Intermolekulêrekragte in verbinding D/pentanoësuur is sterker as die intermolekulêrekragte in esters* ✓
  OF
  Intermolekulêrekragte in ester is swakker as in vebinding D
  Minder energie benodig om die intermolekulêre kragte te oorkom/breek in esters as in verbinding D/pentanoësuur.✓
  OF
  Meer energie benodig om die intermolekulêre kragte te oorkom/breek in verbinding D/pentanoësuur as in esters.✓ (4)

[16]

QUESTION/*VRAAG* 4

4.1.1 Substitution/Hydrolysis reaction. ✓
Substitusie/Hidrolise reaksie (1)

4.1.2 **NOTE/*NOTA***
Penalise 1 mark if a hyphen is missing/*Penaliseer as daar 'n koppelteken uitgelaat is.*

1-chloropropane/*1-chloropropaan* ✓✓ (2)

4.2 Primary alcohol ✓
Alcohol in which the carbon atom bonded to the functional group(-OH) is attached to one carbon atom. ✓ ✓
Primêre alkohol
Alkohol waar die koolstofatoom gebind aan die funksionele groep(-OH) gebind is aan een ander koolstofatoom. (3)

4.3.1 Dehydration reaction/*Dehidrasie reaksie* ✓ (1)

4.3.2 $CH_3CH_2CH_2OH$ ✓ → CH_3CHCH_2 ✓ + H_2O ✓ (3)

4.4 Propane/*Propaan* ✓✓ (2)

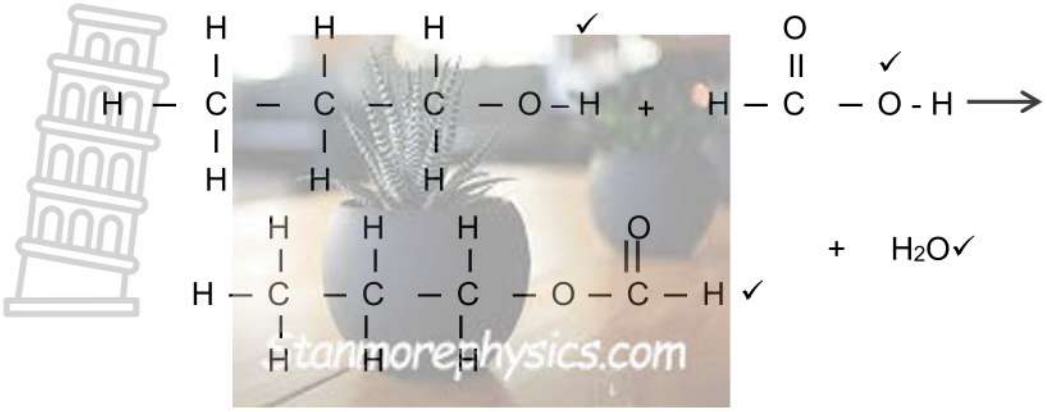
4.5.1 **NOTE/*NOTA***
No mark for dilute H_2SO_4/*Geen punt vir verdunde* H_2SO_4

Sulphuric acid/Hydrogen sulphate/H_2SO_4/Phosphoric acid/H_3PO_4 ✓
Swawelsuur/Waterstofsulfaat/H_2SO_4*/Fosforsuur/* H_3PO_4 (1)

4.5.2 **Marking criteria/*Nasienkriteria*:**

- Correct structural formula for methanoic acid ✓
- Correct structural formula for alcohol ✓
- The whole structural formula for ester correct ✓
- H_2O ✓
- *Korrekte struktuurformule vir metanoësuur* ✓
- *Korrekte struktuurformule vir alkohol* ✓
- *Die hele struktuurformule vir die ester is korrek* ✓
- *H_2O* ✓

IF/*INDIEN*
Condensed structural formula used/*Gekondenseerde struktuur formule gebruik* Max/***Maks ¼***



(4)
[17]

QUESTION/*VRAAG* 5

5.1 **ANY ONE:**
- Change in concentration ✓of products/reactants per unit time.✓
- Change in amount/number of mole/volume/mass ✓of products/reactants per unit time.✓
- Amount/number of mole/volume/mass of products formed/reactants used✓ per unit time.✓
- Rate of change in concentration/amount/number of moles/volume/mass.✓✓ (**2 or 0**)

ENIGE EEN:
- *Verandering in konsentrasie* ✓*van produkte/reaktanse per eenheidtyd.*✓
- *Verandering in hoeveelheid/getal mol/volume/massa* ✓*van produkte/reaktanse per eenheidtyd.*✓
- *Hoeveelheid/getal mol/volume/massa produkte gevorm/reaktanse gebruik*✓ *per eenheidtyd.*✓
- *Tempo van verandering in konsentrasie/hoeveelheid/getal mol/volume/massa.*✓✓(***2 or 0***) (2)

NOTE/*NOTA*
Give the mark for per unit time only if in correct context of reaction rate
Gee die punt vir per eenheidtyd slegs indien in korrekte konteks met reaksietempo.

5.2 Surface area/State of division✓
Kontakoppervlak/Toestand van verdeeldheid (1)

5.3 Experiment/*Eksperiment* II✓ (1)

5.4
- The surface area increase/Experiment 2 has a larger surface area/ more particles exposed (to oxygen gas)✓
- More particles will have enough kinetic energy✓
- More effective collision per unit time/second/Higher frequency of effective collisions ✓
- *Die kontakoppervlak vergroot/Eksperiment 2 het 'n groter kontakoppervlak/meer deeltjies word blootgestel (aan suurstofgas)*
- *Meer deeltjies het genoeg/voldoende kinetiese energie*
- *Meer effektiewe botsings per eenheidtyd/sekonde/hoër frekwensie van effektiewe botsings* (3)

5.5.1 **Marking criteria/*Nasienkriteria*:**
- Δm (7,36-0) ✓ & Δt (5,2-0) ✓
- Answer/*Antwoord* 1,42 ($g \cdot s^{-1}$) ✓

Rate/*Tempo* =Δm/Δt
= (7,36-0) ✓/ (5,2-0) ✓
= 1,42 ($g \cdot s^{-1}$) ✓ (3)

5.5.2

Marking criteria:	***Nasienkriteria*:**
• Formula $n=\frac{m}{M}$ ✓ • Substituting 94 g·mol^{-1} ✓in $n=\frac{m}{M}$ • USE mol ratio n(K) = 2n(K_2O) ✓ • Substitution of 39 g·mol^{-1} and reacting mole in $n=\frac{m}{M}$ ✓ • Substitution of $\frac{6,11}{6,92}(100)$✓ • Answer 88,25%✓ Range: 88,25% - 89,05%	• *Formule* $n=\frac{m}{M}$ ✓ • *Vervanging van 94 g·mol^{-1} ✓in* $n=\frac{m}{M}$ • *GEBRUIK molverhouding n(K) = 2n(K_2O)* ✓ • *Vervanging van 39 g·mol^{-1} en reagerende mol in* $n=\frac{m}{M}$ ✓ • *Vervanging van* $\frac{6,11}{6,92}(100)$ ✓ • *Antwoord 88,25%*✓ *Range: 88,25% - 89,05%*

$n = \frac{m}{M}$✓

$n = \frac{7,36}{94}$ ✓
= 0,0783 mol

n(K) = 2 x 0,783 ✓
= 0,1566 mol

n(K) = m/M
m(K) = 0,1566 x 39✓
= 6,11g

% purity/*suiwerheid* = $\frac{6,11}{6,92}(100)$ ✓

= 88,25% ✓

(6)

5.6 Negative ✓ Exothermic reaction/energy of the product < energy of the reactant/ energy of the reactant > energy of the product ✓
Negatief ✓ Eksotermiese reaksie/energie van die produkte < energie van die reaktanse/ energie van die reaktanse > energie van die produkte ✓

ACCEPT/AANVAAR
More energy is released than absorbed/*Meer energie word vrygestel as wat geabsorbeer word.*
Combustion reaction. It releases energy/Verbrandingsreaksie. Stel energie vry (2)
[18]

QUESTION/*VRAAG* 6

6.1 The dynamic equilibrium when) the rate of the forward reaction equals the rate of the reverse reaction.✓✓ (**2** or **0)**
OR
The stage in a chemical reaction when the concentration of reactants and products remain constant
*(Die dinamiese ewewig wanneer) die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie. (**2** of **0**)*
OF
Die stadium in 'n chemiese reaksie waar die konsentrasie van die reaktanse en produkte konstant bly. (2)

6.2 Endothermic/*Eksotermies* ✓✓

6.3
- Decrease in temperature favours the the reaction that decreases temperature (exothermic reaction) ✓
- The reverse reaction is favoured✓
- Concentration of reactant/NO_2 increases ✓
  OR
  Concentration of products/NO and O_2 decreases
- *Afname in temperatuur bevoordeel die eksotermiese reaksie* ✓
- *Die terugwaartse reaksie word bevoordeel*✓
- *Konsentrasie van reaktanse/NO_2 neem toe* ✓
  OF
  Konsentrasie van produkte/NO en O_2 neem af

(3)

6.4

CALCULATIONS USING NUMBER OF MOLES/*BEREKENING DEUR MOL TE GEBRUIK*

Marking criteria:
a) Change in n(NO_2) = equilibrium nNO_2) - initial n(NO_2) = x - 0,6 ✓
b) Using ratio: NO : N_2O : O_2 = 2: 2: 1 ✓
c) Equilibrium n(NO) = intial n(NO) + change in n(NO)
Equilibrium n(O_2) = intial n(O_2) + change in n(O_2) ✓
d) Dividing by 2 ✓
e) Correct Kc expression in square brackets✓
f) Substitution of equilibrium constant✓
g) Substitution of equilibrium concentrations into Kc expressions✓
h) Final answer. 1,48 mol✓

Nasienkriteria:
a) Verandering in n(NO_2) = ewewig nNO_2) - aanvanklike n(NO_2) = x -0,6✓
b) gebruik verhouding: NO : N_2O : O_2 = 2: 2: 1 ✓
c) Ewewig n(NO) = aanvanklike n(NO) + verandering in n(NO)
Ewewig n(O_2) = aanvanklike n(O_2) + verandering in n(O_2) ✓
d) Korrekte Kc uitdrukking in vierkantige hakkies✓
e) Deel deur 2 ✓
f) Vervanging van ewewigskonstante ✓
g) Vervanging van ewewigskonsentrasies in Kc uitdrukking✓
i) Finale antwoord. 1,48 mol✓

Mol	$2NO_2$	2NO	O_2
Initial mole *Aanvanklike mol*	x	0	0
Change in mole *Verandering in mol*	x-0,6✓	x-0,6	x-0,6)/2 ✓
Equilibrium mole *Mol by ewewig*	0,6	x-0,6	(x-0,6)/2 ✓
Concentration	0,3	(x-0,6)/2	x-0,6/2 ÷ 2 ✓

$$K_c = \frac{[NO]^2 \times [O_2]}{[NO_2]^2} \checkmark$$

$$0,48 \checkmark = \frac{(x - 0,6)/2)^2 \times (x-0,6/4)}{(0,3)^2} \checkmark \quad x = 1,48 \text{ mol} \checkmark$$

(8)

[15]

QUESTION/*VRAAG* 7

7.1.1 Solution with known concentration ✓✓
Oplossing met bekende konsentrasie (2)

7.1.2

Marking criteria/*Nasienkriteria*:
- Formula $c = \frac{m}{MV}$✓ or n=n/M or c=n/V
- Substituting/*vervanging van* 40 g·mol^{-1} and 4g✓
- Dividing by/*deel deur* 0,5dm^3 ✓
- Answer/*Antwoord*✓

OPTION 1/OPSIE 1	**OPTION 2/*OPSIE 2***
c = m/MV ✓ c= 4/(40x0,5) ✓ ✓ c= 0,2 mol·dm^{-3} ✓	n = n/M = 4/40 ✓ = 0.1 mol Any one/*Enige een* ✓ c = n/V = 0.1/0.5 ✓ = 0.2 mol·dm^{-3} ✓

(4)

7.1.3

Marking criteria/*Nasienkriteria*:
- Formula $\frac{c_a v_a}{c_b v_b} = \frac{n_a}{n_b}$ ✓
- Substitution on C_aV_a and Substitution on C_bV_b✓/ Substitution on n= cV and n=cV
- Ratio 1:1✓
- Final answer 0,17 mol·dm^{-3}✓
- *Formule* $\frac{c_a v_a}{c_b v_b} = \frac{n_a}{n_b}$ ✓
- *Vervanging in C_aV_a & vervanging in C_bV_b✓ Vervanging van n=cV en n = cV*
- *Verhouding 1:1*✓
- *Finale antwoord 0,17 mol·dm^{-3}*✓

OPTION 1/OPSIE 1:	***OPTION 2/OPSIE 2:***
$\frac{c_a v_a}{c_b v_b} = \frac{n_a}{n_b}$ ✓ $\frac{c_a x35}{0,2\ x30}$ ✓ $= \frac{1}{1}$ ✓ c_a = 0,17 mol·dm^{-3} ✓	n (NaOH) = cV ✓ = 0,2 x 0,03 = 0,006 mol Ratio: 1 : 1 n (HCl) = 0,006 mol ✓ c = $\frac{n}{V}$ ✓ = $\frac{0,006}{0,035}$ = 0,17 mol·dm^{-3} ✓

(4)

7.1.4 NO ✓
It is a salt of strong acid and a strong base. ✓
Dit is 'n sout van 'n sterk suur en 'n sterk basis (2)

7.2.1 Neutral ✓
[H_3O^+] = [OH^-] = 1x10^{-7}mol·dm^{-3} or pH = 7 ✓

ACCEPT/*AANVAAR*
[H_3O^+] = [OH^-] (2)

7.2.2

OPTION 1/*OPSIE 1:*	**OPTION 2/*OPSIE 2:***
pOH = -log [OH^-] ✓ pOH = -log (3 x 10^{-7}) ✓ pOH = 6,52 ✓ pH + pOH = 14 pH + 6,52 = 14 ✓ pH = 14-6,52 pH = 7,48 ✓	[H_3O^+][OH^-] = 1x10^{-14} [H_3O^+][3x10^{-7}] = 1x10^{-14} ✓ [H_3O^+] = 3.33x10^{-8} (mol·dm^{-3}) ✓ Any one ✓ pH = -log [H_3O^+] = -log [3.33x10^{-8}] ✓ = 7.48 ✓

(5)
[19]

QUESTION/*VRAAG* 8

8.1
- Concentration must be 1 mol·dm^{-3}✓
- Temperature must be 25°C/298K✓
- *Konsentrasie moet 1 mol·dm^{-3} wees*✓
- *Temperatuur moet 25°C/298K wees*✓

(2)

8.2 Sodium chloride/NaCℓ/Potassium chloride/KCℓ or any suitable electrolyte✓
Natriumchloried/ NaCℓ/*Kaliumchloried/* KCℓ/ *of enige geskikte elektroliet*

ACCEPT/*AANVAAR*
Any metal nitrates/Enige metal *nitrate* (1)

8.3 Electrode where reduction takeplace✓✓
Elektrode waar reduksie plaasvind (2)

8.4

Marking guidelines/*Nasienkriteria:*
- $Pb^{2+} + 2e^- \rightleftharpoons Pb$ ($^1/_2$)
- $Pb \leftarrow Pb^{2+} + 2e^-$ ($^2/_2$)
- $Pb \rightleftharpoons Pb^{2+} + 2e^-$ ($^0/_2$)
- $Pb \rightarrow Pb^{2+} + 2e^-$ ($^0/_2$)
- Ignore charges omitted on electron/*Ignoreer indien lading weggelaat is op elektron*
- If charge (+) omitted on Pb^{2+} / *Indien (+) lading weggelaat is op* Pb^{2+} Max. ($^1/_2$)

Example/*Voorbeeld*: $Pb^2 + 2e^- \rightarrow Pb$ ✓

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

8.5 $E^{\ominus}_{cell} = E^{\ominus}_{reduction} - E^{\ominus}_{oxidation}$✓
$E^{\ominus}_{cell} = -0,13$✓ – (-0,91) ✓
= 0,78V✓ (4)

Notes/*Aantekeninge*:
- Accept any other correct formula from the data sheet./*Aanvaar enige ander korrekte formule vanaf gegewensblad*
- Any other formula using unconventional abbreviations, e.g $E^{\ominus}_{cell} = E^{\ominus}_{OA} - E^{\ominus}_{RA}$ followed by correct substitutions/*Enige ander formule wat onkonvensionele afkortings gebruik bv.* $E^{\ominus}_{sel} = E^{\ominus}_{OM} - E^{\ominus}_{RM}$ gevolg deur korrekte vervangings: ¾

8.6

Marking criteria/*Nasienkriteria:*
- oxidation✓ double line✓ reduction ✓
- oksidasie ✓ dubbellyn ✓ reduksie ✓

Cr(s)/ Cr^{2+} (aq)(1 mol•dm^{-3})✓*II* ✓ Pb^{2+}(aq)(1 mol•dm^{-3})/ Pb(s)✓ (3)

8.7 Increases/*Verhoog*✓
Cr is oxidised to Cr^{2+}✓
Cr is geoksideer na Cr^{2+} (2)
[16]

QUESTION/*VRAAG* 9

9.1 Cell in which electric energy is converted to chemical energy.✓✓ **(2 or 0)**
Sel waarin elektriese energie omgeskakel is na chemiese energie .✓✓ **(2 or 0)** (2)

9.2 Copper/*Koper* (Cu)✓ (1)

9.3 X ✓
Oxidation takes place at X/ X loses electrons ✓
Oksiedasie vind by X plaas/X verloor elektrone (2)

9.4

Marking guidelines/*Nasienkriteria:*
- $Cu^{2+} + 2e^- \rightleftharpoons Cu$ ($^1/_2$)
- $Cu \leftarrow Cu^{2+} + 2e^-$ ($^2/_2$)
- $Cu \rightleftharpoons Cu^{2+} + 2e^-$ ($^0/_2$)
- $Cu \rightarrow Cu^{2+} + 2e^-$ ($^0/_2$)
- Ignore charges omitted on electron/*Ignoreer indien lading weggelaat is op elektron*
- If charge (+) omitted on Cu^{2+}
  Indien lading (+) lading weggelaat is op Cu^{2+} Max. ($^1/_2$)

  Example/*Voorbeeld*: $Cu^2 + 2e^- \rightarrow Cu$ ✓

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

9.5

Marking criteria/*Nasienkriteria:*
- Reactants✓ Products✓ Balancing✓
- Ignore double arrows
- Ignore phases
- Marking rule 6.3.10
- *Reaktanse✓ Produkte✓ Balansering✓*
- *Ignoreer dubbel pyle*
- *Ignoreer fases*
- *Nasienreël 6.3.10*

$Cu^{2+}(aq) + 2C\ell^{-}(aq)$✓→ Cu(s)✓+ $C\ell_2$ bal✓

ACCEPT/*AANVAAR*
$CuCl_2$ (aq) ✓ → Cu(s)✓+ $C\ell_2$ bal✓ (3)
[10]

TOTAL/*TOTAAL*: 150