education

Department of Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION

GRADE 12

PHYSICAL SCIENCES P2
(CHEMISTRY)

SEPTEMBER 2026

PHYSICAL SCIENCES P2
12842B

MARKS: 150

TIME: 3 HOURS

X05 **This question paper consists of 15 pages and 4 data sheets.**

N1

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 2.1 and QUESTION 2.2.

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 your ANSWER BOOK, for example, 1.11 E.

1.1 The EMPIRICAL formula of but-2-ene is …

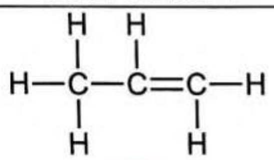
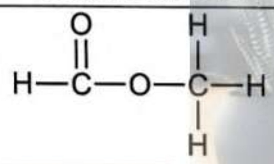
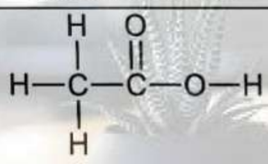
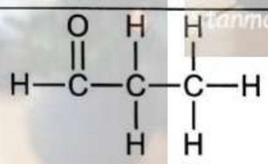
A C_2H.

B CH_2.

C C_4H_8.

D C_4H_{10}. (2)

1.2 Consider the organic compounds below.

COMPOUND 1	COMPOUND 2
	
COMPOUND 3	**COMPOUND 4**
	

The compound that is a functional isomer of a ketone is …

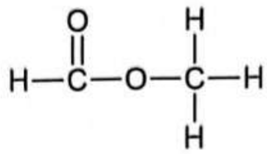
A compound 1.

B compound 2.

C compound 3.

D compound 4. (2)

1.3 Consider the STRUCTURAL FORMULA of an organic compound below.



The correct IUPAC name is …

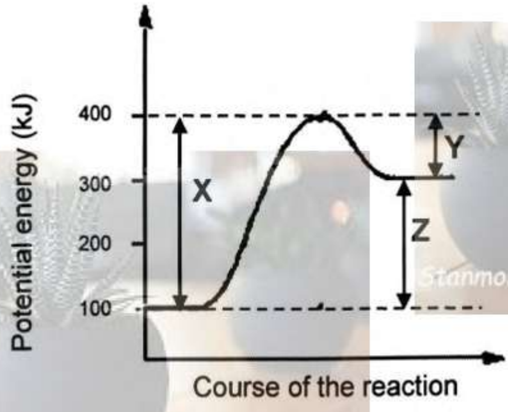
A ethanol.

B methanal.

C ethanoic acid.

D methyl methanoate. (2)

1.4 Study the graph below.



The activation energy for the reverse reaction is …

A X.

B Y.

C Z.

D Y – Z. (2)

1.5 Carbon dioxide gas (CO_2) is prepared by adding pieces of calcium carbonate, mass 100 g, to dilute hydrochloric acid ($HC\ell$) in a conical flask.

Which statement below is correct regarding the reaction and changes in the reaction conditions?

A Increasing the volume of the dilute $HC\ell$ increases the rate of reaction.

B Using 100 g of bigger pieces of calcium carbonate increases the rate of reaction.

C Increasing the temperature increases the rate of reaction.

D The mass of the conical flask and its contents increases as the carbon dioxide is formed. (2)

1.6 Catalysts are extensively used in industries. The most probable reason for this is that a catalyst …

A increases the rates of both the forward and reverse reactions.

B decreases the rate of the reverse reaction only.

C increases the rate of the reverse reaction only.

D can shift the equilibrium position to the preferred side. (2)

1.7 Consider the following hypothetical reaction.

$$A_2(g) + B(g) \rightleftharpoons A_2B(g) \qquad \Delta H < 0$$

The reaction reaches equilibrium at temperature **T**. Which ONE of the following changes to the equilibrium conditions will result in an INCREASE in the equilibrium constant, K_c?

A Increase in temperature

B Decrease in temperature

C Increasing both pressure and temperature

D Increase in pressure by decreasing volume (2)

1.8 Which ONE of the following substances CANNOT act as an ampholyte?

A H_2O

B HCO_3^-

C HNO_3

D HSO_4^- (2)

1.9 Sulphuric acid, $H_2SO_4(aq)$, and hydrochloric acid, $HC\ell(aq)$, solutions of EQUAL CONCENTRATIONS are compared.

How does the concentration of $H_3O^+(aq)$ in a solution of $HC\ell(aq)$ and the pH of $HC\ell(aq)$ compare to those of the $H_2SO_4(aq)$ solution?

	$[H_3O^+]$ OF $HC\ell(aq)$	pH OF $HC\ell(aq)$
A	Higher than	Higher than
B	Lower than	Higher than
C	Higher than	Lower than
D	Equal to	Equal to

(2)

1.10 A standard copper-silver electrochemical cell delivers a current. How do the concentrations of the two electrolytes change with time?

A $[Cu^{2+}]$ increases and $[Ag^+]$ decreases with time.

B $[Cu^{2+}]$ and $[Ag^+]$ decrease until both are zero.

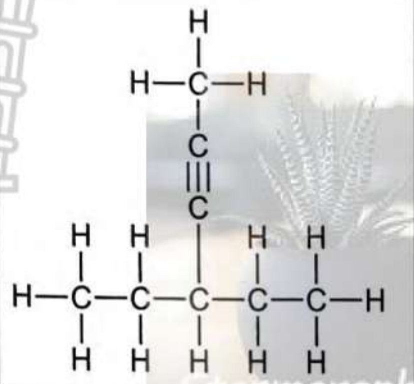
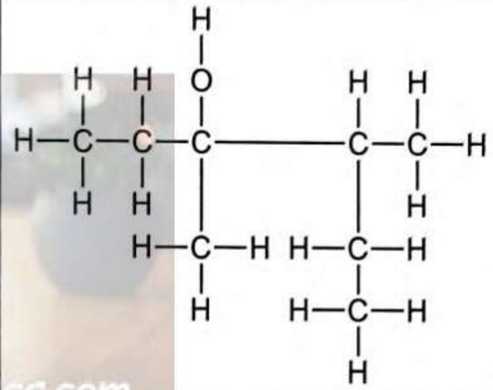
C $[Cu^{2+}]$ decreases and $[Ag^+]$ increases at the same rate.

D $[Cu^{2+}]$ and $[Ag^+]$ are unaffected as the reaction proceeds. (2)

[20]

QUESTION 2 (Start on a new page.)

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

A		**B**	
C	Carboxylic acid	**D**	C_4H_8O
E	C_6H_{12}	**F**	Propyl ethanoate

2.1 Write down the letter(s) that represent(s) the following:

2.1.1 Hydrocarbons (2)

2.1.2 An aldehyde (1)

2.1.3 A compound that can undergo an addition reaction (1)

2.2 For compound **B**, write down the:

2.2.1 General formula of the homologous series to which it belongs (1)

2.2.2 Type of alcohol (1)

2.2.3 IUPAC name (3)

2.3 Compound **C** is a straight-chain functional isomer of compound **F**.

2.3.1 Define the term *functional isomer*. (2)

2.3.2 Write down the structural formula of compound **C**. (2)

2.3.3 Using structural formulae, write down the balanced equation for the formation of compound **F**. (7)

2.4 For compound **A**, write down its IUPAC NAME. (3)

2.5 For compound **D**, write down the condensed structural formula of its FUNCTIONAL ISOMER. (2)

[25]

QUESTION 3 (Start on a new page.)

The boiling points of organic compounds at a specific pressure are compared.

COMPOUND		MOLAR MASS ($g \cdot mol^{-1}$)	BOILING POINT (°C)
A	$CH_3CH_2CH_2CH_3$	58	-0,5
B	CH_3CH_2CHO	58	48
C	CH_3OH	32	65
D	CH_3CH_2OH	46	78

3.1 Define the term *vapour pressure*. (2)

3.2 Choose the symbol (**A** to **D**) of the compound with the highest vapour pressure. (1)

3.3 Explain the answer to QUESTION 3.2. (2)

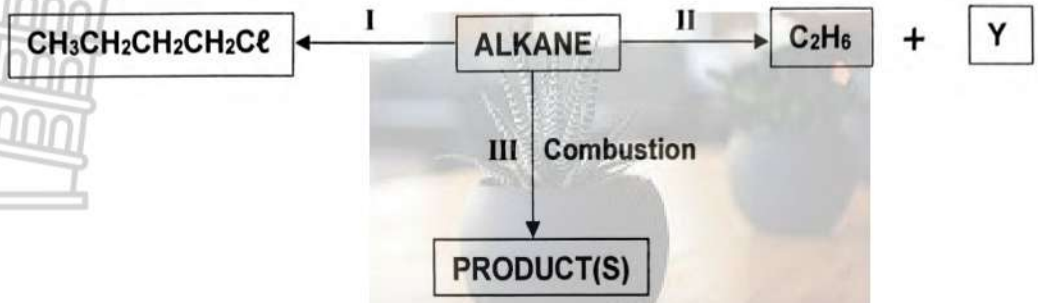
3.4 Compounds **A** to **D** are compared. Fully explain the difference in boiling points of compounds:

3.4.1 **A** and **B** (4)

3.4.2 **C** and **D** (3)
[12]

QUESTION 4 (Start on a new page.)

Study the flow diagram below and answer the questions that follow.



4.1 Write down the type of reaction represented by:

4.1.1 Reaction I (1)

4.1.2 Reaction II (1)

4.2 Consider reaction III.

4.2.1 Write down the IUPAC name of the reactant. (2)

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

4.3 Write down the structural formula of compound Y. (2)

4.4 For reaction I, write down the NAME of the inorganic reactant. (2)
[11]

QUESTION 5 (Start on a new page.)

5.1 The reaction rate of ammonia (NH_3) and oxygen (O_2) in a 2 dm^3 container is monitored. The balanced equation for the reaction is as shown below:

$$NH_3(g) + O_2(g) \rightarrow NO(g) + H_2O(g) \qquad \Delta H < 0$$

The rate of formation of NO at time **T** is found to be 0,3 $mol \cdot dm^{-3} \cdot s^{-1}$.

5.1.1 Copy the above chemical equation into your answer book and balance it. (2)

5.1.2 Calculate the rate at which H_2O is being produced at time **T** in $mol \cdot dm^{-3} \cdot s^{-1}$. (2)

A learner concludes that, to increase the reaction rate, the pressure on the gases should be increased by decreasing the volume of the container to 1 dm^3 at constant temperature.

5.1.3 Is the learner's conclusion correct? Write down YES or NO. (1)

5.1.4 Explain the answer to QUESTION 5.1.3. (3)

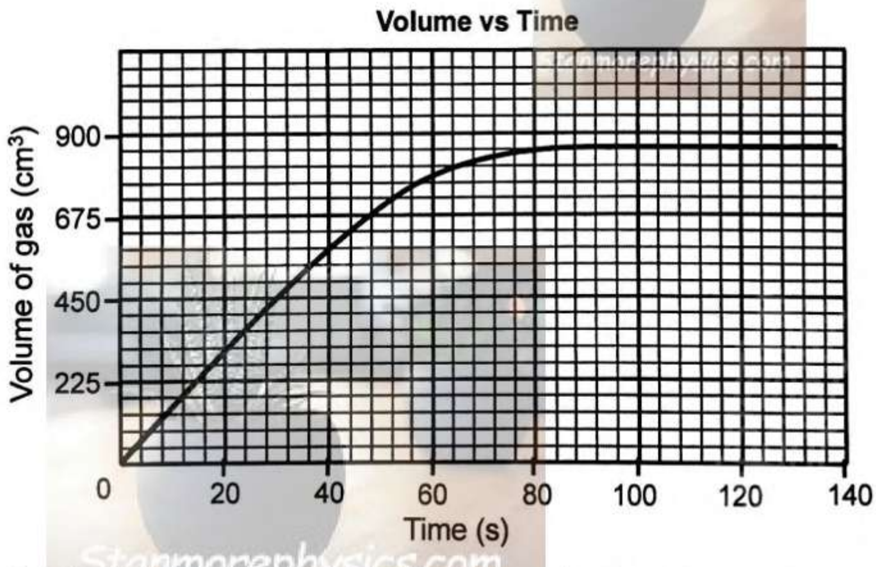
5.2 Two experiments are used to investigate how surface area affects the rate of reaction between excess solid magnesium (Mg) ribbon and dilute nitric acid (HNO_3) at room temperature.

During the reaction, the gas formed is collected in the measuring cylinder. The balanced equation for the reaction is:

$$Mg(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + H_2(g)$$

The summary of the investigation is tabulated below.

EXPERIMENT	MASS OF MAGNESIUM (g)	STATE OF DIVISION
A	2	Ribbon cut into small pieces
B	2	Ribbon as one large piece



5.2.1 Write down the investigative question for this investigation. (2)

5.2.2 The rate of production of hydrogen in the first 50 seconds is 13,8 $cm^3 \cdot s^{-1}$.

A learner predicts that 660 cm^3 of hydrogen will be produced in the first 50 seconds. Prove by calculation whether the learner is correct or not. (3)

5.2.3 Will the reaction rate between 60 and 80 seconds be GREATER THAN, LESS THAN or EQUAL TO the rate calculated in QUESTION 5.2.2? (1)

5.2.4 Use the graph to give a reason for the answer given in QUESTION 5.2.3. (2)

5.2.5 Draw the above graph (not to scale) in your answer book and label it as **A**.

On the same set of axes, draw a graph for experiment **B** and label it as **B**. (2)

5.2.6 Calculate the remaining mass of magnesium after the reaction has stopped.

Take the molar volume of gas to be 24 $dm^3 \cdot mol^{-1}$ at room temperature. (6)

[24]

QUESTION 6 (Start on a new page.)

Consider a solution of ethanoic acid with the following equilibrium established at room temperature.

$$CH_3COOH(aq) + H_2O(\ell) \rightleftharpoons H_3O^+(aq) + CH_3COO^-(aq) \quad \Delta H < 0$$

At equilibrium, it is found that the pH of the solution is 3,2 and the number of moles of $CH_3COOH(aq)$ is 0,066 mol.

6.1 Explain the term *equilibrium*. (2)

6.2 Calculate the equilibrium constant of an aqueous solution of ethanoic acid at room temperature. (5)

6.3 More CH_3COOH is added to the equilibrium mixture. How will the pH of the solution be affected? Write down only INCREASES, DECREASES or STAYS THE SAME. (1)

6.4 Explain the answer to QUESTION 6.3. (3)

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

Indicate the following on the graph:

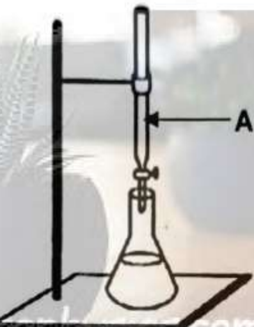
- Activation energy
- Heat of reaction
- Formulae of reactants and products

(4)
[15]

QUESTION 7 (Start on a new page.)

7.1 10 g of impure sodium carbonate ($Na_2CO_3 \cdot 10H_2O$) is dissolved in water to make a solution of 500 cm^3. 25 cm^3 of this solution is titrated with a 0,1 $mol \cdot dm^{-3}$ H_2SO_4 solution.

The apparatus below is used for titration.



$$H_2SO_4(aq) + Na_2CO_3\,(aq) \rightarrow Na_2SO_4(aq) + CO_2(g) + H_2O(\ell)$$

This reaction is known as a neutralisation reaction.

7.1.1 Explain the term *neutralisation reaction*. (2)

7.1.2 Write down the name of the apparatus labelled **A**. (1)

7.1.3 Write down the name of the most suitable indicator for this titration. (1)

7.1.4 Explain the answer to QUESTION 7.1.3. (2)

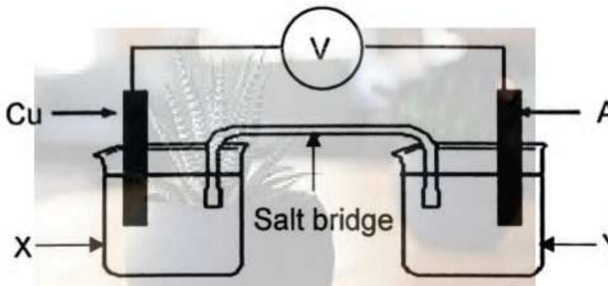
7.2 10 cm^3 of H_2SO_4 is used to neutralise the Na_2CO_3 solution.

7.2.1 Calculate the mass of the impurities in the impure sodium carbonate. (8)

7.2.2 Calculate the percentage purity of the sodium carbonate. (3)
[17]

QUESTION 8 (Start on a new page.)

An electrochemical cell is assembled as shown in the diagram below. The cell functions under standard conditions. The solution in beaker **X** is blue.



8.1 For the above cell, write down the:

8.1.1 Energy conversion (2)

8.1.2 NAME or FORMULA of a substance that can be used in the salt bridge (1)

8.2 In which beaker will the ion concentration decrease? Give a reason for the answer. (2)

8.3 Write down the:

8.3.1 Oxidation half-reaction (2)

8.3.2 Cell notation of the cell (3)

8.4 Calculate the initial emf of the cell under standard conditions. (4)

8.5 $CuC\ell_2$ crystals (about a spatula-full) are dissolved in the copper half-cell solution.

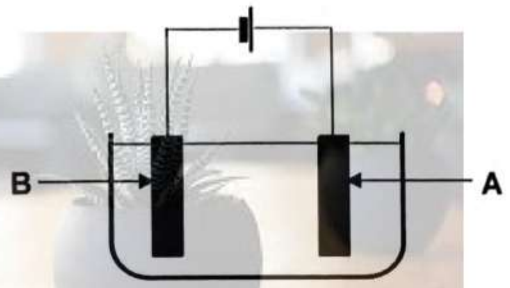
8.5.1 How will this change affect the cell potential? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

8.5.2 Explain the answer to QUESTION 8.5.1. (1)

[16]

QUESTION 9 (Start on a new page.)

The diagram below represents the purification of copper ore to pure copper. The cell also contains zinc, silver and platinum impurities.



9.1 Besides purification, what other process can this type of cell be used for? (2)

9.2 Which electrode is the anode? Write down **A** or **B**. (1)

9.3 Write down the electrode on which pure copper will be deposited. (1)

9.4 Write down the half-reaction that takes place at the anode. (2)

9.5 When the current flows through the cell for **t** minutes, 16,5 g of pure copper is deposited at one of the electrodes. Calculate the number of moles of electrons that flow through the circuit in **t** minutes. (4)
[10]

TOTAL: 150

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* ↓

Increasing reducing ability / *Toenemende reduserende 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
$\mathbf{2H^+ + 2e^-}$	$\rightleftharpoons$	$\mathbf{H_2(g)}$	**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

TABLE 3: THE PERIODIC OF ELEMENTS

KEY/*SLEUTEL*

Atomic number / *Atoomgetal*: 29
Electronegativity / *Elektronegatiwiteit*: 1,9
Symbol / *Simbool*: Cu
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 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

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

education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

GRADE/*GRAAD* 12

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

SEPTEMBER 2026

MARKS/*PUNTE*: 148

UPDATED MARKING GUIDELINES
NASIENRIGLYNE

These marking guidelines consist of 15 pages.
Hierdie nasienriglyne bestaan uit 15 bladsye.

QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 D ✓✓ (2)

1.3 D ✓✓ (2)

1.4 B ✓✓ (2)

1.5 C ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

1.8 C ✓✓ (2)

1.9 B ✓✓ (2)

1.10 A ✓✓ (2)
[20]

QUESTION 2/*VRAAG 2*

2.1.1 E ✓ and/*en* A ✓ (2)

2.1.2 D ✓ (1)

2.1.3 E ✓
Accept/*Aanvaar*: A (1)

2.2.1 $C_nH_{2n+1}OH$ ✓
Accept/*Aanvaar*: $C_nH_{2n+2}O$ (1)

2.2.2 Tertiary (alcohol)/*Tersiêr (alkohol)* ✓ (1)

2.2.3

Marking criteria:
- Correct stem, i.e. hexanol ✓
- Correct substituents (dimethyl) identified ✓
- IUPAC name completely correct, including numbering, sequence, hyphens and commas ✓

IF: 'an' omitted, deduct 1 mark

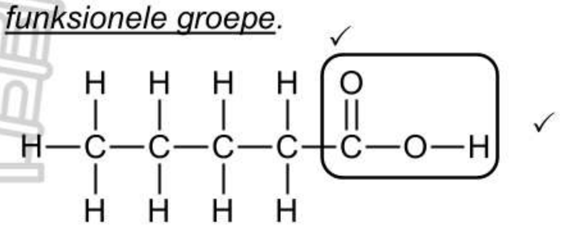
Nasienkriteria:
- *Korrekte stam, d.i. heksanol*
- *Substituente (dimetiel) korrek geïdentifiseer*
- *IUPAC-naam volledig korrek, insluitend nommering, volgorde, koppeltekens en kommas*

INDIEN: *'an' weggelaat word, trek 1 punt af.*

3,4-dimethylhexan-3-ol/3,4-dimethyl-3-hexanol ✓✓✓
3,4-dimetielheksan-3-ol / 3,4-dimetiel-3-heksanol (3)

2.3.1 Compounds with the same molecular formulae, ✓ but different functional groups. ✓
Verbindings met dieselfde molekulêre formule, maar verskillende funksionele groepe. (2)

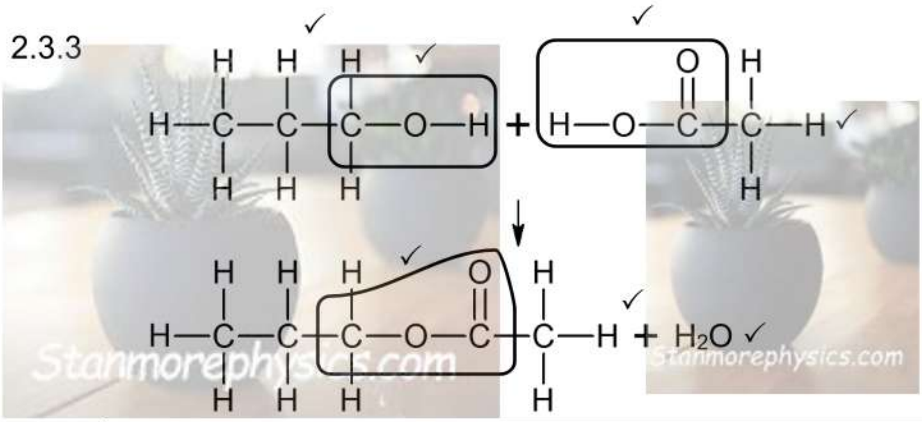
2.3.2



Marking criteria/Nasienriglyne:
• Whole structure correct/*Hele struktuur korrek:* $^{2}/_{2}$
• Only functional group correct/*Slegs funksionele groep korrek:* $^{1}/_{2}$
ACCEPT/*AANVAAR:*
-OH is condensed / *gekondenseerd*

(2)

2.3.3



Notes/*Aantekeninge*:	
• Ignore/*Ignoreer* ⇌	
• Any additional reactants and/or products :	
Enige addisionele reaktanse en/of ander produkte:	Max./*Maks.* $^{6}/_{7}$
• Condensed or semi-structural formulae:	
Gekondenseerde of semi-strukturele formules:	Max./*Maks.* $^{4}/_{7}$
• Molecular formulae:	
Molekulêre formules:	Max./*Maks.* $^{1}/_{7}$

(7)

2.4

Marking criteria/Nasienriglyne:
• Correct stem, i.e., hexyne/*Korrekte stam d.i. heksyn* ✓
• Correct substituent (ethyl) correctly identified *Korrek geïdentifiseerde substituent (etiel)* ✓
• IUPAC name is completely correct, including numbering, sequence, hyphens and commas *IUPAC-naam is volledig korrek, insluitend nommering, volgorde, koppeltekens en kommas* ✓

4-ethylhex-2-yne/4-ethyl-2-hexyne/*4-etielheks-2-yn / 4-etiel-2-heksyn* (3)

2.5 $CH_3CH_2COCH_3$ ✓✓ OR/*OF* $CH_3COCH_2CH_3$ (**2 or/*of* 0**) (2)

[25]

QUESTION 3/*VRAAG 3*

3.1

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

The pressure exerted by vapour at equilibrium with its liquid in a closed system. ✓✓
Die druk wat deur damp uitgeoefen word wanneer dit in ewewig is met sy vloeistof in 'n geslote sisteem. (2)

3.2 A ✓
Accept/*Aanvaar* butane/*butaan* (1)

3.3 (Compound A) has the lowest boiling point ✓✓
(Verbinding A) het die laagste kookpunt (2)

3.4.1
- Between butane/Compound A molecules are London forces. ✓
- Between propanal/Compound B molecules are dipole-dipole forces (and London forces). ✓
- Dipole-dipole forces are stronger than London forces. ✓

  OR

  London forces are weaker than dipole-dipole forces.

  OR

  Intermolecular forces between propanal (B) molecules are stronger than those between butane (A).

  OR

  Intermolecular forces between butane (A) molecules are weaker than those between propanal (B).
- More energy is needed to overcome/break the intermolecular forces between propanal molecules. ✓

  OR

  Less energy is needed to overcome/break the intermolecular forces between butane molecules.

- *Tussen butaan/Verbinding A-molekules is daar London-kragte.*
- *Tussen propanal/Verbinding B-molekules is daar dipool-dipoolkragte (en London-kragte).*
- *Dipool-dipoolkragte is sterker as London-kragte.*

  OF

  London-kragte is swakker as dipool-dipoolkragte.

  OF

  Intermolekulêre kragte tussen propanal (B)-molekules is sterker as dié tussen butaan (A)-molekules.

  OF

  Intermolekulêre kragte tussen butaan (A)-molekules is swakker as dié tussen propanal (B)-molekules.
- *Meer energie is nodig om die intermolekulêre kragte tussen propanal-molekules te breek.*

  OF

  Minder energie is nodig om die intermolekulêre kragte tussen butaan molekules te breek. (4)

3.4.2 **Only using compound D**
- Larger surface area/longer chain length/less compact ✓
- Stronger intermolecular forces ✓
- More energy is needed to break intermolecular forces ✓

OR

Only using compound C
- Smaller surface area/shorter chain length/more compact
- Weaker intermolecular forces
- Less energy needed to break intermolecular forces

OR

From C to D
- Increase in surface area/chain length/becomes less compact
- Increase in the strength of intermolecular forces
- More energy needed to break the intermolecular forces

OR

From D to C
- Decrease in surface area/chain length/becomes more compact
- Decrease in strength of intermolecular forces
- Less energy needed to break intermolecular forces

Slegs met verbinding D
- *Groter oppervlak/langer kettinglengte/minder kompak*
- *Sterker intermolekulêre kragte*
- *Meer energie benodig om die intermolekulêre kragte te breek*

Slegs met verbinding C
- *Kleiner oppervlak/korter kettinglengte/meer kompak*
- *Swakker intermolekulêre kragte*
- *Minder energie benodig om die intermolekulêre kragte te breek*

OF

Vanaf C na D
- *Toename in oppervlak/kettinglengte/word minder kompak*
- *Toename in die sterkte van intermolekulêre kragte*
- *Meer energie benodig om die intermolekulêre kragte te breek*

OF

Vanaf D na C
- *Afname in oppervlak/kettinglengte/word meer kompak*
- *Afname in die sterkte van intermolekulêre kragte*
- *Minder energie benodig om die intermolekulêre kragte te breek* (3)

[12]

QUESTION 4/*VRAAG 4*

4.1.1 Substitution/halogenation/chlorination ✓
Substitusie/halogenasie/chlorering (1)

4.1.2 Elimination/cracking/*Eliminasie/kraking* ✓ (1)

4.2.1 Butane/*Butaan* ✓✓ (2)

4.2.2 $2C_4H_{10} + 13O_2$ ✓ $\longrightarrow$ $8CO_2 + 10H_2O$ ✓ bal. ✓

<u>Marking criteria/*Nasienkriteria:*</u>
- Reactants ✓ *Reaktanse* | Products ✓ *Produkte* | Balancing: ✓ *Balansering*
- Ignore double arrows./*Ignoreer dubbelpyle.*
- Marking rule 6.3.10/*Nasienreël 6.3.10.*
- Ignore phases./*Ignoreer fases.*

IF/*INDIEN*:

Structural formula for C_4H_{10} Max. $\frac{2}{3}$
Struktuur formule vir C_4H_{10} : Maks.

Equal sign instead of arrow: Max. $\frac{2}{3}$
Gelykaanteken ipv pyl: Maks.

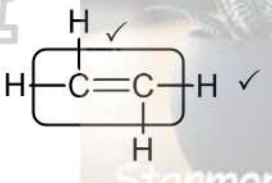
- Multiples of *balancing coefficients: Max.* $\frac{2}{3}$
  Veelvoude van balanseerkoëffisiënte: Maks.

(3)

4.3

Marking criteria/*Nasienriglyne*:

- Whole structure correct/*Hele struktuur korrek*: $^{2}/_{2}$
- Only functional group correct: $^{1}/_{2}$
  Slegs funksionele groep korrek:



Notes/Notas:

- Condensed or semi-structural formula:
  Gekondenseerde of semi-strukturele formule:
  Max./*Maks.* $^{1}/_{2}$
- Molecular formula:
  Molekulêre formule: Max./*Maks.* $^{0}/_{2}$

(2)

4.4 Chlorine (gas)/*Chloor- (gas)* ✓✓ (2)

[11]

QUESTION 5/*VRAAG 5*

5.1.1 $\underline{4NH_3(g) + 5O_2(g)}$ ✓ → $\underline{4NO(g) + 6H_2O(g)}$ ✓ (2)

5.1.2 **POSITIVE MARKING FROM QUESTION 5.1.1**
POSITIEWE NASIEN VANAF VRAAG 5.1.1

Rate/*Tempo* (H_2O) = $\frac{3}{2}$ (0,3) OR/*OF* $\frac{6}{4}$ (0,3) ✓

= 0,45 ($mol{\cdot}dm^{-3}{\cdot}s^{-1}$) ✓ (2)

5.1.3 Yes/*Ja* (1)

5.1.4 Increase in pressure:

- The same number of particles is now confined to a smaller space/increase in number of moles of gas per volume/increase in concentration. ✓
- More particles per unit volume. ✓
- More effective collisions per (unit) time. ✓

- *Toename in druk – dieselfde aantal deeltjies is nou in 'n kleiner ruimte ingeperk/dit verhoog die aantal mol gas per volume/toename in konsentrasie.*
- *Meer deeltjies per volume-eenheid.*
- *Meer effektiewe botsings per tydseenheid.* (3)

5.2.1

Marking criteria/Nasienkriteria:
• Both independent and dependent variables identified ✓ *Beide onafhanklike en afhanklike veranderlikes*
• Correct question about relationship between independent and dependent variables ✓ *Korrekte vraag oor die verband tussen onafhanklike en afhanklike veranderlikes*

Example: What is the relationship between surface area/state of division and the rate of reaction?

IF: the question has dependent and independent variables correct, but can be answered with a yes or no, award only 1 mark for correct identification of variables.

Voorbeeld: *Wat is die verband tussen oppervlak/toestand van verdeeldheid en die reaksietempo?*

INDIEN: *die vraag die afhanklike en onafhanklike veranderlikes korrek het, maar kan met 'n ja of nee beantwoord word, gee slegs 1 punt vir korrekte identifikasie van die veranderlikes.* (2)

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

$\boxed{13{,}8 = \frac{\Delta V}{50}}$ ✓

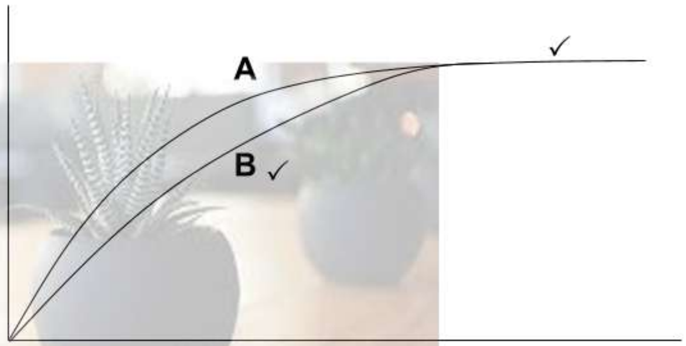
V = 690 cm^3 ✓

The learner is incorrect/*Die leerder is nie korrek nie* ✓ (3)

5.2.3 Less than/*Minder as* ✓ (1)

5.2.4 Decrease in gradient/slope/*Afname in gradiënt/helling* ✓✓ (2)

5.2.5



(2)

Marking criteria/*Nasienkriteria*:
• B at lower rate than A/*B teen laer tempo as A* ✓
• Graphs reach the same final volume/*Grafieke bereik dieselfde finale volume* ✓
• If no graph is labelled/ *Indien geen grafiek benoem is nie* Max./*Maks.* $^0/_2$.

5.2.6

Marking criteria/*Nasienriglyne:*

(a) Formula/*Formule* $n = \frac{V}{V_m}$/ $m = nM$ ✓
(b) Correctly substituting/*Korrekte vervanging* 0,855 and/*en* 24 ✓
(c) Correct ratio/*Korrekte verhouding* $n(H_2):n(Mg)$ ✓
(d) Substitution of/*Vervanging van* 24 in $n = \frac{m}{M}$ ✓
(e) Subtraction: initial mass(Mg) – used mass(Mg) ✓
Aftrekking: aanvanklike massa (Mg) – gebruikte massa (Mg)
(f) Final answer/*Finale antwoord:* 1,04 – 1,15 g ✓

$n(H_2)$ produced/*gevorm* $= \frac{V}{V_m}$

$= \boxed{\frac{0,855}{24}}$ ✓ OR/*OF* $\boxed{\frac{855}{24000}}$

$= 0,0356$ mol

$n(Mg) = n(H_2) = 0,0356$ mol ✓

ANY/*ENIGE* ✓

$m(Mg)_{used/gebruik} = nM$
$= (0,0356)(24)$ ✓
$= 0,855$ g

$m(Mg)_{remaining/wat\ oorbly} = 2 – 0,855$ ✓
$= 1,145$ g ✓

(6)
[24]

QUESTION 6/*VRAAG 6*

6.1 (When) the rate of the forward reaction is equal to the rate of the reverse reaction/ (when) the concentration of reactants and products is constant. **(2 or 0)** ✓✓
(Wanneer) die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie/(wanneer) die konsentrasie van reaktante en produkte konstant is. (2)

6.2

> **Marking criteria/*Nasienriglyne*:**
> - Formula/*Formule* pH = -log $[H_3O^+]$/pH = -log $[H^+]$/$[H_3O^+] = 10^{-pH}$ ✓
> - Substitution of/*Vervanging van* 3,2 in pH = -log $[H_3O^+]$ ✓
> - Correct Kc expression/*Korrekte Kc uitdrukking* ✓
> - Substitution of equilibrium concentrations into correct Kc expression and final answer marks removed (volume not given)
>   *Punte vir substitusie van ewewigskonsentrasies in korrekte Kc-uitdrukking en finale antwoord verwyder (volume nie gegee nie).*

pH = -log $[H_3O^+]$ ✓
✓ 3,2 = -log $[H_3O^+]$/$[H_3O^+] = 10^{-3,2}$

$[H_3O^+] = 6,30957 \times 10^{-4}\ mol \cdot dm^{-3}$

$$K_C = \frac{[H_3O^+][CH_3COO^-]}{[CH_3COOH]}$$ ✓ (3)

6.3 Decreases/*Afneem* ✓ (1)

6.4 Addition of CH_3COOH will cause an <u>increase in concentration or amount of H_3O^+</u> ✓
Addisie van CH_3COOH sal 'n <u>toename in konsentrasie of hoeveelheid van H_3O^+</u> veroorsaak.
pH decreases/*verminder* ✓✓ (3)

6.5

Marking criteria/*Nasienriglyne*:

Exothermic reaction curve/ *Eksotermiese reaksie kurwe*:

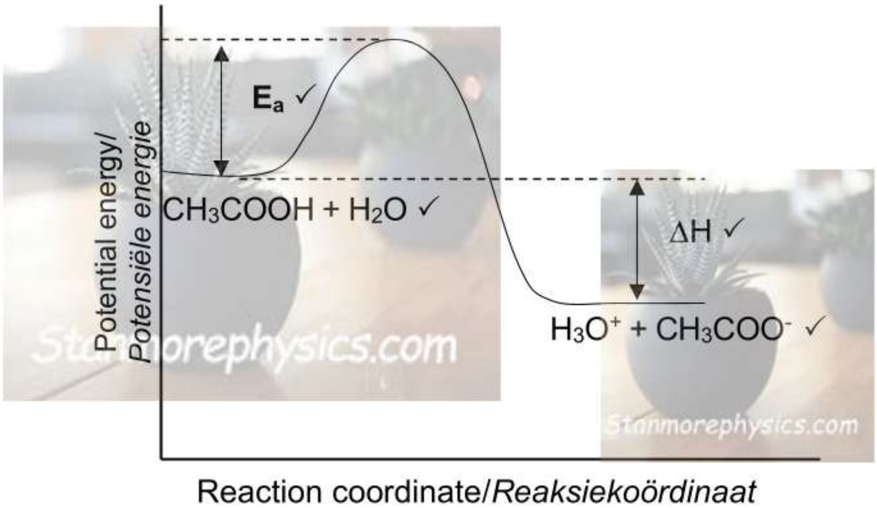
- $CH_3COOH + H_2O$ correctly shown at energy of reactants/*korrek getoon by energie van reaktante* ✓
- $H_3O^+ + CH_3COO^-$ correctly shown at energy of products/*korrek getoon by energie van produkte* ✓
- Activation energy (E_a) of reactants correctly shown/*Aktiveringsenergie (Ea) van reaktante korrek getoon* ✓
- Heat of reaction (ΔH) correctly shown/*Reaksiewarmte (ΔH) korrek getoon* ✓

IF:

Endothermic reaction curve drawn, deduct E_a and ΔH mark: Max. $^2/_4$

***INDIEN*:**

Endotermiese reaksie kurwe geteken is, trek Ea en ΔH punt af: Maks. $^2/_4$



(4)
[13]

QUESTION 7/*VRAAG 7*

7.1.1 The reaction of an acid with a base ✓ to form a salt and water ✓
Die reaksie van 'n suur met 'n basis om 'n sout en water te vorm (2)

7.1.2 A = Burette/*Buret* ✓ (1)

7.1.3 Methyl orange/*Metiel oranje* ✓ (1)

7.1.4 Reaction of strong acid and weak base/ Solution is acidic/Colour change is in pH range less than 7/The endpoint of this titration is within pH range in which indicator changes colour. ✓✓

Reaksie van sterk suur en swak basis/ Oplossing is suur/Kleurverandering is in 'n pH-reeks minder as 7/Die eindpunt van hierdie titrasie is binne die pH-reeks waarin die indikator van kleur verander. (2)

7.2.1

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

a) Formula/*Formule*: $n = cV$/ $n = \frac{m}{M}$ ✓
b) Substitution of/Vervanging van 0,1 ✓ and 0,01 ✓
c) Ratio/*Verhouding* $n(H_2SO_4):n(Na_2CO_3) = 1 : 1$ ✓
d) $n(Na_2CO_3)_{initial} = n(Na_2CO_3)_{reacted} \times \frac{500}{25}$ ✓
e) $m(Na_2CO_3)_{pure} = n(Na_2CO_3)_{initial} \times 286$ ✓
f) 10g – (e) ✓
g) Final answer/*Finale antwoord:* 4,28 g ✓

$$c = \frac{n}{V} \checkmark$$

$$0,1 \checkmark = \frac{n}{0,01} \checkmark$$

$$n(H_2SO_4) = 0,001 \text{ mol}$$

$$n(Na_2CO_3)_{reacted} = n(H_2SO_4) = 0,001 \text{ mol} \checkmark$$

$$n(Na_2CO_3)_{initial} = 0,001 \times \frac{500}{25} \checkmark = 0,02 \text{ mol}$$

$$m(Na_2CO_3)_{pure} = nM = 0,02 \times 286 \checkmark = 5,72 \text{ g}$$

$$m_{impurities} = 10 - 5,72 \checkmark = 4,28 \text{ g} \checkmark$$

(8)

7.2.2 **POSITIVE MARKING FROM QUESTION 7.2.1**
POSITIEWE NASIEN VANAF VRAAG 7.2.1

$$\% \, Na_2CO_3 = \frac{5,72}{10} \checkmark \times 100 \checkmark = 57,2 \% \checkmark$$

(3)

[17]

QUESTION 8/*VRAAG 8*

8.1.1 Chemical (energy) to electrical (energy) **(2 or 0)** ✓✓
Chemiese (energie) na elektriese (energie) (2)

8.1.2 Potassium nitrate/*Kaliumnitraat* KNO_3
Any soluble salt/*enige oplosbare sout* ✓ (1)

8.2 X ✓
Cu^{2+}/copper (II) ion is reduced **OR** Cu^{2+}/copper (II) ion is a stronger oxidising agent. ✓
*Die Cu^{2+}/koper(II)-ioon word gereduseer **OF** die Cu^{2+}/koper(II)-ioon is 'n sterker oksideermiddel.* (2)

8.3.1 $A\ell \rightarrow A\ell^{3+} + 3e^-$ ✓✓

Marking criteria/*Nasienkriteria:*

- $A\ell \rightleftharpoons A\ell^{3+} + 3e^-$ $\frac{1}{2}$ $A\ell^{3+} + 3e^- \rightleftharpoons A\ell$ $\frac{0}{2}$
  $A\ell^{3+} + 3e^- \rightarrow A\ell$ $\frac{0}{2}$ $A\ell^{3+} + 3e^- \leftarrow A\ell$ $\frac{2}{2}$
- Ignore if charge omitted on electron/*Ignoreer as lading op elektron weggelaat is*
- If charge (+) omitted on/*Indien lading (+) weggelaat word op* $A\ell^{3+}$/:
  Max./*Maks:* $\frac{1}{2}$

  Example/*Voorbeeld*: $A\ell \rightarrow A\ell^{3} + 3e^-$

(2)

8.3.2 $\overset{\checkmark}{\overline{A\ell(s) | A\ell^{3+}(aq)}} \overset{\checkmark}{||} \overset{\checkmark}{\overline{Cu^{2+}(aq) | Cu(s)}}$

OR/*OF*

$A\ell(s) | A\ell^{3+}(1\ mol\cdot dm^{-3}) || Cu^{2+}(1\ mol\cdot dm^{-3}) | Cu(s)$

OR/*OF*

$A\ell | A\ell^{3+} || Cu^{2+} | Cu$ (3)

8.4 **OPTION/*OPSIE* 1**

$E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ ✓
$= 0{,}34$ ✓ $- (-1{,}66)$ ✓
$= 2\ V$ ✓

$E^{\theta}_{sel} = E^{\theta}_{reduksie} - E^{\theta}_{oksidasie}$
$= 0{,}34 - (-1{,}66)$
$= 2\ V$

> **Notes/*Notas***:
> - Accept any other correct formula from the data sheet.
>   *Aanvaar enige ander korrekte formule uit die gegewensblad.*
> - Any other formula using unconventional abbreviations, e.g.
> $E^{\theta}_{cell} = E^{\theta}_{OA} - E^{\theta}_{RA}$ followed by correct substitutions
>   *Enige ander formule wat onkonvensionele afkortings gebruik, bv.*
> $E^{\theta}_{cell} = E^{\theta}_{OM} - E^{\theta}_{RM}$ *gevolg deur korrekte vervangings:* Max./*Maks* $^{3}/_{4}$

OPTION/*OPSIE* 2

✓	$A\ell \rightarrow A\ell^{3+} + 3e^{-}$	+1,66 (V) ✓
	$Cu^{2+} + 2e^{-} \rightarrow Cu$	+0,34 (V) ✓
	$2A\ell + 3Cu^{2+} \rightarrow 2A\ell^{3+} + 3Cu$	2 V ✓

(4)

8.5.1 Increase/*Toeneem* ✓ (1)

8.5.2 Concentration of Cu^{2+} increases ✓
Konsentrasie Cu^{2+} neem toe
OR/*OF*
Forward reaction is favoured.
Die voorwaartse reaksie word bevoordeel. (1)
[16]

QUESTION 9/*VRAAG 9*

9.1 Electroplating/decomposition (of copper (II) chloride) ✓✓
Elektroplatering/ontbinding (van koper(II)chloried) (2)

9.2 Electrode/*Elektrode* A ✓ (1)

9.3 Electrode/*Elektrode* B ✓ (1)

9.4 $Cu \rightarrow Cu^{2+} + 2e^-$ ✓✓

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

- $Cu \rightleftharpoons Cu^{2+} + 2e^-$ $\frac{1}{2}$ $Cu^{2+} + 2e^- \rightleftharpoons Cu$ $\frac{0}{2}$
  $Cu^{2+} + 2e^- \rightarrow Cu$ $\frac{0}{2}$ $Cu^{2+} + 2e^- \leftarrow Cu$ $\frac{2}{2}$
- Ignore if charge omitted on electron/*Ignoreer as lading op elektron weggelaat is*
- If charge (+) omitted on/*Indien lading (+) weggelaat word op* Cu^{2+}/:
  Max./*Maks:* $\frac{1}{2}$
  Example/*Voorbeeld*: $Cu \rightarrow Cu^2 + 2e^-$

(2)

9.5

<u>Marking criteria/*Nasienriglyne*</u>:
(a) Formula/*Formule* $n = \frac{m}{M}$ ✓
(b) Substituting 10 and 63,5 in/*Vervang 10 en 63,5 in* $n = \frac{m}{M}$ ✓
(c) Using ratio/*Gebruik verhouding*: $n(Cu) : n(e^-) = 1:2$ ✓
(d) Final answer/*Finale antwoord* = 0,52 ✓

$n = \frac{m}{M}$ ✓
$= \boxed{\frac{16,5}{63,5}}$ ✓
$= 0,2598$ (mol)

$n(e^-) = 2n(Cu)$
$= 2 \times 0,2598$ ✓
$= 0,52$ mol ✓ (4)

[11]

TOTAL/*TOTAAL*: 150