education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY (P2)

SEPTEMBER 2026

MARKS: 150

TIME: 3 hours

This question paper consists 15 pages and 4 data sheets.

INSTRUCTIONS AND INFORMATIONS

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. Show ALL formulae and substitutions in ALL calculations.

8. Round off your FINAL numerical answers to a minimum of TWO decimal places.

9. Give brief motivations, discussions, etc. where required.

10. You are advised to use the attached DATA SHEETS.

11. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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

1.1 Which ONE of the following compounds cannot be an ester?

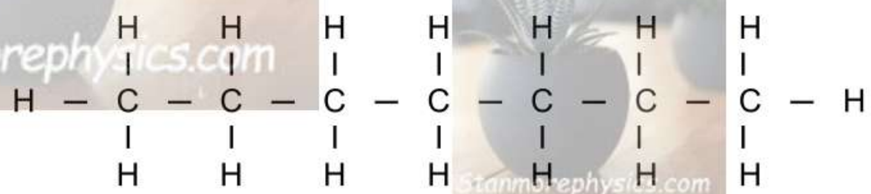
A $C_2H_4O_2$

B $C_3H_6O_2$

C $C_3H_8O_2$

D $C_4H_8O_2$ (2)

1.2 The structural formula of an organic compound is given below:



Which one of the following statements are TRUE?

(i) The compound is a hydrocarbon
(ii) The compound belongs to the same homologous series as methane
(iii) The compound has a higher vapour pressure than methane

A (i) and (ii) only

B (i) and (iii) only

C (ii) and (iii) only

D (i), (ii) and (iii) (2)

1.3 The compound C_3H_6 undergoes the following reaction.

$$C_3H_6(g) + Br_2(\ell) \longrightarrow \mathbf{P}(\ell)$$

Which one of the following combinations CORRECTLY describes the type of reaction and IUPAC name of the compound **P**?

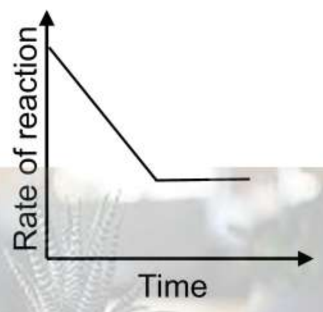
	TYPE OF REACTION	IUPAC NAME
A	Cracking	1-bromopropane
B	Elimination	2-bromopropane
C	Addition	1,2-dibromopropane
D	Addition	1,2-dibromopropene

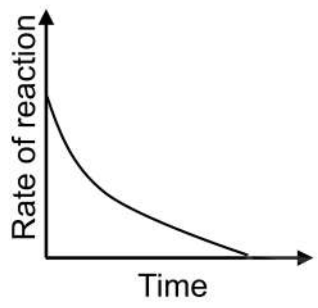
(2)

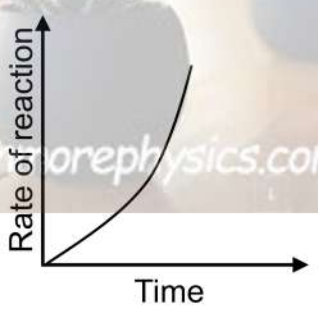
1.4 The following is a reaction between excess of hydrochloric acid and powdered magnesium:

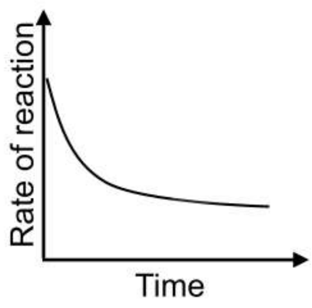
$$Mg(s) + 2HC\ell(aq) \longrightarrow MgC\ell_2(aq) + H_2(g)$$

Which ONE of the following graphs CORRECTLY shows the rate of reaction over a period of time?

A


B


C


D


(2)

1.5 The following chemical reaction reaches equilibrium in a closed container:

$$C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g) \quad \Delta H > 0$$

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

Which ONE of the following combinations is CORRECT for the new equilibrium?

	CONCENTATION OF H_2	**EQUILIBRIUM CONSTANT (K_c)**
A	Increases	Increases
B	Increases	Decreases
C	Remain constant	Remain constant
D	Decreases	Remain constant

(2)

1.6 Consider the following equilibrium reaction.

$$\underset{\textbf{BLUE}}{[Cu(H_2O)_6]^{2+}(aq)} + C\ell^-(aq) \rightleftharpoons \underset{\textbf{GREEN}}{[Cu(H_2O)_5]^{+}(aq)} + H_2O(\ell) \quad \Delta H < 0$$

Which ONE of the following will both change the colour of the solution from BLUE to GREEN?

A Add HCℓ and increase the temperature

B Add HCℓ and decrease the temperature

C Add water and increase the temperature

D Add water and decrease the temperature (2)

1.7 Consider the acid base reaction given below:

$$H_2SO_4(aq) + H_2O(\ell) \longrightarrow HSO_4^-(aq) + H_3O^+(aq)$$

Dilute sulphuric acid, H_2SO_4, is gradually added to distilled water.

Which ONE of the following combination correctly describes the pH and pOH of water?

	pH VALUE	pOH VALUE
A	Decreases	Increases
B	Increases	Decreases
C	Decreases	Remain constant
D	Remain constant	Remain constant

(2)

1.8 The list of acids is given below:

$HC\ell$	H_2O	H_2S

Which ONE of the following is the CORRECT order of increasing strength of acid?

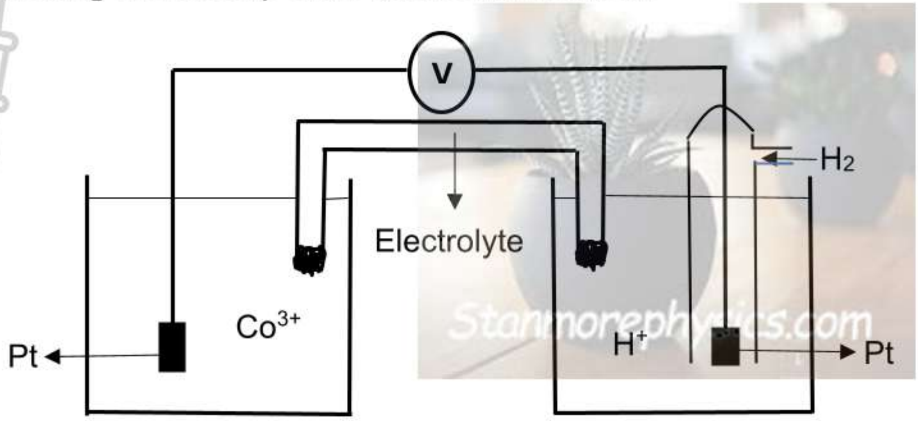
A $H_2O < H_2S < HC\ell$

B $H_2O < HC\ell < H_2S$

C $H_2S < H_2O < HC\ell$

D $HC\ell < H_2S < H_2O$ (2)

1.9 The following is the setup of an electrochemical cell.



Which one of the following is the correct cell notation of the above electrochemical cell?

A $\quad$ Pt , H_2/H^+ // Co^{3+}/Co^{2+}/ Pt

B $\quad$ Pt / H_2/H^+ // Co^{3+},Co^{2+}/ Pt

C $\quad$ Pt / Co^{3+},Co^{2+} // H_2/H^+ / Pt

D $\quad$ Pt / Co^{3+}/Co^{2+} // H_2/H^+ / Pt (2)

1.10 The oxidation number of Cℓ in $HClO_4$ is …

A $\quad$ -1.

B $\quad$ +4.

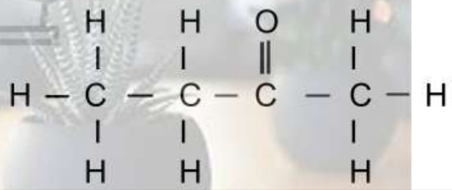
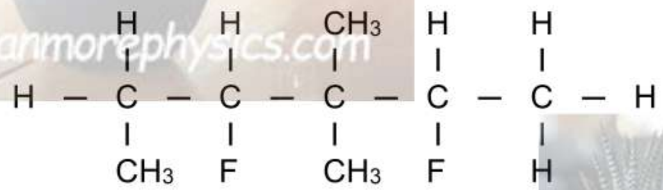
C $\quad$ -7.

D $\quad$ +7. (2)

[20]

QUESTION 2 (Start on a new page.)

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

A	$CH_3(CH_2)_2CHO$	**B**	CH_3CH_2CCH
C		**D**	$CH_3(CH_2)_3OH$
E		**F**	Hexan-3-ol
G	2-methylpropanoic acid	**H**	Ethylpropanoate

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

2.2 Write down the compounds which are functional isomers. (2)

2.3 Write down the NAME of the FUNCTIONAL GROUP to which compound **A** belongs. (1)

2.4 Is compound **F** a primary, secondary or tertiary alcohol?

Give a reason for the answer. (2)

2.5 Write down the:

2.5.1 IUPAC name of compound **B** (2)

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

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

2.5.4 STRUCTURAL FORMULA of compound **H** (2)

2.5.5 CONDENSED FORMULA of the positional isomer of compound **D** (2)

[18]

QUESTION 3 (Start on a new page.)

The physical properties of four organic compounds shown in the table below are compared.

	COMPOUND	MOLECULAR MASS ($g \cdot mol^{-1}$)
A	Pentane	72
B	2-Methylbutane	?
C	1-Butanol	74
D	Propanoic acid	74

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

3.2 Write down the molecular mass of compound **B**. (1)

3.3 Compounds **A** and **B** are compared.

3.3.1 Will the boiling point of compound **A** be HIGHER THAN, LOWER THAN or EQUAL TO the boiling point of compound **B**? (1)

3.3.2 Fully explain the answer in QUESTION 3.3.1. (3)

3.4 Compounds **C** and **D** are compared.

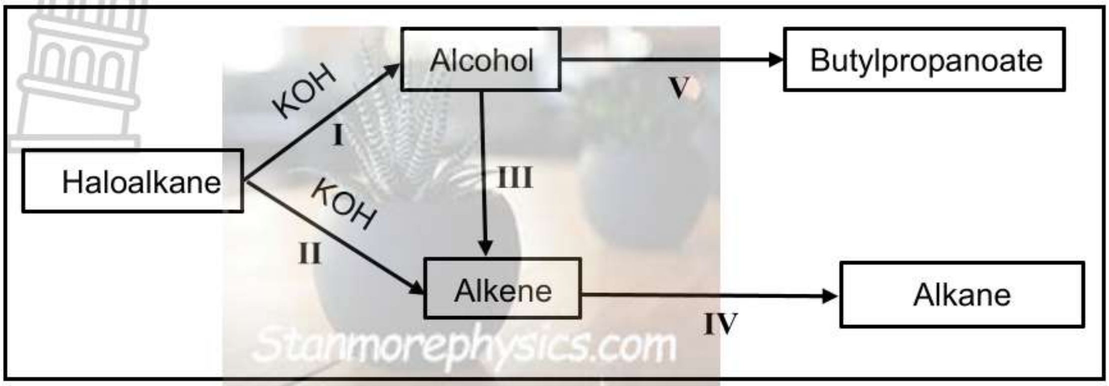
3.4.1 Which compound has the lower vapour pressure? (2)

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

[13]

QUESTION 4 (Start on a new page.)

The flow diagram below shows how a primary haloalkane can be used to prepare different organic compounds under different reaction conditions.



Consider reaction **II**

4.1 Write down:

4.1.1 The type of reaction (1)

4.1.2 ONE reaction condition (other than heat) (1)

Reaction **I** is a substitution reaction.

4.2 Write down the:

4.2.1 TYPE of substitution reaction (1)

4.2.2 NAME or FORMULA of the two inorganic products formed (2)

4.3 Write down the balanced equation for reaction **III** using STRUCTURAL FORMULAE. (4)

4.4 Hydrogen is used as a reactant in reaction **IV.**

Write down the:

4.4.1 NAME or FORMULA of the CATALYST used (1)

4.4.2 IUPAC name of the ALKANE (2)

4.4.3 Balanced equation using MOLECULAR FORMULAE for the complete combustion of the alkane (3)

4.5 In reaction **V** the alcohol reacts with carboxylic acid to form butylpropanoate.

Write down the:

4.5.1 Type of reaction (1)

4.5.2 Balanced equation using CONDENSED FORMULAE (5)
[21]

QUESTION 5 (Start on a new page.)

The reaction between excess diluted HCℓ and pure zinc of mass 10 g is used to investigate how concentration affects the rate of reaction. The balanced equation for the reaction is:

$$Zn(s) + 2HC\ell(aq) \rightarrow ZnC\ell_2(aq) + H_2(g)$$

INVESTIGATION	CONCENTRATION OF HCℓ ($mol \cdot dm^{-3}$)	RATE OF PRODUCTION $H_2(g)$ ($mol \cdot dm^{-3} \cdot s^{-1}$)
1	0,4	2×10^{-2}
2	0,6	$3,8 \times 10^{-2}$
3	0,8	$5,4 \times 10^{-2}$

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

5.2 Describe the trend in the rate of reaction. (1)

5.3 Use the COLLISION THEORY to explain the answer in QUESTION 5.2. (2)

For INVESTIGATION 3

5.4 Calculate the:

5.4.1 Average rate at which HCℓ is used up in $mol \cdot dm^{-3} \cdot s^{-1}$ (2)

5.4.2 Volume of the hydrogen gas produced if the reaction lasts for 3 s. (6)

5.5 The investigation is repeated using 15 g of Zn with excess HCℓ of concentration 0,8 $mol \cdot dm^{-3}$.

Write down INCREASE, DECREASE or REMAIN THE SAME:

5.5.1 Rate of reaction (1)

5.5.2 Volume of hydrogen gas produced (1)

5.6 Explain the answer in QUESTION 5.5.1. (2)
[17]

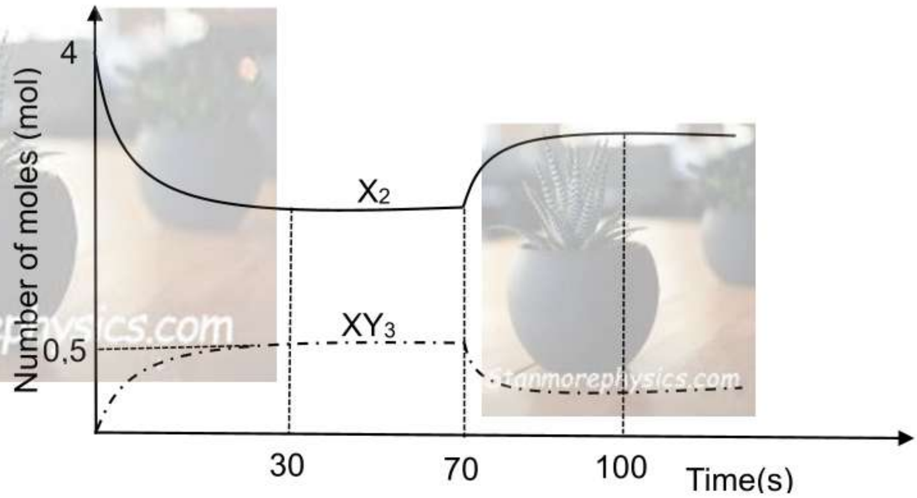
QUESTION 6 (Start on a new page.)

Consider the balanced equation for a hypothetical reversible reaction that takes place when 4 moles of gas X_2 and 4 moles of gas Y_2 are pumped into a 2 dm^3 sealed container.

$$X_2(g) + 3Y_2(g) \rightleftharpoons 2XY_3(g)$$

6.1 Define the term *reversible reaction*. (2)

The graph shows the number of moles of gas X_2 and gas XY_3 from the time the container is sealed.



Use the graph to answer the questions below.

6.2 At 30s, how many moles of XY_3 are formed? (1)

6.3 Calculate the equilibrium constant, K_c at 50s. (7)

6.4 At 70s, the temperature is increased.

6.4.1 Is the forward reaction an EXOTHERMIC or ENDOTHERMIC reaction? (1)

6.4.2 Explain the answer in QUESTION 6.4.1. (3)

6.4.3 Will the K_c value, INCREASE, DECREASE or REMAIN CONSTANT? (1)
[15]

QUESTION 7 (Start on a new page.)

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

7.2 The table below shows aqueous solutions of ionic compounds each with the same concentration at room temperature.

$Na_2CO_3(aq)$	$NaC\ell(aq)$	$NH_4C\ell(aq)$	$CH_3COONa(aq)$

Write down the formula for the:

7.2.1 Neutral solution and explain the answer (2)

7.2.2 Solution with pH less than 7. Use a balanced ionic equation to explain the answer (3)

7.3 In an experiment 300 cm^3 of a 0,1 $mol{\cdot}dm^{-3}$ solution of sulphuric acid, H_2SO_4, is added to 200 cm^3 of a 0,5 $mol{\cdot}dm^{-3}$ solution of sodium hydroxide, NaOH, at 25°C. The balanced equation for the reaction is:

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

Calculate the pH of the final mixture. (8)

[15]

QUESTION 8 (Start on a new page.)

The table below shows two half cells **A** and **B** used to assemble an electrochemical cell under standard conditions.

Half cell A	$Fe^{2+} + 2e^{-} \rightleftharpoons Fe$
Half cell B	$Ni^{2+} + 2e^{-} \rightleftharpoons Ni$

8.1 Write down the energy conversion that takes place in the above electrochemical cell. (2)

8.2 In which direction will electrons flow in the external circuit of the above electrochemical cell? (**Ni** to **Fe** or **Fe** to **Ni**) (1)

8.3 Explain the answer to QUESTION 8.2 in terms of the relative strength of reducing agents. (3)

8.4 How will each of the following change when the cell functions normally? Write INCREASES, DECREASES or REMAIN CONSTANT:

8.4.1 The concentration of Ni^{2+} ions (1)

8.4.2 The mass of Fe (1)

8.5 Write down the half reaction to support the answer in QUESTION 8.4.2. (2)

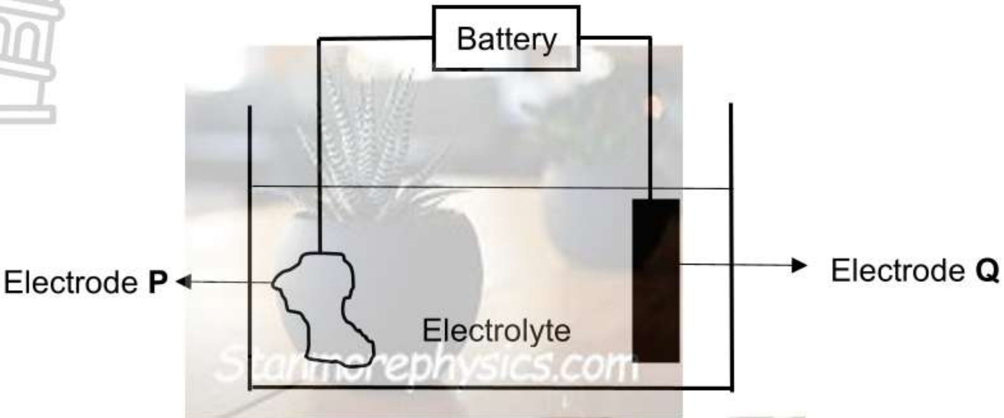
8.6 Write down the balanced net ionic equation for this cell. (3)

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

8.8 What will the emf of the cell be when the rate of the forward reaction is equal to the rate of reverse reaction in the cell? (1)
[18]

QUESTION 9 (Start on a new page.)

The simplified diagram below represents an electrolytic cell used for purification of copper that contains impurities. Electrode **P** is the impure copper.



9.1 Define the term *electrolyte*. (2)

9.2 Write down the NAME or FORMULA of the electrolyte used in the electrochemical cell. (1)

9.3 Is the impure copper metal the ANODE or CATHODE?

Give a reason for the answer. (2)

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

9.5 Calculate the mass of copper deposited at the cathode when 1,5 A of current is delivered by the battery in 20 minutes. (6)
[13]

TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 2 (CHEMIE)

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

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

TABLE 2: FORMULAE/TABEL 2: FORMULES

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

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE1

KEY/*SLEUTEL*

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

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

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

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

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

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

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

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

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

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)

SEPTEMBER 2026

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

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

QUESTION/*VRAAG* 1

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

QUESTION/*VRAAG* 2

2.1 Organic molecules with the same molecular formula, ✓but different functional groups. ✓
Organiese molekule met dieselfde molekulêre formule, maar verskillende funksionele groepe. (2)

2.2 A ✓and C✓/ *A en C* (2)

2.3 Formyl✓group/*Formiel groep* (1)

2.4 Secondary.✓ The carbon bonded to the hydroxyl group(-OH) is bonded to 2 other carbon atoms/the functional group is bonded to 2 other carbon atoms.✓
Sekondêr. Die koolstofatoom waaraan die hidroksielgroep(-OH) gebind is, is aan twee ander koolstofatome gebind/die funksionele groep is gebind aan twee ander koolstofatome. (2)

2.5

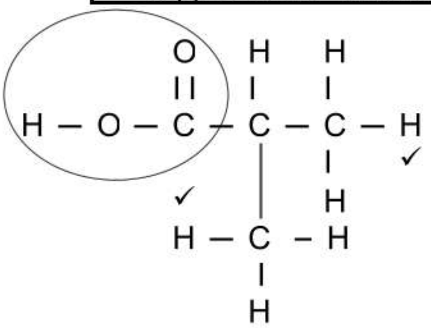
2.5.1 But-1-yne ✓✓ / *But-1-yn* (2)

2.5.2 2,4-difluoro-3,3-dimethylpentane✓✓✓
2,4-difluoro-3,3-dimetielpentaan (3)

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

Nasienkriteria:
- *Korrekte stam d.i. pentaan* ✓
- *Alle substituente(difluoro en dimetiel) korrek geïdentifiseer* ✓
- *IUPAC naam heeltemal korrek insluitende nommering, volgorde, koppeltekens en kommas.* ✓

2.5.3



Marking criteria:
- Functional group✓
- Whole structure correct✓

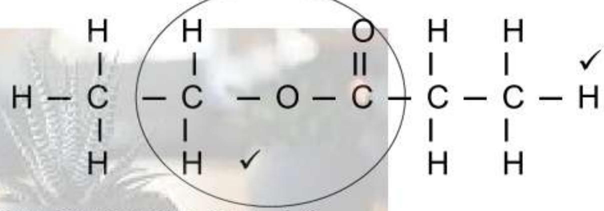
Nasienkriteria:
- *Funksionele groep* ✓
- *Hele struktuur korrek* ✓

(2)

2.5.4

Marking criteria:
- Functional group✓
- Whole structure correct ✓

Nasienkriteria:
- *Funksionele groep* ✓
- *Hele struktuur korrek* ✓



(2)

2.5.5 $CH_3CHOHCH_2CH_3$✓✓ (2)

[18]

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.

> **Marking criteria/*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 72 ($g.mol^{-1}$) ✓ (1)

3.3.1 Higher than✓/Hoër as (1)

3.3.2 From B to A

- **Structure:**
  The chain length increases✓.
- **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.✓

OR

From A to B

- **Structure:**
  The chain length decreases.✓
- **Intermolecular forces:**
  The strength of the London forces/induced dipole/Van der Waals/ intermolecular forces decrease✓
- **Energy:**
  Lesser energy needed to overcome/break the intermolecular forces.✓

Van B na A

- ***Struktuur:***
  Die kettinglengte neem toe. ✓
- ***Intermolekulêre kragte:***
  Die sterkte van die Londonkragte/geïnduseerde dipool/Van der Waals/intermolekulêre kragte neem toe. ✓
- ***Energie:***
  Meer energie word benodig om die intermolekulêre kragte te oorkom/breek. ✓

OF

Van A na B (3)

- ***Struktuur:***
  Die kettinglengte neem af. ✓
- ***Intermolekulêre kragte:***
  Die sterkte van die Londonkragte/geïnduseerde dipool/Van der Waals/intermolekulêre kragte neem af. ✓
- ***Energie:***
  Minder energie word benodig om die intermolekulêre kragte te oorkom/breek. ✓

3.4.1 D/propanoic acid/*propanoësuur* ✓✓ (2)

3.4.2
- Boiling point of D is higher than C/ Boiling point of C is lower than D ✓
- Compound D/propanoic acid/carboxylic acid has two sites of hydrogen bond. Compound C/alcohol/1-butanol has one site of hydrogen bond. ✓
- Intermolecular forces in compound D/ propanoic acid/carboxylic acid are stronger than the intermolecular forces in alcohols ✓
  OR
  Intermolecular forces in C/alcohol/1-butanol are weaker than in compound D
- More energy needed to overcome/break the intermolecular forces in D/propanoic acid/carboxylic acid than in compound C/alcohol/1-butanol. ✓
  OR
  Less energy needed to overcome/break the intermolecular forces in C/alcohol/1-butanol than in D/propanoic acid/carboxylic acid.
- *Kookpunt van D is hoër as C/Koopunt van C is laer as D.*
- *Verbinding D/propanoësuur/karboksielsuur het twee plekke vir waterstofbinding. Verbinding C/1-butanol/alkohol het een plek vir waterstofbinding.*
- *Intermolekulêre kragte in D/propanoësuur/karboksielsuur is sterker as die intermolekulêre kragte in C/alkohol/1-butanol.*
  OF
- *Intermolekulêre kragte in C/alkohol/butanol is swakker as in D/propanoësuur/karboksielsuur.*
- *Meer energie word benodig om die intermolekulêre kragte in D/propanoësuur/karboksielsuur te oorkom/breek as die intermolekulêre kragte in C/alkohol/1-butanol.*
  OF
- *Minder energie word benodig om die intermolekulêre kragte in C/alkohol/butanol te oorkom/breek as die intermolekulêre kragte in D/propanoësuur/karboksielsuur.* (4)

[13]

QUESTION/*VRAAG* 4

4.1.1 Elimination✓/*Eliminasie* (1)

4.1.2 Concentrated strong base/KOH✓/ *Gekonsentreerde sterk basis/KOH* (1)

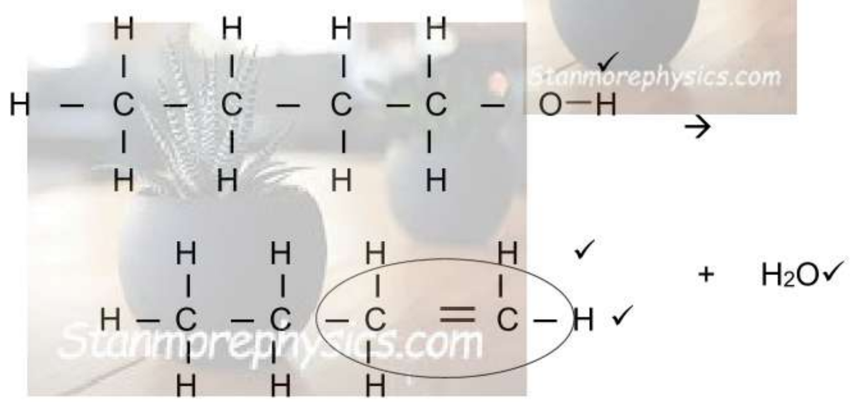
4.2.1 Hydrolysis (reaction)✓/*Hidrolise (reaksie)* (1)

4.2.2 KCℓ ✓and H_2O ✓/ *KCℓ ✓en* H_2O ✓ (2)

4.3

Marking criteria:
- Correct structural formula for butanol ✓
- Functional group of alkene is correct✓
- The whole structural formula is correct ✓
- H_2O ✓

Nasienkriteria:
- *Korrekte struktuurformule vir butanol*
- *Funksionele groep van alkeen is korrek*
- *Die hele struktuurformule is korrek*
- H_2O



(4)

4.4.1 Platinum or Pt/Paladium or Pd/Nickel/Nikkel or Ni✓ (1)

4.4.2 Butane✓✓/*Butaan* (2)

4.4.3 $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$ (Bal) ✓ ✓ ✓ (3)

4.5.1 Esterification✓/*Esterfikasie* (1)

4.5.2

<u>Marking criteria:</u>
- Correct condensed structural formula for butanol ✓
- Correct condensed structural formula for propanoic acid ✓
- Functional group of ester is correct✓
- The whole condensed structural formula is correct ✓
- H_2O ✓

IF
- Any additional reactants or products: Deduct 1 mark
- Structural formulae used. Max. ($^4/_5$)
- Molecular formulae used. Max. ($^1/_5$)
- Only reactants without arrow Max. ($^2/_5$) : Marking rule 6.3.10

<u>Nasienkriteria:</u>
- *Korrekte gekondenseerde struktuurformule vir butanol* ✓
- *Korrekte gekondenseerde struktuurformule vir propanoësuur* ✓
- *Funksionele groep van die ester is korrek*✓
- *Die hele gekondenseerde struktuurformule is korrek* ✓
- H_2O ✓

INDIEN
- *Enige addisionele reaktanse of produkte: Trek 1 punt af*
- *Struktuurformules gebruik. Maks.* ($^4/_5$)
- *Molekulêre formules gebruik. Maks.* ($^1/_5$)
- *Slegs reaktanse sonder pyl Maks.* ($^2/_5$) *: Nasienreël 6.3.10*

$$\underset{✓}{CH_3CH_2CH_2CH_2OH} + \underset{✓}{CH_3CH_2COOH} \rightarrow CH_3CH_2\underset{✓}{COO}\underset{✓}{CH_2CH_2CH_2CH_3} + \underset{✓}{H_2O}$$

OR/*OF*

$$\underset{✓}{CH_3CH_2CH_2CH_2OH} + \underset{✓}{CH_3CH_2COOH} \rightarrow CH_3CH_2\overset{\overset{O}{||}}{C}O\,✓\,\underset{✓}{CH_2CH_2CH_2CH_3} + \underset{✓}{H_2O}$$ (5)

[21]

QUESTION/*VRAAG* 5

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

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

<u>NOTE/*NOTA*</u>
Give the mark for <u>per unit time</u> only if in correct context of reaction rate
Gee die punt vir <u>per eenheidtyd</u> slegs in die korrekte konteks van reaksietempo (2)

5.2 As concentration increases rate also increases. ✓
Soos die konsentrasie toeneem sal die reaksietempo ook toeneem. (1)

5.3
- Amount of particles per unit volume increases✓
- More effective collision per unit time/second/Higher frequency of effective collisions ✓
- *Hoeveelheid deeltjies per volume-eenheid neem toe*
- *Meer effektiewe botsings per eenheidtyd/sekonde/hoër frekwensie van effektiewe botsings* (2)

5.4.1

Marking criteria/*Nasienkriteria*:
- Ratio of HCℓ and H_2/*Verhouding HCℓ and H_2 is* 2:1 ✓
- Answer/*Antwoord* $1{,}08 \times 10^{-1}$($mol \cdot dm^{-3} \cdot s^{-1}$) ✓

HCℓ : H_2
2 : 1✓
x : $5{,}4 \times 10^{-2}$
Rate/*tempo* = $1{,}08 \times 10^{-1}$ ($mol \cdot dm^{-3} \cdot s^{-1}$) ✓**Accept/Aanvaar** : 0,11 ($mol \cdot dm^{-3} \cdot s^{-1}$) (2)

5.4.2

Marking criteria/*Nasienkriteria*:
- Any Formula/*Enige formule* $n = \frac{m}{M}$ or $c = \frac{n}{V}$ ✓
- Substituting/*Vervanging* 65 $g \cdot mol^{-1}$ ✓in $n = \frac{m}{M}$
- USE ratio/*GEBRUIK verhouding* ✓
- Rate substitution/*Tempo vervanging*✓
- Substitution of/*Vervanging van* $\frac{0{,}15}{0{,}162}$✓
- Answer/*Antwoord* 0,949 dm^3✓

$n = \frac{m}{M}$✓

$n = \frac{10}{65}$✓

$= 0{,}1539$ mol

$n(H_2) = 0{,}1539$ mol ✓

Rate $= \Delta c/\Delta t$

$\Delta c = (5{,}4 \times 10^{-2})(3)$✓

$= 0{,}162\ mol \cdot dm^{-3}$

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

$V = \frac{0{,}1539}{0{,}162}$ ✓

$= 0{,}95\ dm^3$✓ (6)

5.5.1 Increases✓/*Toeneem* (1)

5.5.2 Increases✓/*Toeneem* (1)

5.5.3 Surface area/State of division increases/More particles are exposed to HCℓ ✓
More effective collision per unit time ✓
Kontakoppervlak/Toestand van verdeeldheid neemtoe/Meer deeltjies blootgestel aan HCℓ ✓
Meer effektiewe botsings per eenheidtyd ✓ (2)
[17]

QUESTION/*VRAAG* 6

6.1 Reaction in which products can be converted to reactants (and vice versa).✓✓ (**2** or **0**)
Reaksie wanneer produkte terug na reaktanse omgeskakel kan word. (2)

6.2 0,5 (mol)✓ (1)

6.3

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

Marking criteria/*Nasienkriteria*:

a) Equilibrium/*Ewewig* n(XY_3) ✓
b) Using ratio/*Gebruik verhouding*: $X_2 : Y_2 : XY_3$ = 1: 3: 2✓
c) Equilibrium/*Ewewig* n(X_2) = intial/*aanvanklik* n(X_2) – change/ n(X_2)
Equilibrium n(Y_2) = intial n(Y_2) - change n(Y_2) ✓
d) Dividing/*Deel deur* by 2 ✓
e) Correct K_c expression in square brackets/*Korrekte K_c uitdrukking in vierkantige hakies* ✓
f) Substitution of equilibrium concentrations into K_c expressions✓
Vervanging van ewewigskonsentrasies in die K_c uitdrukking
g) Final answer/*Finale antwoord* 0.0078✓

mol	X_2	$3Y_2$	$2XY_3$	
Initial mole/ *Aanvanklike mol*	4	4	0	
Change in mole/ *Verandering in mol*	0,25	0,75	0,5 ✓ (b)	
Equilibrium mole/ *Ewewigs mol*	3,75	3,25 ✓(c)	0,5 ✓ (a)	
Concentration/ *Konsentrasie*	1,875	1,625	0,25	✓ (d)

$$K_c = \frac{[XY_3]^2}{[X_2][Y_2]^3} \checkmark \text{ (e)}$$

$$K_c = \frac{(0,25)^2}{(1,875)(1,625)^3} \checkmark \text{ (f)}$$

K_c = 0,0078 ✓ (g) (7)

6.4.1 Exothermic✓/*Eksotermies* (1)

6.4.2
- The number of moles of X_2 (reactant) increases and the number of moles of XY_3 (product) decreases ✓
- Increase in temperature favours the endothermic reaction ✓
- The reverse reaction is favoured✓
- *Die aantal mol X_2 (reaktans) neemtoe en die aantal mol XY_3 (produk) neem af*
- *Toename in temperatuur bevoordeel die endotermiese reaksie*
- *Die terugwaartse reaksie word bevoordeel* (3)

6.4.3 Decrease✓/*Afneem* (1)

[15]

QUESTION/*VRAAG* 7

7.1 Ionise incompletely in water to form low concentration of H_3O^+ ions ✓✓ **(2 or 0)**
Ioniseer onvolledig in water om 'n lae konsentrasie H_3O^+ ione te vorm (2)

7.2.1 NaCℓ ✓
It is a salt of <u>strong acid and a strong base</u>/ ✓
Dit is 'n sout van 'n <u>sterk suur en 'n sterk basis</u> (2)

7.2.2 $NH_4C\ell$ ✓

$NH_4^+ + H_2O \rightarrow NH_3 + H_3O^+$ ✓✓ (3)

7.3

Marking criteria:
- Calculate n (H_2SO_4) using $c = \frac{n}{V}$ ✓
- Calculate n (NaOH) using $c = \frac{n}{V}$ ✓
- Using Ratio 1 : 2 correctly ✓
- Calculate $n(NaOH)_{excess} = n(NaOH)_{initial} - n(NaOH)_{used}$ ✓
- Substitute 0,04 and 0,5 in $c = \frac{n}{V}$ ✓
- Any formula $p^{OH} = -\log[OH^-]$ or $p^H = -\log[H_3O]^+$ ✓
- Substitution in the formula $p^H + p^{OH} = 14$ or $K_w = [H_3O^+][OH^-]$ ✓
- Answer 12,9 ✓

Nasienkriteria:
- *Bereken n (H_2SO_4) using $c = \frac{n}{V}$* ✓
- *Bereken n (NaOH) using $c = \frac{n}{V}$* ✓
- *Gebruik verhouding 1 : 2 korrek* ✓
- *Bereken $n(NaOH)_{oormaat} = n(NaOH)_{aanvanklik} - n(NaOH)_{gebruik}$* ✓
- *Vervang 0,04 en 0,5 in $c = \frac{n}{V}$* ✓
- *Enige formule $pOH = -\log[OH^-]$ of $pH = -\log[H_3O]^+$* ✓
- *Vervanging in die formule $pH + pOH = 14$ of $K_w = [H_3O^+][OH^-]$* ✓
- *Antwoord 12,9* ✓

$n(H_2SO_4) = \underline{0,1 \times 0.3}$ ✓
$= 0,03$ mol

$n(NaOH) = \underline{0,5 \times 0,2}$ ✓
$= 0,1$ mol

$n(H_2SO_4) : n(NaOH)$
1 : 2
$n(NaOH) = 0,06$ mol ✓

n(excess) = 0,1 – 0,06 ✓ = 0,04 mol

$$c(NaOH) = \frac{n}{V}$$
$$= \frac{0,04}{(0,3 + 0,2)} \checkmark$$
$$= 0,08 \text{ mol}$$

$p^{OH} = -\log[OH^-]$ ✓
$p^{OH} = -\log(0,08)$
$p^{OH} = 1,1$
$p^H + p^{OH} = 14$
$p^H + 1,1 = 14$ ✓
$p^H = 14 - 1,1$
$p^H = 12,9$ ✓ (8)

QUESTION/*VRAAG* 8

8.1 Chemical energy is converted to electric energy. ✓✓ **(2 or 0)**
Chemiese energie omgeskakel na elektriese energie (2)

8.2 Fe to Ni/*Fe na Ni*✓ (1)

8.3 Fe is a stronger reducing agent ✓ than Ni. ✓ Ni^{2+} is reduced to Ni/Fe is oxidised to Fe^{2+}.✓
Fe is 'n sterker reduseermiddel na Ni. Ni^{2+} is gereduseer na Ni/Fe is geoksideer na Fe^{2+}. (3)

8.4.1 Decreases✓/*Afneem* (1)

8.4.2 Decreases✓/*Afneem* (1)

8.5 $Fe \rightarrow Fe^{2+} + 2e^-$ ✓✓

NOTE/NOTA:
- $Fe^{2+} + 2e^- \rightleftharpoons Fe$ ($^1/_2$)
- $Fe \leftarrow Fe^{2+} + 2e^-$ ($^2/_2$)
- $Fe \rightleftharpoons Fe^{2+} + 2e^-$ ($^0/_2$)
- $Fe \rightarrow Fe^{2+}(aq) + 2e^-$ ($^0/_2$)
- Ignore charges omitted on electron/*Ignoreer indien lading weggelaat is op elektron.*
- If charge (+) omitted on Fe^{2+}/ *Indien lading (+) weggelaat is op Fe^{2+}*
  Max. ($^1/_2$)
  Example/*Voorbeeld*: $Fe^2 + 2e^- \rightarrow Fe$ ✓
- Ignore phases/*Ignoreer fases*

(2)

8.6 $Fe + Ni^{2+}$ ✓ $\rightarrow Ni + Fe^{2+}$ ✓ bal.✓

Reactants/*Reaktante*✓ Products/*Produkte* ✓ Balancing/*Balansering* ✓ (3)

8.7 $E^\ominus_{cell} = E^\ominus_{reduction} - E^\ominus_{oxidation}$✓

$E^\ominus_{cell} = -0{,}27$✓ $-(-0{,}44)$ ✓ $= 0{,}17$ V✓

NOTE/*NOTA*:
- Accept any other correct formula from the data sheet./*Aanvaar enige ander korrekte formule vanaf die inligtingsblad.*
- 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 vervanging : ¾

(4)

8.8 0(V)✓ (1)
[18]

QUESTION/*VRAAG* 9

9.1 Solution that conducts electricity through movements ions✓✓ **(2 or 0)**
Oplossing wat elektrisiteit gelei deur die beweging van ione (2)

9.2 Copper sulphate/*Kopersulfaat/*$CuSO_4$✓ (1)

9.3 Anode/*Anode*✓ Oxidation takes place/*Oksidasie vind plaas* ✓ (2)

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

NOTE/*NOTA*

- $Cu^{2+} + 2e^- \rightleftharpoons Cu$ ($^1/_2$)
- $Cu \leftarrow Cu^{2+} + 2e^-$ ($^2/_2$)
- $Cu \rightleftharpoons Cu^{2+} + 2e^-$ ($^0/_2$)
- $Cu \rightarrow Cu^{2+}(aq) + 2e^-$ ($^0/_2$)

- Ignore charges omitted on electron/*Ignoreer indien lading weggelaat is op elektron.*
- If charge (+) omitted on Cu^{2+}/ *Indien lading (+) weggelaat is op* Cu^{2+} Max. ($^1/_2$)
  Example: $Cu^2 + 2e^- \rightarrow Cu$ ✓
- Ignore phases/*Ignoreer fases* (2)

9.5

Marking criteria:
- Calculate Q using $Q = I\Delta t$ ✓
- Calculate number of elctrons using $n = \frac{Q}{e^-}$ ✓
- Calculate n using $n = \frac{N}{N_A}$ ✓
- Calculate $n_{(Cu)}$ using the ratio 1 : 2 correctly ✓
- Calculate the mass of Cu (n x 63,5) ✓
- Answer 0,59 g ✓

Nasienkriteria:
- *Bereken Q deur* $Q = I\Delta t$ te gebruik
- *Bereken die aantal elektrone deur* $n = \frac{Q}{e^-}$ *te gebruik*
- *Bereken n deur* $n = \frac{N}{N_A}$ *te gebruik* ✓
- *Bereken* $n_{(Cu)}$ *deur die verhouding 1 : 2 korrek te gebruik*
- *Bereken die massa van Cu (n x 63,5)*
- *Antwoord 0,59 g* ✓

$Q = I \times \Delta t$

$Q = 1,5 \times 1200$ ✓

$= 1800$ C

$n = \frac{1800}{1,6 \times 10^{-19}}$ ✓

$= 1,125 \times 10^{22}$ electrons/*elektrone*

$n = \frac{N}{N_A}$

$= \frac{1,125 \times 10^{22}}{6,02 \times 10^{23}}$ ✓

$= 0,01868771$ mol

$n_{(Cu)} = \frac{1}{2} \times 0,01868771$ ✓

$= 9,344 \times 10^{-3}$ mol

$m = n \times M$

$= 9,344 \times 10^{-3} \times 63,5$ ✓

$m = 0,59$g ✓

(6)
[13]

TOTAL/*TOTAAL*: 150