education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION

GRADE 12

PHYSICAL SCIENCES P2
(CHEMISTRY)

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 and other applicable information in the appropriate spaces on the ANSWER BOOK.
2. The 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 3.1 and QUESTION 3.2.
6. You may use a non-programmable pocket 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 where necessary.
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, for example, 1.11 E.

1.1 Which ONE of the following is an unsaturated hydrocarbon?

A C_4H_{10}

B $CH_3(CH)_2CH_3$

C $CH_3(CH_2)_2CH_3$

D $CH_3CH_2CH_2CH_3$ (2)

1.2 Consider the organic molecule below.

$$C_4H_8O_2$$

Its correct IUPAC name is …

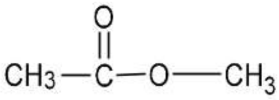
A butan-2-ol.

B butanoic acid.

C methyl butanoate.

D ethyl butanoate. (2)

1.3 Consider the organic structure below.



$$CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-O-CH_3$$

The IUPAC name of its FUNCTIONAL ISOMER is …

A methyl ethanoate.

B propanoic acid.

C ethyl methanoate.

D ethanoic acid. (2)

1.4 The reaction of copper(II) carbonate with EXCESS dilute hydrochloric acid is used to investigate the rate of reaction. The balanced equation for this reaction is:

$$CuCO_3(s) + 2HC\ell(aq) \rightarrow CuC\ell_2(aq) + H_2O(\ell) + CO_2(g)$$

The rate of reaction can experimentally be measured by measuring the …

A hydrochloric acid used.

B amount of water formed per time.

C volume of CO_2 produced per time.

D temperature of the mixture. (2)

1.5 Which ONE of the following statements concerning equilibrium is NOT correct?

A Equilibrium is reached in a closed system.

B At equilibrium, the concentration of reactants and products is constant.

C At equilibrium, the concentration of reactants and products is not necessarily the same.

D At equilibrium, the concentration of reactants is equal to the concentration of products. (2)

1.6 Write down the conjugate base of the following acid:

$$HC\ell O_4$$

A $HC\ell O_3^-$

B $HC\ell O_4^-$

C $C\ell O_4^-$

D $H_2C\ell O_4$ (2)

1.7 The role of an indicator during a titration is to …

A show the color of the base.

B standardise the solution.

C show the color of the acid.

D identify the endpoint. (2)

1.8 Which statement is CORRECT for a Zn-Cu galvanic cell that operates under standard conditions?

A The concentration of the Zn^{2+} ions in the zinc half-cell gradually decreases.

B The concentration of the Cu^{2+} ions in the copper half-cell gradually increases.

C The intensity of the colour of the electrolyte in the copper half-cell gradually decreases.

D Negative ions migrate from the zinc half-cell to the copper half-cell. (2)

1.9 What is the energy convertion in an electrolytic cell?

A Electrical to chemical

B Chemical to electrical

C Electrical to mechanical

D Chemical to mechanical (2)

1.10 During the purification of copper, the …

A impure copper is the positive electrode.

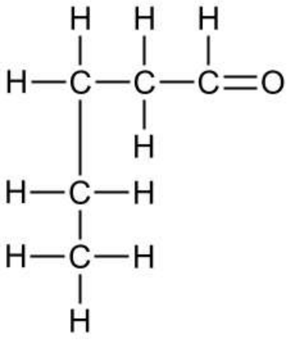
B impure copper is connected to the cathode.

C pure copper is the positive electrode.

D pure copper is connected to the anode. (2)
[20]

QUESTION 2 (Start on a new page.)

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

A	$CH_3COCH(CH_3)_2$	**B**	3,3-dimethylhexane
C		**D**	
E	$C_2H_4O_2$	**F**	Propan-1-ol

2.1 Write down the letter(s) representing:

2.1.1 An aldehyde (1)

2.1.2 Functional isomers (1)

2.1.3 A carboxylic acid (1)

2.2 Write down the general formula of the homologous series to which compound **B** belongs. (2)

2.3 For compound **C**, write down the:

2.3.1 Letter of the molecule that is its structural isomer (1)

2.3.2 Type of structural isomerism named in QUESTION 2.2.1 (1)

2.3.3 IUPAC name (3)

2.4 For compound **A**, write down the structural formula of its chain isomer. (3)

2.5 Compounds **E** and **F** react to form an organic molecule. For this reaction, write down the:

2.5.1 Type of reaction (1)

2.5.2 NAME or FORMULA of the catalyst used (1)

2.5.3 IUPAC name of the ORGANIC product formed (2)

[17]

QUESTION 3 (Start on a new page.)

The boiling points of four organic compounds are shown in the table below.

COMPOUND		BOILING POINT (°C)	MOLAR MASS ($g \cdot mol^{-1}$)
A	CH_3CH_2COOH	141,1	74
B	$CH_3(CH_2)_3OH$	….	74
C	$CH_3CH(CH_3)CH_2OH$	108	74
D	$CH_3COCH_2CH_3$	79,6	72

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

3.2 Compounds **C's** boiling point is lower than that of compound **B**. Fully explain. (3)

3.3 Consider compounds **A**, **B** and **D**.

3.3.1 Predict the value of the boiling point of compound **B** in °C. Choose from:

145	141	117,7

(1)

3.3.2 Fully explain the answer to QUESTION 3.3.1. (6)

3.4 The vapour pressures of three straight-chained alkanes **E**, **F** and **G** are shown below.

COMPOUND		VAPOUR PRESSURE at 25 °C (kPa)
E	C_2H_6	4 187
F	C_3H_8	1 050
G	C_4H_{10}	250

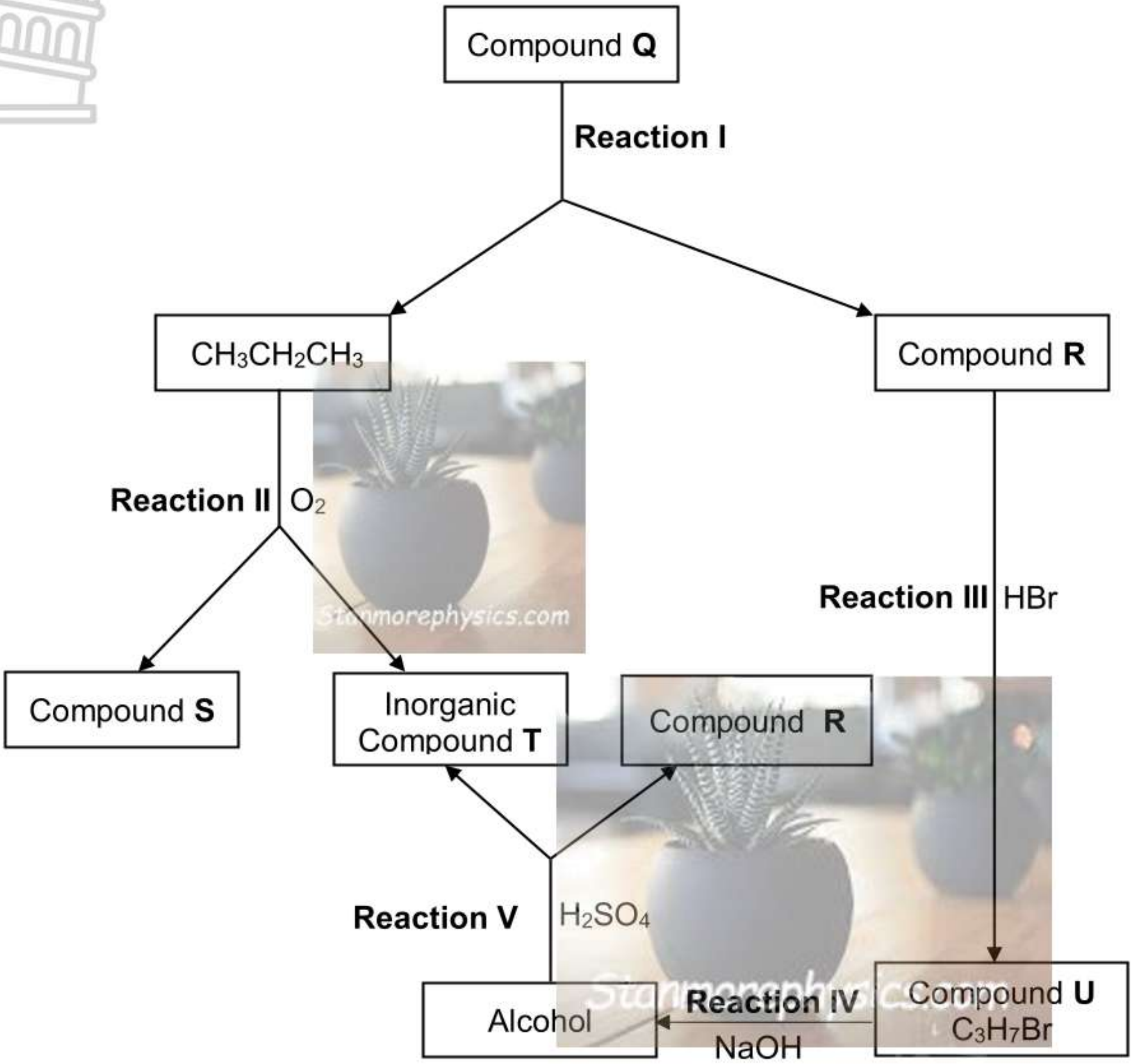
3.4.1 Write the IUPAC NAME of the compound with the highest BOILING POINT. (2)

3.4.2 Fully explain the trend in the vapour pressure from compound **E** to compound **G**. (3)

[17]

QUESTION 4 (Start on a new page.)

The flow diagram below shows a number of organic reactions. Reaction **I** is CATALYTIC CRACKING.



4.1 Define the term *cracking*. (2)

4.2 Consider reaction **II**.

4.2.1 What type of reaction is it? Choose from ENDOTHERMIC or EXOTHERMIC. (1)

4.2.2 Using MOLECULAR FORMULAE, write down the balanced chemical equation. (3)

4.2.3 Write down the NAME of compound **S**. (1)

4.3 In reaction **III**, compound **R** reacts with HBr to form compound **U**, which is a major product with molecular formula C_3H_7Br.

For reaction **III**, write down:

4.3.1 The type of reaction (1)

4.3.2 ONE reaction condition (1)

4.3.3 The IUPAC name of compound **U** (2)

4.4 For reaction **IV**, write down the:

4.4.1 Structural formula of the alcohol formed (2)

4.4.2 Type of reaction (1)

4.5 For reaction **V**, write down the:

4.5.1 Type of elimination reaction (1)

4.5.2 IUPAC name of compound **R** (2)
[17]

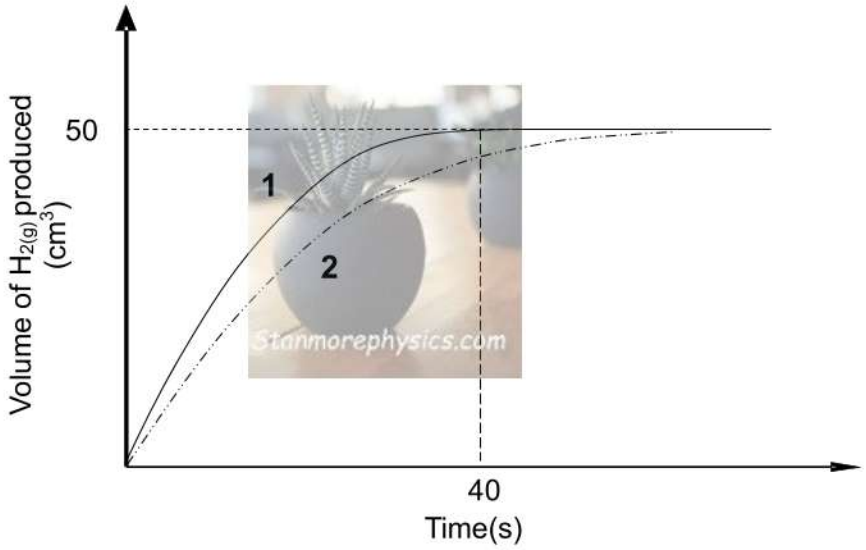
QUESTION 5 (Start on a new page.)

A factor influencing the rate of a chemical reaction is investigated by conducting two experiments, **1** and **2,** in which the following reaction occurs:

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

In both experiments, the same mass of magnesium(Mg) is added to an EXCESS hydrochloric acid(HCℓ) solution with the same concentration in an open flask at STP.

The graph below shows the changes in the amount of gas collected during the reaction in experiments **1** and **2**.



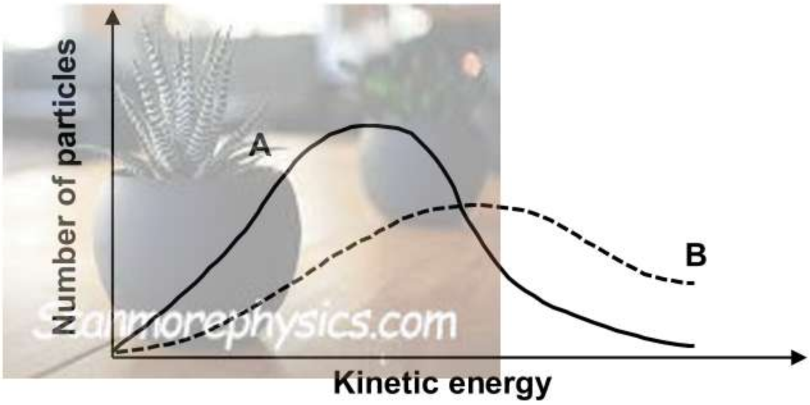
5.1 Write down the name of the apparatus used for collecting the gas. (1)

5.2 Define the term *rate of reaction*. (2)

5.3 Calculate the average rate (in $dm^3 \cdot s^{-1}$) at which hydrogen is produced in experiment **1**. (3)

5.4 If 2 g of magnesium was used for this investigation, calculate the percentage purity of the magnesium. (7)

5.5 The Maxwell-Boltzmann distribution curves for the reaction in experiment **1** and **2** are given below.



5.5.1 Which factor affecting the reaction rate is being investigated? (1)

5.5.2 Which curve (**A** or **B**) represents the reaction in experiment **2**? (1)

5.5.3 Explain the answer to QUESTION 5.5.2 by referring to the collision theory. (2)

[17]

QUESTION 6 (Start on a new page.)

Carbon, C, reacts with an unknown amount of carbon dioxide, CO_2, in a sealed 2 dm^3 container, at a temperature **T**. The equilibrium constant, K_c, at this temperature is 0,2. The balanced equation for the reaction is:

$$CO_2(g) + C(s) \rightleftharpoons 2CO(g)$$

At equilibrium, the concentration of carbon monoxide, CO, is found to be 0,04 $mol{\cdot}dm^{-3}$.

6.1 Can the above situation be referred to as a closed system?
Write down YES or NO. (1)

6.2 Explain the answer to QUESTION 6.1. (2)

6.3 Calculate the initial moles of CO_2 used. (8)

6.4 Is the yield of carbon monoxide HIGH or LOW? (1)

6.5 Explain the answer to QUESTION 6.4. (2)

6.6 When the temperature is decreased, the yield of CO decreases.

6.6.1 Is the forward reaction EXOTHERMIC or ENDOTHERMIC? (1)

6.6.2 Use Le Chatelier's principle to explain the answer to QUESTION 6.6.1. (2)

6.7 Draw a graph of potential energy ($kJ{\cdot}mol^{-1}$) versus the reaction coordinate for the reverse reaction.

Indicate the following on the graph:

- Activation energy
- Heat of reaction (ΔH)
- Energy of reactants and products

Write down the actual formulae of reactants and products (CO_2, C and CO) on the graph as labels of these energies. (4)

[21]

QUESTION 7 (Start on a new page.)

7.1 A standard solution of NaOH with a pH of 13,4 is used to neutralise 3,125 cm^3 of a 0,4 $mol{\cdot}dm^{-3}$ solution of H_2SO_4. The balanced chemical equation of the reaction is:

$$H_2SO_4(aq) + 2NaOH(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(\ell)$$

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

7.1.2 Is NaOH a strong or weak base? (1)

7.1.3 Explain the answer to QUESTION 7.1.2. (2)

7.1.4 Calculate the concentration of the NaOH solution. (5)

7.1.5 Calculate the volume of the NaOH needed to neutralise the acid. (5)

7.2 A laboratory technician neutralises an accidental spill by pouring 5 g of baking soda ($NaHCO_3$) on a 50 cm^3 hydrochloric acid solution of concentration 1,6 $mol{\cdot}dm^{-3}$.

$$HC\ell(aq) + NaHCO_3(s) \rightarrow NaC\ell(aq) + CO_2(g) + H_2O(\ell)$$

Calculate the pH of the final solution. Assume the volume remains constant. (7)

[22]

QUESTION 8 (Start on a new page.)

A learner has the following reagents to construct an operational GALVANIC CELL under standard conditions: Lead, Pb, lead nitrate, $Pb(NO_3)_2$, silver, Ag, silver nitrate, $AgNO_3$, and iron(III) chloride, $FeC\ell_3$

8.1 Define the term *electrolyte*. (2)

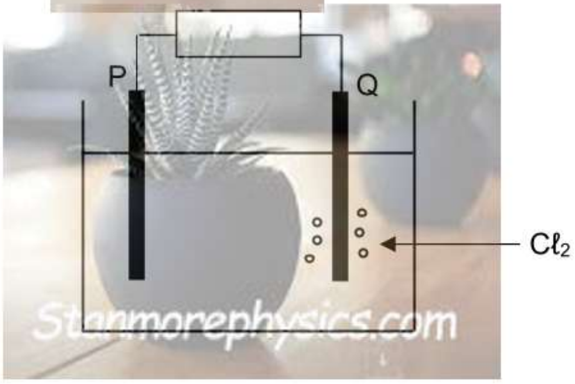
8.2 Using ONLY the reagents given above, write down the cell notation of the operational galvanic cell. (3)

8.3 Write down the NAME or FORMULA of a substance that can be used in the salt bridge. (2)

8.4 Calculate the EMF of the above cell. (4)
[11]

QUESTION 9 (Start on a new page.)

The simplified diagram below represents the electrolysis of a copper(II) chloride solution.



9.1 Write down ONE safety measure which must be taken during the above process. (1)

9.2 Explain why the safety measure in QUESTION 9.1 is necessary. (2)

9.3 In what direction are the electrons moving? Choose from **P to Q** or **Q to P**. (1)

9.4 Write down the NAME of the substance that forms at electrode **P**. (1)

9.5 Write down the balanced net ionic equation for the reaction. (3)
[8]

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* $c=\frac{m}{MV}$	$n=\frac{V}{V_m}$
$\frac{c_aV_a}{c_bV_b}=\frac{n_a}{n_b}$	$pH=-\log[H_3O^{+}]$
$K_w=[H_3O^{+}][OH^{-}]=1\times10^{-14}$ *at/by 298 K*	
$E^{\theta}_{cell}=E^{\theta}_{cathode}-E^{\theta}_{anode}$ *OR* $E^{\theta}_{cell}=E^{\theta}_{reduction}-E^{\theta}_{oxidation}$ *OR* $E^{\theta}_{cell}=E^{\theta}_{oxidising\ agent}-E^{\theta}_{redusing\ agent}$	$E^{\theta}_{sel}=E^{\theta}_{katode}-E^{\theta}_{anode}$ *OF* $E^{\theta}_{sel}=E^{\theta}_{reduksie}-E^{\theta}_{oksidasie}$ *OR* $E^{\theta}_{sel}=E^{\theta}_{oksideermiddel}-E^{\theta}_{reduseermiddel}$

TABLE 3: THE PERIODIC OF ELEMENTS

KEY/SLEUTEL

Atomic number
Atoomgetal

Electronegativity → 1,9 **Cu** ← **Symbol**
Elektronegatiwiteit ***Simbool***

29 1,9 Cu 63,5

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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 2,1 H 1																	2 He 4
3 1,0 Li 7	4 1,5 Be 9											5 2,0 B 11	6 2,5 C 12	7 3,0 N 14	8 3,5 O 16	9 4,0 F 19	10 Ne 20
11 0,9 Na 23	12 1,2 Mg 24											13 1,5 Aℓ 27	14 1,8 Si 28	15 2,1 P 31	16 2,5 S 32	17 3,0 Cℓ 35,5	18 Ar 40
19 0,8 K 39	20 1,0 Ca 40	21 1,3 Sc 45	22 1,5 Ti 48	23 1,6 V 51	24 1,6 Cr 52	25 1,5 Mn 55	26 1,8 Fe 56	27 1,8 Co 59	28 1,8 Ni 59	29 1,9 Cu 63,5	30 1,6 Zn 65	31 1,6 Ga 70	32 1,8 Ge 73	33 2,0 As 75	34 2,4 Se 79	35 2,8 Br 80	36 Kr 84
37 0,8 Rb 86	38 1,0 Sr 88	39 1,2 Y 89	40 1,4 Zr 91	41 Nb 92	42 1,8 Mo 96	43 1,9 Tc	44 2,2 Ru 101	45 2,2 Rh 103	46 2,2 Pd 106	47 1,9 Ag 108	48 1,7 Cd 112	49 1,7 In 115	50 1,8 Sn 119	51 1,9 Sb 122	52 2,1 Te 128	53 2,5 I 127	54 Xe 131
55 0,7 Cs 133	56 0,9 Ba 137	57 La 139	72 1,6 Hf 179	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 1,8 Tℓ 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po	85 2,5 At	86 Rn
87 0,7 Fr	88 0,9 Ra 226	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

Increasing oxidising ability / *Toenemende oksiderende vermoë*

Increasing reducing ability / *Toenemende reduserende vermoë*

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

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

Increasing oxidising ability / *Toenemende oksiderende vermoë* ↓

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
$Pt^{2+} + 2\ e^-$	$\rightleftharpoons$	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
$H_2O_2 + 2H^+ + 2\ e^-$	$\rightleftharpoons$	$2H_2O$	+1,77
$Co^{3+} + e^-$	$\rightleftharpoons$	Co^{2+}	+ 1,81
$F_2(g) + 2e^-$	$\rightleftharpoons$	$2F^-$	+ 2,87

Increasing reducing ability / *Toenemende reduserende vermoë* ↑

education
Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

GRADE/*GRAAD* 12

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

SEPTEMBER 2025

MARKS/*PUNTE*: 150

MARKING GUIDELINES/*NASIENRIGLYNE*

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

QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 B ✓✓ (2)

1.3 B ✓✓ (2)

1.4 C ✓✓ (2)

1.5 D ✓✓ (2)

1.6 C ✓✓ (2)

1.7 D ✓✓ (2)

1.8 C ✓✓ (2)

1.9 A ✓✓ (2)

1.10 A ✓✓ (2)
[20]

QUESTION 2/*VRAAG 2*

2.1.1 D ✓ (1)

2.1.2 A & D ✓ (1)

2.1.3 E ✓ (1)

2.2 C_nH_{2n+2} ✓✓ (2)

2.3.1 B ✓ (1)

2.3.2 Chain (isomers)/*Ketting (isomere)* ✓ (1)

2.3.3 2,2,4-trimethylpentane/*trimetielpentaan* ✓✓✓ (3)

Marking criteria/*Nasienkriteria*:
- Correct stem, i.e. pentane ✓
  Korrekte stam, d.w.s. pentaan
- Correct substituents (methyl) identified. ✓
  Korrekte substituente (metiel) geïdentifiseer.
- IUPAC name entirely correct including numbering, sequence, hyphens and commas. ✓
  IUPAC-naam heeltemal korrek insluitend nommering, volgorde, koppeltekens en kommas.

2.4

Marking criteria/*Nasienkriteria:*
- Functional group/*Funksionele groep* ✓
- 5 C-atoms in the longest chain ✓
  5 C-atome in die langste ketting
- Whole structure correct ✓
  Hele struktuur korrek

(3)

2.5.1 Esterification/condensation / *Verestering/kondensasie* ✓ (1)

2.5.2 H_2SO_4/sulphuric acid / *swaelsuur* ✓ (1)

2.5.3 Propyl ✓ ethanoate ✓ / *Propyl etanoaat* (2)

[17]

QUESTION 3/*VRAAG 3*

3.1

Marking criteria/*Nasienkriteria*:
If any of the underlined key phrases in the correct context is omitted, deduct 1 mark.
Indien enige van die onderstreepte sleutelfrases in die korrekte konteks weggelaat is, trek 1 punt af.

The temperature at which the vapour pressure of a liquid is equal to the atmospheric pressure. ✓✓
Die temperatuur waarby die dampdruk van 'n vloeistof gelyk is aan die atmosferiese druk. (2)

3.2 **Compound C**
- Is more branched/compact/spherical/smaller surface area ✓
- Weaker intermolecular forces ✓
- Less energy needed to break/overcome intermolecular forces ✓

Verbinding C
- *Is meer vertak/kompak/sferies/kleiner oppervlakte*
- *Swakker intermolekulêre kragte*
- *Minder energie benodig om intermolekulêre kragte te breek/oorkom*

OR/*OF*

Compound B
- Is less branched/compact/spherical/larger surface area
- Stronger intermolecular forces
- More energy is needed to break/overcome intermolecular forces

Verbinding B
- *Is minder vertak/kompak/sferies/groter oppervlakte*
- *Sterker intermolekulêre kragte*
- *Meer energie benodig om intermolekulêre kragte te breek/oorkom* (3)

3.3.1 117,7 (°C) ✓ (1)

3.3.2
- Between molecules of compound A are 2 sites of hydrogen bonds (in addition to London and dipole-dipole forces) ✓
- Between molecules of compound B is 1 site of hydrogen bonds (in addition to London and dipole-dipole forces) ✓
- Between compound D are dipole-dipole forces (in addition to London forces) ✓
- Intermolecular forces between molecules of B are weaker than those between molecules of A ✓ but stronger than those between molecules of D ✓
- Less energy needed to overcome intermolecular forces of B compared to that of A ✓/ More energy needed to overcome intermolecular forces of B compared to that of D

- *Tussen molekules van verbinding A is 2 plekke van waterstofbindings (bykomend tot Londen en dipool-dipoolkragte)*
- *Tussen molekules van verbinding B is 1 plek van waterstofbindings (bykomend tot Londen en dipool-dipoolkragte)*
- *Tussen verbinding D is dipool-dipoolkragte (bykomend tot Londen-kragte)*
- *Intermolekulêre kragte tussen molekules van B is swakker as dié tussen molekules van A, maar sterker as dié tussen molekules van D*
- *Minder energie benodig om intermolekulêre kragte van B te oorkom in vergelyking met dié van A / Meer energie benodig om intermolekulêre kragte van B te oorkom in vergelyking met dié van D* (6)

3.4.1 Butane/*Butaan* ✓✓ (2)

3.4.2 **From compound E to G**:
- Chain length increases ✓
- Strength of intermolecular forces increases ✓
- More energy needed to break the intermolecular forces ✓

Vanaf verbinding E na G:
- *Kettinglengte neem toe*
- *Sterkte van intermolekulêre kragte neem toe*
- *Meer energie benodig om die intermolekulêre kragte te breek*

OR/*OF*

From compound G to E
- Chain length decreases
- Strength of intermolecular forces decreases
- Less energy needed to break the intermolecular forces

Van verbinding G na E
- *Kettinglengte neem af*
- *Sterkte van intermolekulêre kragte neem af*
- *Minder energie benodig om die intermolekulêre kragte te breek* (3)

[17]

QUESTION 4/*VRAAG 4*

4.1

Marking criteria/*Nasienkriteria*:
If any of the underlined key phrases in the correct context is omitted, deduct 1 mark.
Indien enige van die onderstreepte sleutelfrases in die korrekte konteks weggelaat is, trek 1 punt af.

A chemical process in which <u>longer chain hydrocarbon molecules</u> are <u>broken down</u> to <u>shorter,</u> more useful <u>molecules</u>. ✓✓
'n Chemiese proses waarin <u>langerketting koolwaterstofmolekules</u> in korter, meer bruikbare <u>molekules</u> <u>afgebreek word</u>. (2)

4.2.1 Exothermic/*Eksotermies* ✓ (1)

4.2.2 $C_3H_8 + 5O_2$ ✓ $\rightarrow$ $3CO_2$ ✓ $+ 4H_2O$ ✓

Marking criteria/*Nasienkriteria:*
- Reactants ✓ *Reaktanse* Products ✓ *Produkte* Balancing ✓ *Balansering*
- Ignore ⇌ and phases
  Ignoreer ⇌ en fases
- Marking rule 6.3.10/*Nasienreël 6.3.10*

(3)

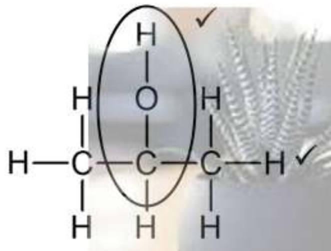
4.2.3 Carbon dioxide/*Koolstofdioksied* ✓ (1)

4.3.1 Addition/hydrohalogenation/hydrobromination ✓
Addisie/hidrohalogenering/hidrobromering (1)

4.3.2 No water/use unreactive solvent ✓
Geen water/gebruik onreaktiewe oplosmiddel (1)

4.3.3 2-bromo ✓propane ✓ /*2-broom propaan* (2)

4.4.1



Marking criteria*:*
- Functional group correct. ✓
- Whole structural formula correct. ✓

Nasienkriteria:
- *Funksionele groep korrek.*
- *Hele struktuurformule korrek.*

(2)

4.4.2 Substitution/hydrolysis / *Substitusie/hidrolise* ✓ (1)

4.5.1 Dehydration / *Dehidrasie* ✓ (1)

4.5.2 Propene/prop-1-ene/1-propene / *Propeen/prop-1-een/1-propeen* ✓✓ (2)
[17]

QUESTION 5/*VRAAG 5*

5.1 Gas syringe/measuring cylinder / *Gasspuit/maatsilinder* ✓ (1)

5.2
- Change in concentration/mass/volume/amount of reactants/ products per unit time ✓✓
- Mass/volume/amount/concentration of reactants used/products formed per unit time
- Rate of change in concentration/mass/volume/amount of reactants or products **(2 or/*of* 0)**

- *Verandering in konsentrasie/massa/volume/hoeveelheid reaktanse/ produkte per tydseenheid*
- *Massa/volume/hoeveelheid/konsentrasie van reaktanse gebruik/ produkte gevorm per tydseenheid*
- *Tempo van verandering in konsentrasie/massa/volume/hoeveelheid van reaktanse of produkte*

(2)

5.3

Marking criteria/*Nasienriglyne:*

(a) Substitute 0,05 in rate formula /*Vervang 0,05 in tempoformule* ✓
(b) Substitute 40 in rate formula / *Vervang 40 in tempoformule* ✓
(c) Final answer/*Finale antwoord:* $1,25 \times 10^{-3}\ dm^3 \cdot s^{-1}$ ✓

Rate/*Tempo* $= \frac{\Delta V}{\Delta t}$ ✓

$= \frac{0,05}{40}$ ✓

$= 1,25 \times 10^{-3}\ (dm^3 \cdot s^{-1})$ ✓

(3)

5.4 **Marking criteria/*Nasienriglyne:***

(a) Formula/*Formule*: $n = \frac{V}{V_m}$/ $n = \frac{m}{M}$ ✓
(b) Substitute/*Vervang* 22,4 in $n = \frac{V}{V_m}$ ✓
(c) Using ratio/*Gebruik verhouding* n(Mg): n(H_2) = 1:1 ✓
(d) Substitute/*Vervang* 24 in $n = \frac{m}{M}$ ✓
(e) Divide/*Deel* m(Mg)$_{\text{reacted/gereageer}}$ by m(Mg)$_{\text{initial/begin}}$/divide/*deel* n(Mg)$_{\text{reacted/gereageer}}$ by n(Mg)$_{\text{initial/begin}}$
(f) Multiply by/*Vermenigvuldig met* 100 ✓
(g) Final answer/*Finale antwooord:* 2,5 % ✓
RANGE/*GEBEID*: 2,5 % to 2,79 %

OPTION/*OPSIE* 1

$$n(H_2) = \frac{V}{V_m} \checkmark$$
$$= \frac{0,05}{22,4} \checkmark$$
$$= 2,232 \times 10^{-3} \text{ mol}$$
$$n(Mg) = n(H_2)$$
$$= 2,232 \times 10^{-3} \text{ mol} \checkmark$$
$$m(Mg)_{\text{reacted}} = n \times M$$
$$= (2,232 \times 10^{-3})(24) \checkmark$$
$$= 0,054 \text{ g}$$
$$\% \text{ purity/suiwerheid} = \frac{0,054}{2 \checkmark} \times 100 \checkmark$$
$$= 2,5 \% \checkmark$$

OPTION/*OPSIE* 2

$$n(H_2) = \frac{V}{V_m} \checkmark$$
$$= \frac{0,05}{22,4} \checkmark$$
$$= 2,232 \times 10^{-3} \text{ mol}$$
$$n(Mg)_{\text{reacted/gereageer}} = n(H_2)$$
$$= 2,232 \times 10^{-3} \text{ mol} \checkmark$$
$$n(Mg)_{\text{initial/begin}} = \frac{m}{M}$$
$$= \frac{2}{24} \checkmark$$
$$= 0,083 \text{ mol}$$
$$\% \text{ purity/suiwerheid} = \frac{2,232 \times 10^{-3}}{0,083 \checkmark} \times 100 \checkmark$$
$$= 2,69 \% \checkmark$$

5.5.1 Temperature/*Temperatuur* ✓ (1)

5.5.2 A ✓ (1)

5.5.3 **Curve A:**

- Fewer particles with enough/sufficient kinetic energy ✓
  OR
  Fewer particles with $E_k \geq E_a$
- Less effective collisions per unit time ✓

Kromme A:

- *Minder deeltjies met genoeg/voldoende kinetiese energie*
  OF
  Minder deeltjies met $E_k \geq E_a$
- *Minder effektiewe botsings per tydseenheid* (2)

[17]

QUESTION 6/ *VRAAG 6*

6.1 Yes/*Ja* ✓ (1)

6.2 The system doesn't exchange matter with the surroundings/sealed container. ✓✓
Die stelsel ruil nie materie uit met die omgewing nie/verseëlde houer. (2)

6.3

CALCULATIONS USING NUMBER OF MOLES
Marking criteria:

(a) Multiplying [CO] and dividing [CO_2] by 2. ✓
(b) Change moles CO = equilibrium moles CO ✓
(c) **USING** ratio CO_2 : CO = 1 : 2 ✓
(d) Equilibrium moles CO_2 = initial moles CO_2 - change moles CO_2 ✓
(e) Correct K_c expression (formulae in square brackets) ✓
(f) Substituting K_c value into K_c expression ✓
(g) Substituting concentrations into the correct K_c expression ✓
(h) Final answer = 0,056 ✓

BEREKENINGE MET GEBRUIK VAN AANTAL MOL
Nasienkriteria:

(a) Vermenigvuldig [CO] en deel [CO_2] deur 2. ✓
(b) Verander mol CO = ekwilibrium mol CO ✓
(c) ***GEBRUIK*** *verhouding CO_2 : CO = 1 : 2* ✓
(d) Ekwilibrium mol CO_2 = aanvanklike mol CO_2 - verander mol CO_2 ✓
(e) Korrekte K_c-uitdrukking (formules tussen vierkantige hakies) ✓
(f) Vervanging van K_c-waarde in K_c-uitdrukking ✓
(g) Vervang konsentrasies in die korrekte K_c-uitdrukking ✓
(h) Finale antwoord = 0,056 ✓

OPTION/*OPSIE* 1	CO_2	CO	
Initial quantity/*Aanvanklike hoeveelheid* (mol)/	0,056✓	0	
Change/*Verandering* (mol)	0,04	0,08 ✓	Ratio/ *Verhouding* ✓
Quantity at equilibrium/*Hoeveelheid by ewewig* (mol)	0,016 ✓	0,08	
Equilibrium concentration/*Ewewigs-konsentrasie* (mol·dm^{-3})	8×10^3	0,04	÷ & × 2 ✓

$K_c = \frac{[CO]^2}{[CO_2]}$ ✓

$0,2$ ✓ $= \frac{0,04^2}{[CO_2]}$ ✓

$[CO_2] = 8 \times 10^3$

Wrong K_c expression *Verkeerde K_c-uitdrukking*	Max/*Maks*: $^5/_8$
No K_c expression *Geen K_c-uitdrukking*	Max/*Maks*: $^7/_8$

(8)

OPTION/*OPSIE* 2	CO_2	CO	
Initial quantity/*Aanvanklike hoeveelheid* (mol)	x	0	
Change/*Verandering* (mol)	0,04	0,08 ✓	Ratio/ *Verhouding* ✓
Quantity at equilibrium/*Hoeveelheid by ewewig* (mol)	x – 0,04 ✓	0,08	
Equilibrium concentration/*Ewewigs-konsentrasie* ($mol\cdot dm^{-3}$)	$\frac{x - 0,04}{2}$	0,04	÷ & × 2 ✓

$$K_c = \frac{[CO]^2}{[CO_2]} \checkmark$$

$$0,2 \checkmark = \frac{0,04^2}{\frac{x-0,04}{2}} \checkmark$$

$$x = 0,056 \text{ (mol)} \checkmark$$

Wrong K_c expression *Verkeerde K_c-uitdrukking*	Max/*Maks*: $^5/_8$
No K_c expression *Geen K_c-uitdrukking*	Max/*Maks*: $^7/_8$

6.4 Low/*Laag* ✓ (1)

6.5 Low K_c value/*Lae K_c-waarde* ✓✓ (2)

6.6.1 Endothermic/*Endotermies* ✓ (1)

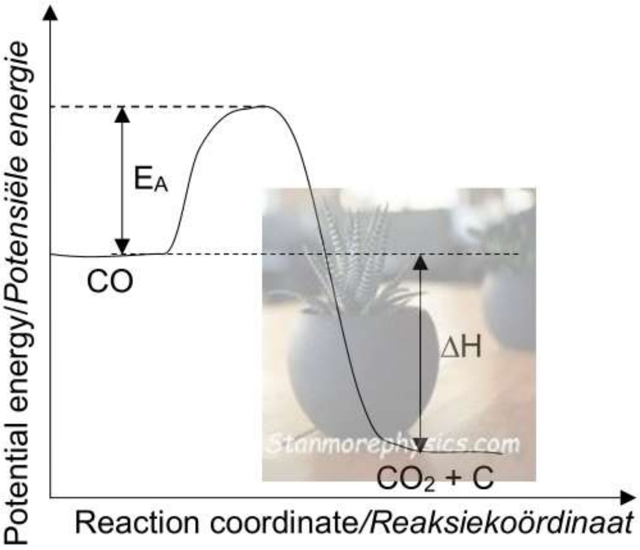
6.6.2 Decrease in temperature favours exothermic reaction ✓
Reverse reaction is favoured/concentration of products decreases/ concentration of reactants increases ✓

Verlaging in temperatuur bevoordeel eksotermiese reaksie
Omgekeerde reaksie word bevoordeel/konsentrasie van produkte neem af/ konsentrasie van reaktanse neem toe (2)

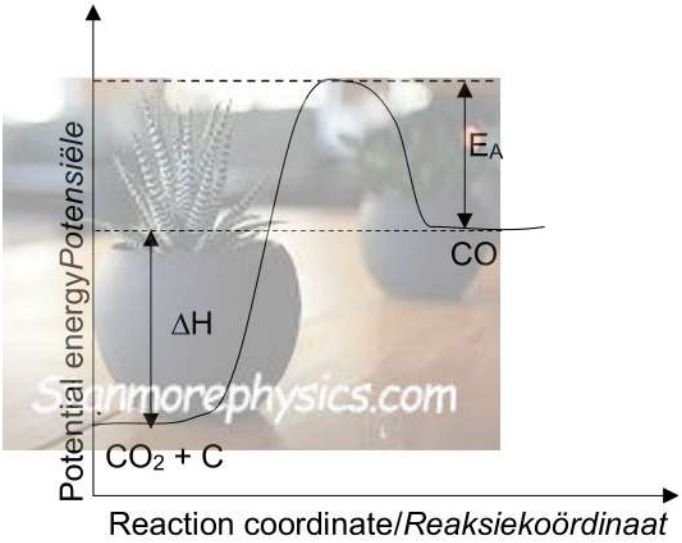
6.7

Marking criteria/*Nasienkriteria*:

(a) Correct shape of the graph/*Korrekte vorm van die grafiek* ✓
(b) E_A (reactants = CO) correctly indicated/*E_A (reaktanse = CO) korek aangedui* ✓
(c) ∆H correctly indicated/*Korrek aangedui* ✓
(d) Energy of reactants with label CO and energy of products with label CO_2 + C indicated/*Energie met reaktanse met byskrif CO en energie van produkte met byskrif CO_2 + C aangedui* ✓



OR/*OF*



(4)
[21]

QUESTION 7/*VRAAG 7*

7.1.1 A solution of known concentration ✓✓
'n Oplossing met 'n bekende konsentrasie (2)

7.1.2 Strong/*Sterk* ✓ (1)

7.1.3 Dissociates/ionises completely in water to form a high concentration of hydroxide/OH^- ions ✓✓
Dissosieer/ioniseer heeltemal in water om 'n hoë konsentrasie van hidroksied/ OH-ione te vorm (2)

7.1.4

<u>Marking criteria/*Nasienriglyne:*</u>

(a) Formula/*Formule* pH = $-\log[H_3O^+]$/$K_w = [H_3O^+][OH^-]$ ✓
(b) Correctly substituting 13,4 in pH formular ✓
Korrekte vervanging 13,4 in pH formule
(c) Substituting 10^{-14} in formula $K_w = [H_3O^+][OH^-]$✓
Vervang 10^{-14} *in formule* $K_w = [H_3O^+][OH^-]$
(d) Substitute $3,98 \times 10^{-14}$ in formula $K_w = [H_3O^+][OH^-]$ ✓
Vervang $3,98 \times 10^{-14}$ *in formule* $K_w = [H_3O^+][OH^-]$
(e) Final answer/*Finale antwoord:* 0,25 $mol \cdot dm^{-3}$ ✓

pH = $-\log[H_3O^+]$ ✓
13,4 ✓ = $-\log[H_3O^+]$
$[H_3O^+] = 3,981 \times 10^{-14}$ $mol \cdot dm^{-3}$

$K_w = [H_3O^+][OH^-]$
10^{-14} ✓ = $3,981 \times 10^{-14}$ ✓ $[OH^-]$
$[OH^-] = 0,25$ $mol \cdot dm^{-3}$ ✓ (5)

7.1.5

<u>Marking criteria/*Nasienriglyne:*</u>

(a) Formula/*Formule* $\frac{CaVa}{CbVb} = \frac{n_a}{n_b}$ /n = cV ✓
(b) Multiply/*Vermenigvuldig* 0,4 by/*met* 3,125 in $\frac{CaVa}{CbVb} = \frac{n_a}{n_b}$ **OR/*OF***
0,4 by 3,125 x 10^{-3} in n = cV✓
(c) Using ratio/*Gebruik verhouding*: $n(H_2SO_4) : n(NaOH)$ = 1:2 ✓
(d) Multiply/*Vermenigvuldig* V by 0,25 ✓
(e) Final answer/*Finale antwoord:* 0,01 dm^3/10 cm^3 ✓

<u>OPTION/*OPSIE* 1</u>	**<u>OPTION/*OPSIE* 2</u>**
$\frac{CaVa}{CbVb_{✓}} = \frac{n_a}{n_b}$ ✓ $\frac{(0,4)(3,125)^{✓}}{(0,25)(Vb)} = \frac{1}{2}$ ✓ $V_b = 10cm^3$ ✓	$n(H_2SO_4) = cV$ ✓ = $(0,4093,05 \times 10^{-3})$ ✓ = $1,25 \times 10^{-3}$ mol $n(NaOH) = 2n(H_2SO_4)$ = $2 \times 1,25 \times 10^{-3}$ ✓ = $2,5 \times 10^{-3}$ $n(NaOH) = cV$ $2,5 \times 10^{-3} = 0,25$ V ✓ V = 0,01 dm^3 ✓

(5)

7.2

Marking criteria*:*

(a) Substituting 5 & 84 in Formula $n = \frac{m}{M}$ ✓
(b) Multiplying 1,6 by 0,05 ✓
(c) Using ratio: $n(HC\ell) : n(NaHCO_3) = 1:1$ ✓
(d) Subtracting $n(HC\ell)$ reacted from $n(HC\ell)$initial ✓
(e) Dividing $n(HC\ell)$left by 0,05 ✓
(f) Substituting $c(HC\ell)$ in pH formular ✓
(g) Final answer = 0,4 ✓

Nasienkriteria:

(a) Vervang 5 & 84 in Formule $n = \frac{m}{M}$ ✓
(b) Vermenigvuldiging 1,6 met 0,05 ✓
(c) Gebruik verhouding: $n(HC\ell) : n(NaHCO_3) = 1:1$ ✓
(d) Trek $n(HC\ell)$ *gereageer van* $n(HC\ell)$ *begin* ✓
(e) Deel $n(HC\ell)$ *links deur 0,05* ✓
(f) Vervanging van $c(HC\ell)$ *in pH-formule* ✓
(g) Finale antwoord = 0,4 ✓

$$n(NaHCO_3)_{initial/begin} = \frac{m}{M} = \frac{5}{84}\ ✓ = 0{,}06\ mol$$

$$n(HC\ell)_{reacted/gereageer} = n(NaHCO_3)\ ✓ = 0{,}06\ mol$$

$$n(HC\ell)_{initial/begin} = cV = (1{,}6)(0{,}05)\ ✓ = 0{,}08\ mol$$

$$n(HC\ell)_{unreacted/ongereageerde} = 0{,}08 - 0{,}06\ ✓ = 0{,}02\ mol$$

$$c(HC\ell) = \frac{n}{V} = \frac{0{,}02}{0{,}05}\ ✓ = 0{,}4\ mol\cdot dm^{-3}$$

$$[H_3O^+] = c(HC\ell) = 0{,}4\ mol\cdot dm^{-3}$$

$$pH = -\log[H_3O^+] = -\log 0{,}4\ ✓ = 0{,}4\ ✓$$

RANGE/*GEBIED*: 0,39 – 0,4

(7)
[22]

QUESTION 8/*VRAAG 8*

8.1 A solution that conducts electricity through the movement of ions ✓✓
'n Oplossing wat elektrisiteit gelei deur die beweging van ione (2)

8.2 $Pb(s)\ |\ Pb^{2+}(aq)$ ✓ $\overset{\checkmark}{||}$ $Ag^{+}(aq)\ |\ Ag(s)$ ✓ (3)

8.3 Potassium chloride/KCℓ ✓✓
Any other soluble salt, excluding lead and silver salts

Kaliumchloried/KCℓ
Enige ander oplosbare sout behalwe lood- en silwersoute (2)

8.4

<table>
<tr><td rowspan="2"><u>OPTION/<i>OPSIE</i> 1</u>
$E^{\theta}_{cell/sel} = E^{\theta}_{reduction/reduksie} - E^{\theta}_{oxidation/oksidasie}$ ✓
$= 0,80$ ✓ $- (-0,13)$ ✓
$= 0,93\ V$ ✓</td><td><u>Notes/<i>Aantekeninge:</i></u>
Accept any other correct formula from the data sheet.
<i>Aanvaar enige ander korrekte formule uit die datablad.</i></td></tr>
<tr><td>Any other formula using unconventional abbreviations, e.g. $E^{\theta}_{cell} = E^{\theta}_{OA} - E^{\theta}_{R}$ followed by correct substitutions:
Max: $^{3}/_{4}$
<i>Enige ander formule wat onkonvensionele afkortings gebruik, bv. $E^{\theta}_{sel} = E^{\theta}_{OA} - E^{\theta}_{R}$ gevolg deur korrekte vervangings:</i>
<i>Maks:</i> $^{3}/_{4}$</td></tr>
<tr><td colspan="2"><u>OPTION/<i>OPSIE</i> 2</u>
$Ag^{+} + e^{-} \rightarrow Ag$] ✓ $E^{\theta} = +0,80\ (V)$ ✓
$Pb \rightarrow Pb^{2+} + 2e^{-}$] $E^{\theta} = +0,13\ (V)$ ✓
$2Ag^{+} + Pb \rightarrow 2Ag + Pb^{2+}$ $E^{\theta} = +0,93\ V$ ✓</td></tr>
</table>

(4)
[11]

QUESTION 9/*VRAAG 9*

9.1 (Gas) mask/*work in fume cupboard* ✓
(Gas)-masker/werk in dampkas (1)

9.2 Chlorine gas is poisonous/*Chloorgas is giftig* ✓✓ (2)

9.3 Q to/*tot* P ✓ (1)

9.4 Copper/*Koper* ✓ (1)

9.5 $2C\ell^-(aq) + Cu^{2+}(aq)$ ✓ $\rightarrow$ $C\ell_2(g) + Cu(s)$ ✓ Balancing/*Balansering* ✓

Marking criteria/*Nasienkriteria:*

- Reactants ✓ Products ✓ Balancing ✓
  Reaktanse *Produkte* *Balansering*
- Ignore ⇌ and phases
  Ignoreer ⇌ en fases
- Marking rule 6.3.10/*Nasienreël 6.3.10*

(3)

[8]

TOTAL/*TOTAAL*: 150