GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2026

10842

PHYSICAL SCIENCES: CHEMISTRY

(PAPER 2)

PHYSICAL SCIENCES: Paper 2
10842E

TIME: 3 hours

MARKS: 150

17 pages + 4 data sheets

X05

INSTRUCTIONS AND INFORMATION

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

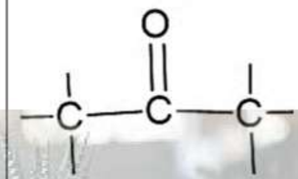
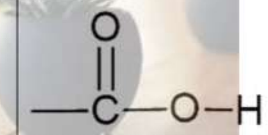
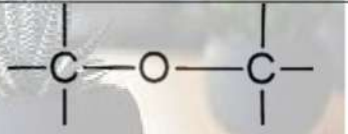
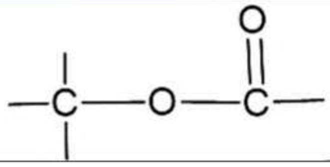
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four 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 D.

1.1 A chemical formula that indicates the elements and the number of each type of atom in a molecule, is defined as:

A Structural formula
B Condensed formula
C Molecular formula
D General formula (2)

1.2 The correct structural formula of the functional group for an ester is:

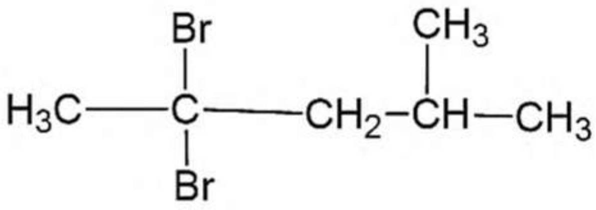
A		B	
C		D	

(2)

1.3 Hexyl octanoate is added to water. This ester is insoluble in water because ...

A an ester has only dipole-dipole forces.
B water has hydrogen bonding while an ester has ionic forces.
C an ester has a sweet smell which keeps it afloat.
D an ester has stronger London forces. (2)

1.4 The correct IUPAC name for the structure below is:

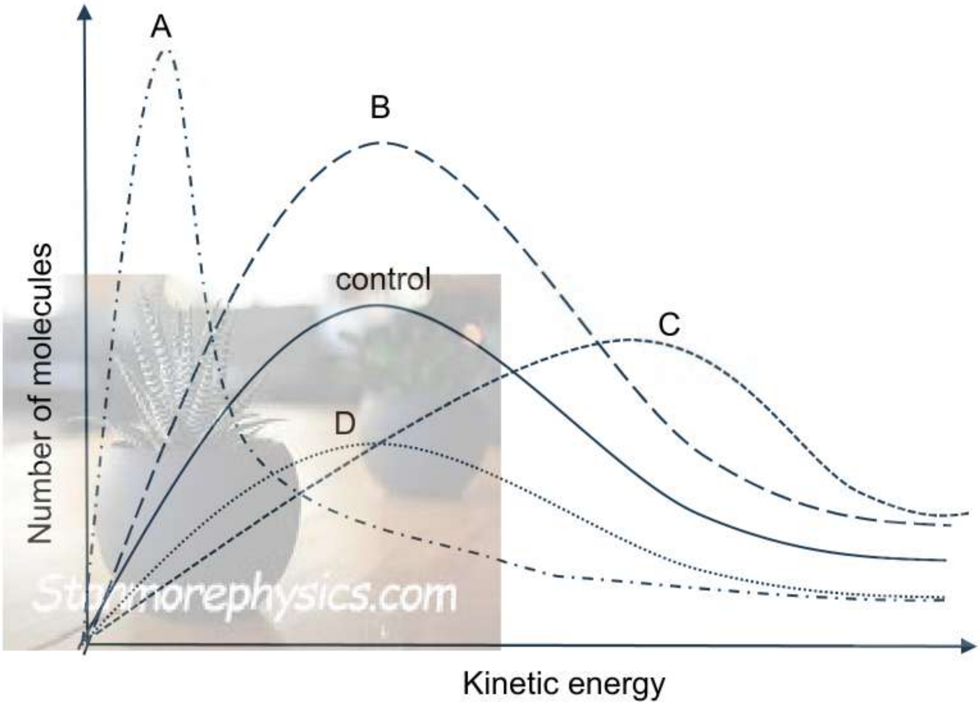


A 2-methyl-4,4-dibromopentane
B 2,2-dibromo-1,1-dimethylbutane
C 2,2-dibromo-4-methylpentane
D dibromo-dimethylbutane (2)

1.5 The Maxwell-Boltzmann distribution curve for the following reaction is given and indicated as the control in the graph:

$$Zn + 2HC\ell \rightarrow ZnC\ell_2 + H_2 \qquad \Delta H<0$$

In a second experiment the concentration of hydrochloric acid is increased. Which graph best compares with the control graph?

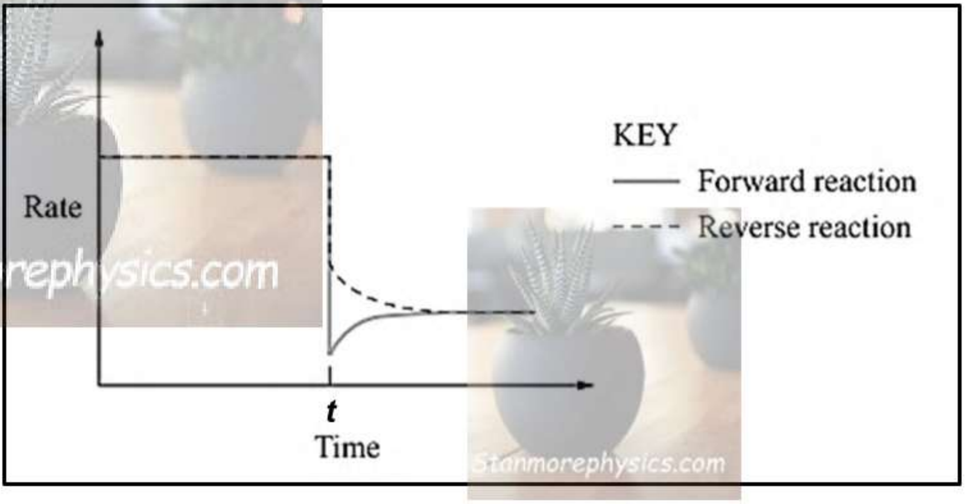


(2)

1.6 Carbon dioxide reacts with hydrogen gas to form carbon monoxide and water vapour in a sealed container, as shown in the chemical equation given below:

$$CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$$

A temperature change was applied to the equilibrium system at time ***t***, and the rates of both the forward and reverse reactions were monitored.



Which statement correctly shows the temperature change that was applied and the nature of the forward reaction at time ***t***?

A Decrease in temperature, endothermic
B Decrease in temperature, exothermic
C Increase in temperature, endothermic
D Increase in temperature, exothermic (2)

1.7 A weak acid solution is diluted by adding acid to water. The temperature is kept constant.

Which of the following best describes the effect on the K_a value and the concentration of hydronium ions in the new diluted weak acid solution?

	K_a VALUE	CONCENTRATION OF HYDRONIUM IONS
A	Decreases	Increases
B	Decreases	Decreases
C	Remains the same	Increases
D	Remains the same	Decreases

(2)

1.8 The pH of a solution changes from 8 to 5.

What happens to the concentration of hydrogen ions during this change in pH? (Assume that the temperature is kept constant.)

A It increases by a factor of 3.
B It decreases by a factor of 3.
C It increases by a factor of 1 000.
D It decreases by a factor of 1 000. (2)

1.9 Magnesium reacts quickly with hot water to form magnesium hydroxide and hydrogen gas, as shown in the equation below:

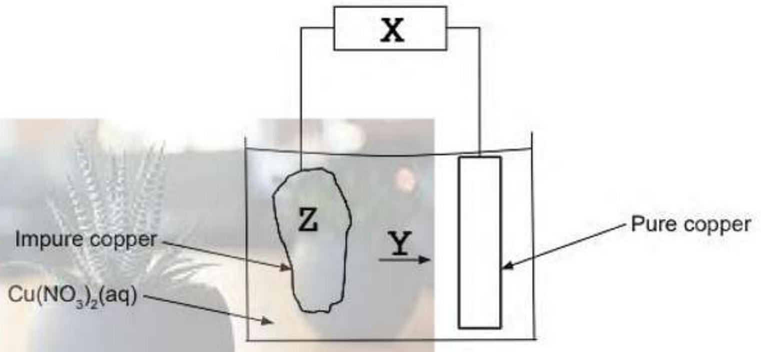
$$Mg(s) + 2H_2O(\ell) \rightarrow Mg(OH)_2(aq) + 2H_2(g)$$

Which of the following correctly identifies the oxidising agent and reducing agent in the above reaction?

	OXIDISING AGENT	**REDUCING AGENT**
A	H_2O	H_2
B	H_2O	Mg
C	Mg	H_2O
D	$Mg(OH)_2$	Mg

(2)

1.10 The cell below was set up to demonstrate the purification of copper.



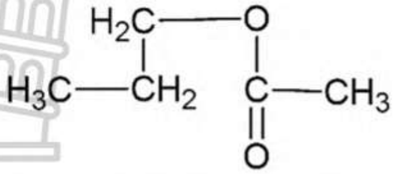
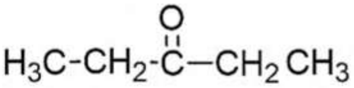
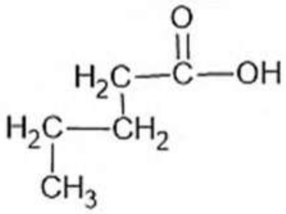
Which of the following is the correct labels for **X**, **Y** and **Z**, as indicated in the diagram above?

	X	Y	Z
A	Voltmeter	Direction of anion flow	Anode
B	Power supply	Direction of cation flow	Anode
C	Voltmeter	Direction of anion flow	Cathode
D	Power supply	Direction of cation flow	Cathode

(2)
[20]

QUESTION 2 (Start on a new page.)

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

A		**B**	$CH_3CHC(CH_3)CH_2CH_3$
C	 $H_3C\text{-}CH_2\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH_2CH_3$	**D**	$CH_3(CH_2)_2COCH_3$
E		**F**	$CH_3CH_2CH_2CHO$
G	Ethanol	**H**	$CH_2CHCH_2CH_3$

2.1 Define the term *unsaturated compound*. (2)

2.2 Write down the IUPAC name for compound **A**. (2)

2.3 Write down the STRUCTURAL FORMULA of the functional isomer for compound **F**. (2)

2.4 Compound **H** reacts with HBr. Write down the IUPAC name of the major product. (2)

2.5 Write down the STRUCTURAL FORMULA and IUPAC name of compound **B**. (2)

2.6 Write down the symbol of the compound that contains a hydroxyl functional group. (1)

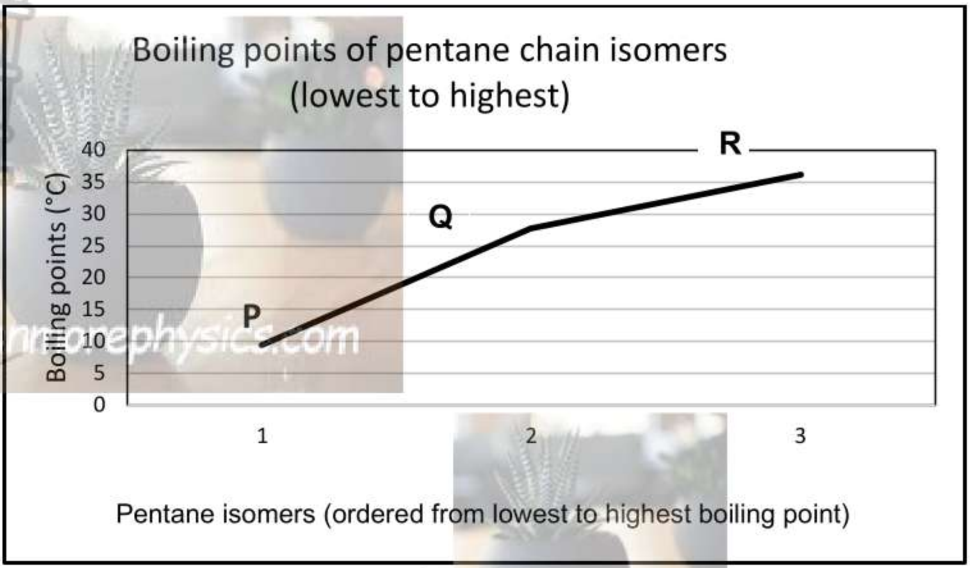
2.7 What is the difference between compound **C** and compound **D**? Give a reason for the answer. (2)

2.8 Write down the general formula of the homologous series to which compound **B** belongs. (1)

[14]

QUESTION 3 (Start on a new page.)

The boiling points of the three chain isomers of pentane are given in the graphs below.



GRAPH A

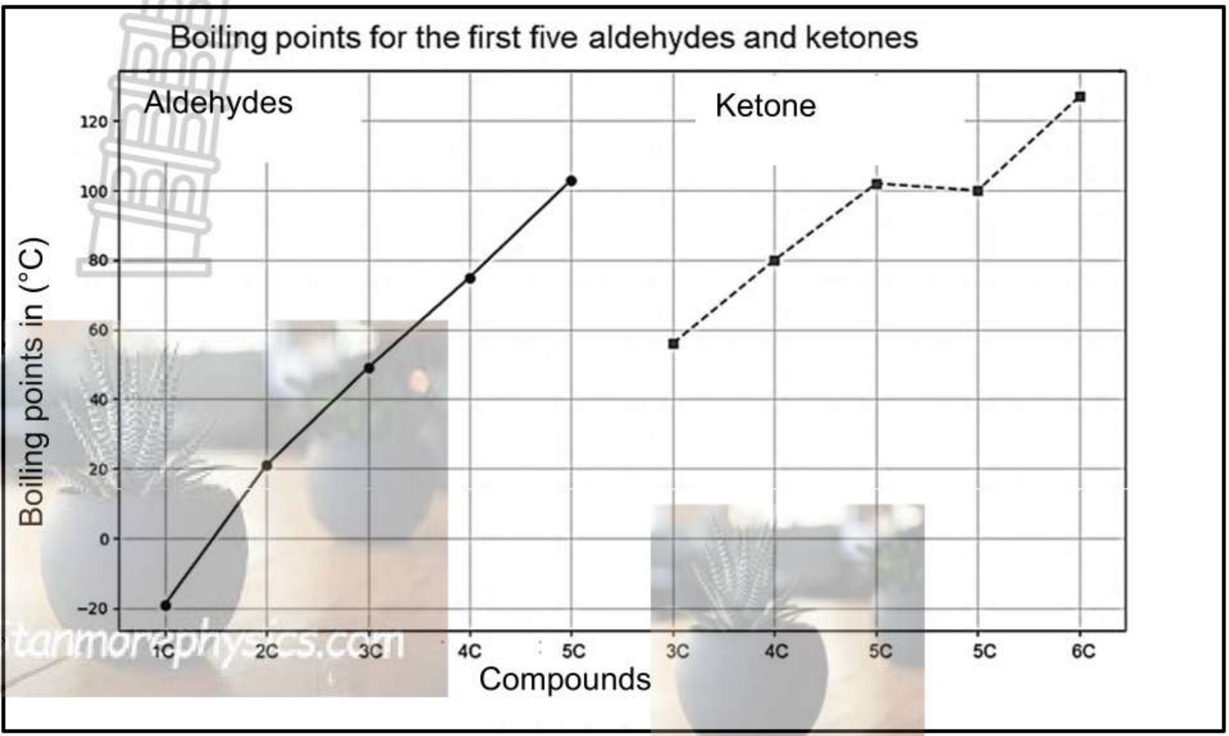
3.1 Define the term *chain isomer*. (1)

3.2 For GRAPH A:

The graph shows three chain isomers for an alkane with the molecular formula C_5H_{12}.

3.2.1 Write down the IUPAC names for compounds **P** and **Q**. (2)

3.2.2 Explain the difference in the boiling points of compounds **P** and **Q**. (3)



GRAPH B

3.3 For GRAPH B:

3.3.1 Give a reason why there are no ketone compounds containing one or two carbon atoms. (1)

3.3.2 Write down the STRUCTURAL FORMULA of the functional group of an aldehyde. (2)

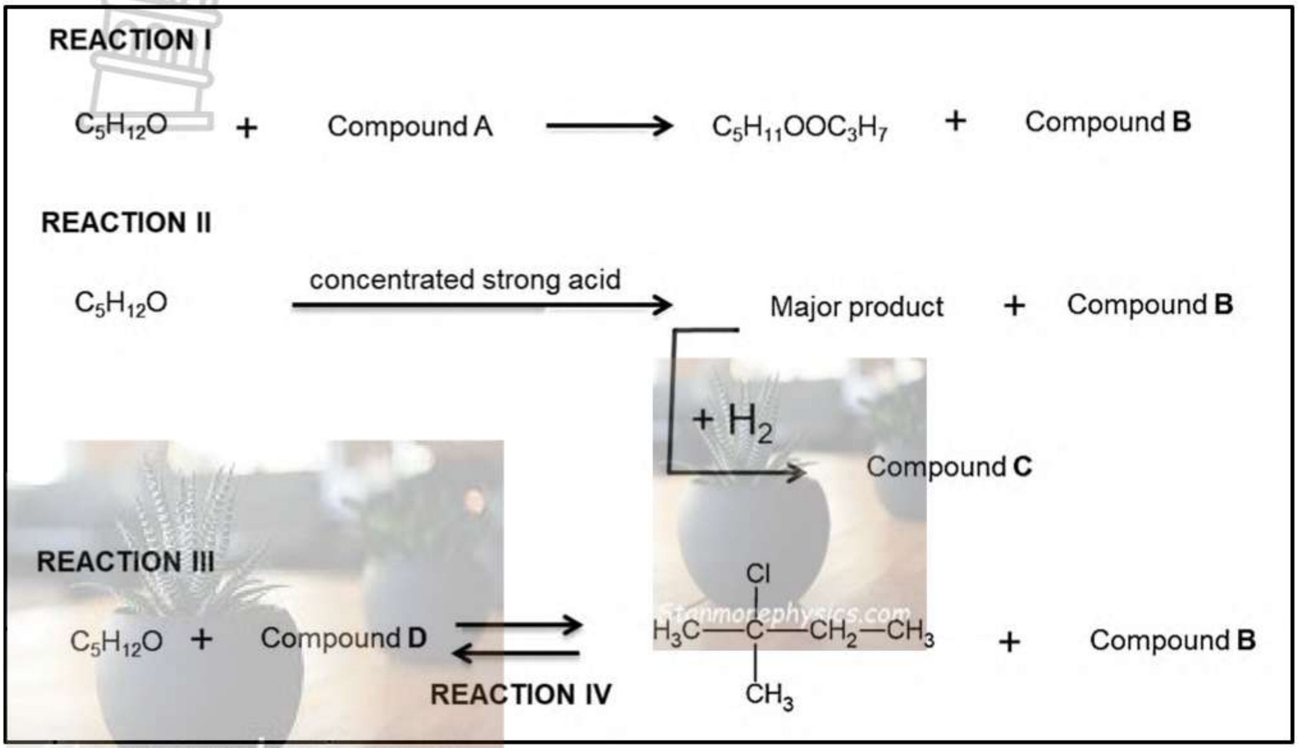
3.3.3 Refer to the aldehydes. Explain the tendency in the boiling points of the first five aldehydes. (3)

3.3.4 Which compound has the higher vapour pressure: propanal or propanone? Explain the answer. (3)

[15]

QUESTION 4 (Start on a new page.)

A primary, a secondary and a tertiary alcohol are used in three different reactions. The flow diagram below represents these reactions.



4.1 For REACTION I:

4.1.1 Name the type of reaction. (1)

4.1.2 What precautions should be taken during this experiment? Give a reason for the answer. (2)

4.1.3 Use structural formulae to write the complete chemical reaction. (4)

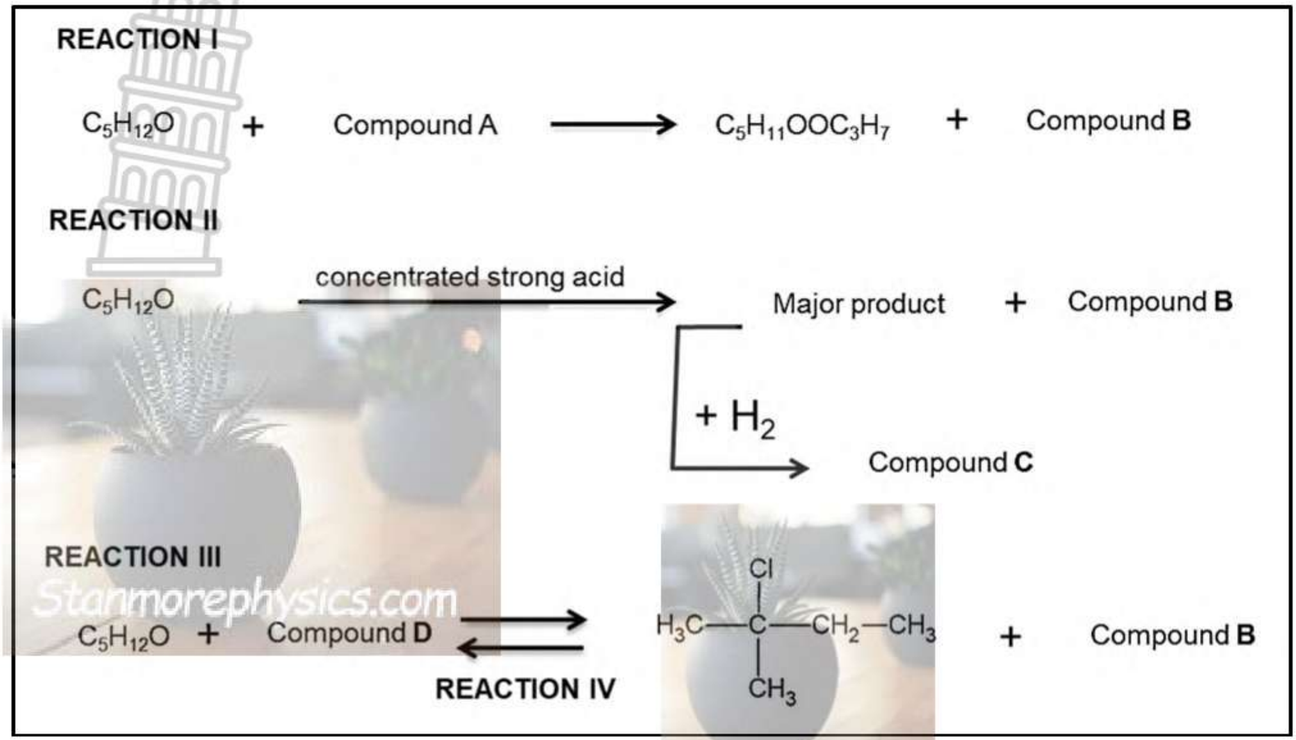
4.1.4 Name the catalyst that is used in this reaction (1)

4.2 For REACTION II: ($C_5H_{12}O$ secondary alcohol)

4.2.1 Name the type of elimination reaction that initially occurs in REACTION **II**. (1)

4.2.2 Use condensed structural formulae to write down the reaction between the major product and hydrogen. (3)

4.2.3 Use molecular formulae to write down the balanced combustion reaction of compound **C** in sufficient oxygen. (3)



4.3 For REACTIONS III and IV:

4.3.1 Is this a PRIMARY, SECONDARY or TERTIARY alcohol? Give a reason for the answer. (2)

4.3.2 State the reaction condition needed for REACTION III. (1)

4.3.3 Name the type of reaction that takes place. (1)

4.3.4 Name compound **D**. (1)

4.3.5 The reaction can be reversed. Name a reaction condition required for the reverse reaction. (REACTION IV) (1)

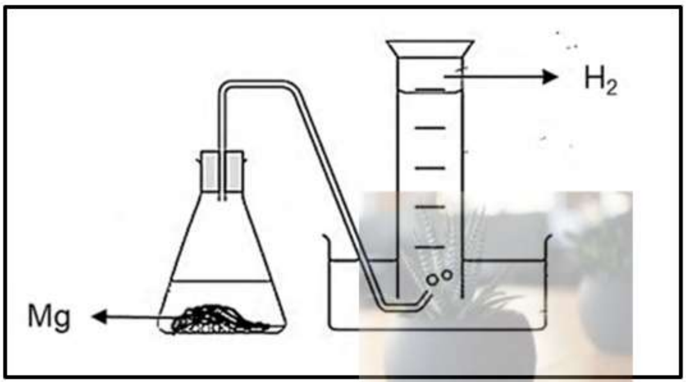
[21]

QUESTION 5 (Start on a new page.)

The rate of reaction between magnesium ribbon and dilute hydrochloric acid at room temperature is investigated. The experiment is conducted in a laboratory at 25°C, at which the molar volume of hydrogen gas is 25,4 $dm^3 \cdot mol^{-1}$.

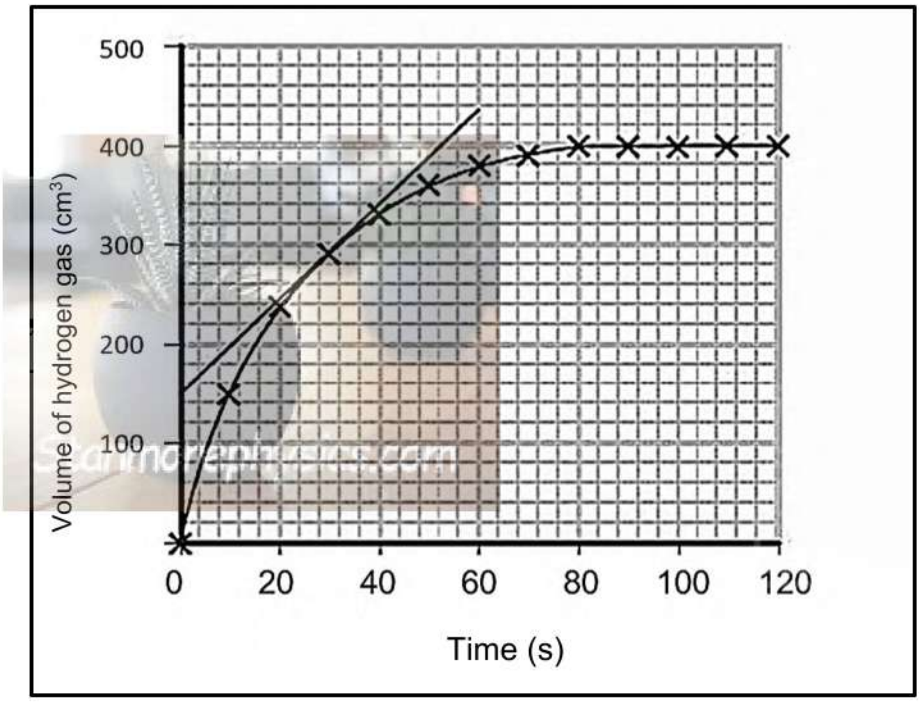
$$Mg(s) + 2HC\ell(aq) \rightarrow MgC\ell_2(aq) + H_2(g)$$

The apparatus used is shown in the diagram below.



The volume of hydrogen gas given off was measured at regular intervals during the reaction.

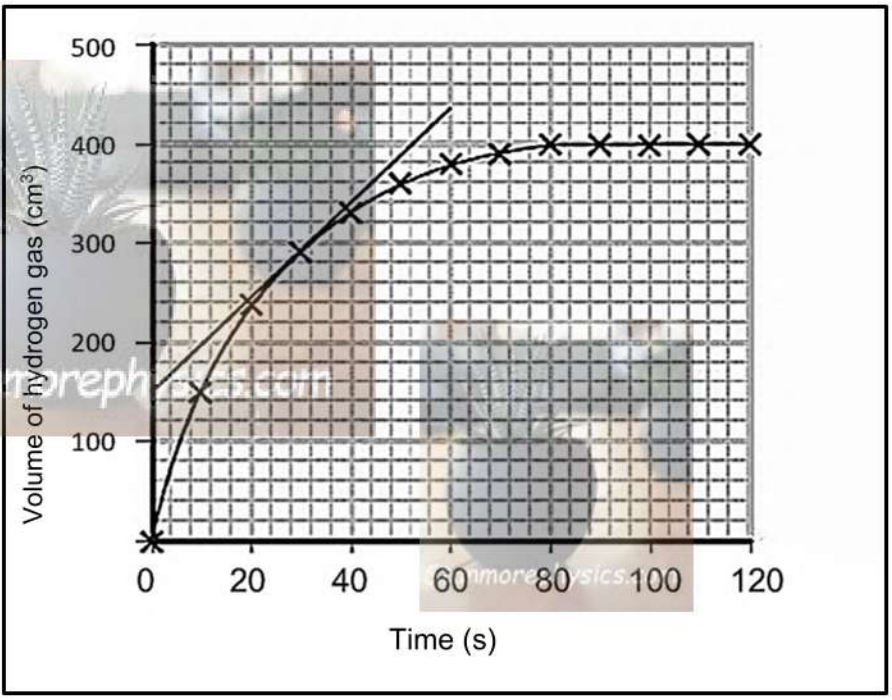
The graph below shows the results of this experiment.



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

5.2 Use the graph to calculate the instantaneous rate of the reaction at 30 s, in $cm^3 \cdot s^{-1}$. (3)

5.3 The volume of hydrochloric acid used in the conical flask was 100 cm^3. If 1 g of magnesium ribbon was used, calculate the percentage purity of the magnesium ribbon. (5)



5.4 In a second experiment, the same mass of magnesium is used, but in powder form. Explain how the graph obtained in this experiment will differ from the graph obtained in the initial experiment. (2)

5.5 In a third experiment, the same mass of magnesium ribbon is used, but this time the concentration of the hydrochloric acid is increased. Explain fully, using the collision theory, the effect of this change on the rate of the reaction. (4)

[16]

QUESTION 6 (Start on a new page.)

An unknown quantity (**X** moles) of hydrogen sulphide is mixed with 0,2 moles of methane in a sealed container with a volume of 3 dm³. The following chemical equilibrium is established:

$$2H_2S(g) + CH_4(g) \leftrightharpoons CS_2(\ell) + 4H_2(g)$$

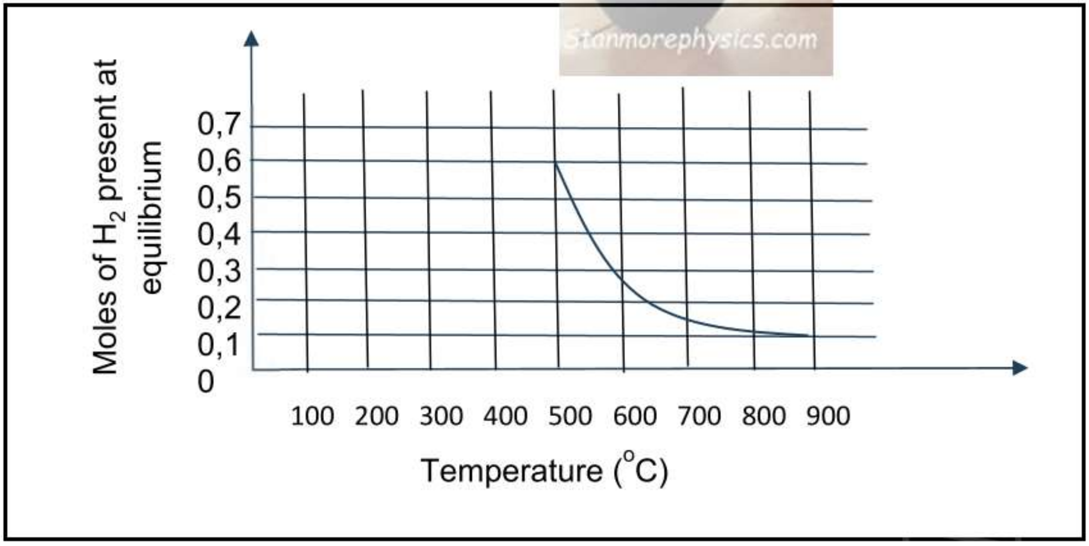
6.1 State *Le Chatelier's principle*. (2)

6.2 Some methane gas was removed from the container.

6.2.1 What effect does this have on the volume of carbon sulphide? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

6.2.2 Explain the answer to QUESTION 6.2.1 by using Le Chatelier's principle. (2)

6.3 The temperature inside the container was increased and the graph shows the number of moles of hydrogen gas present in the system after equilibrium has been established at different temperatures.



The temperature of the equilibrium system was increased from 500 °C to 900 °C.

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

6.3.2 Explain the answer to QUESTION 6.3.1. (3)

6.3.3 Calculate the value of the unknown quantity, X (the initial number of moles of hydrogen sulphide), in the container at 500 °C. The Kc value measured at this temperature is 2. (9)

[18]

QUESTION 7 (Start on a new page.)

Magnesium carbonate, $MgCO_3(s)$, and a solution of nitric acid, $HNO_3(aq)$, react in a conical flask according to the balanced chemical equation:

$$MgCO_3(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + CO_2(g) + H_2O(\ell)$$

A few drops of methyl orange are added to the final mixture and the mixture turns red.

7.1 Does magnesium carbonate act as a strong base or a weak base? Give a reason for the answer. (2)

7.2 Will the magnesium nitrate solution have a pH ABOVE 7, BELOW 7 or EQUAL TO 7? Give a reason for the answer. (2)

7.3 The following data was obtained from the reaction of 30 cm^3 excess nitric acid solution with a concentration of 0,5 $mol{\cdot}dm^{-3}$ and magnesium carbonate granules in a conical flask. The volume of gas produced was recorded at a temperature and pressure at which the molar gas volume is 25 $dm^3{\cdot}mol^{-1}$.

Time (min.)	0	1	2	3	4	5	6
Volume of gas produced (cm^3)	0	12	18	25	32	33	33

7.3.1 Use the table of results above to draw a sketch graph of the volume of gas produced versus time in the ANSWER BOOK. ALL relevant values and labels must be shown. (4)

7.3.2 What happens to the reaction after 5 minutes? Explain the answer by referring to the shape of the graph. (3)

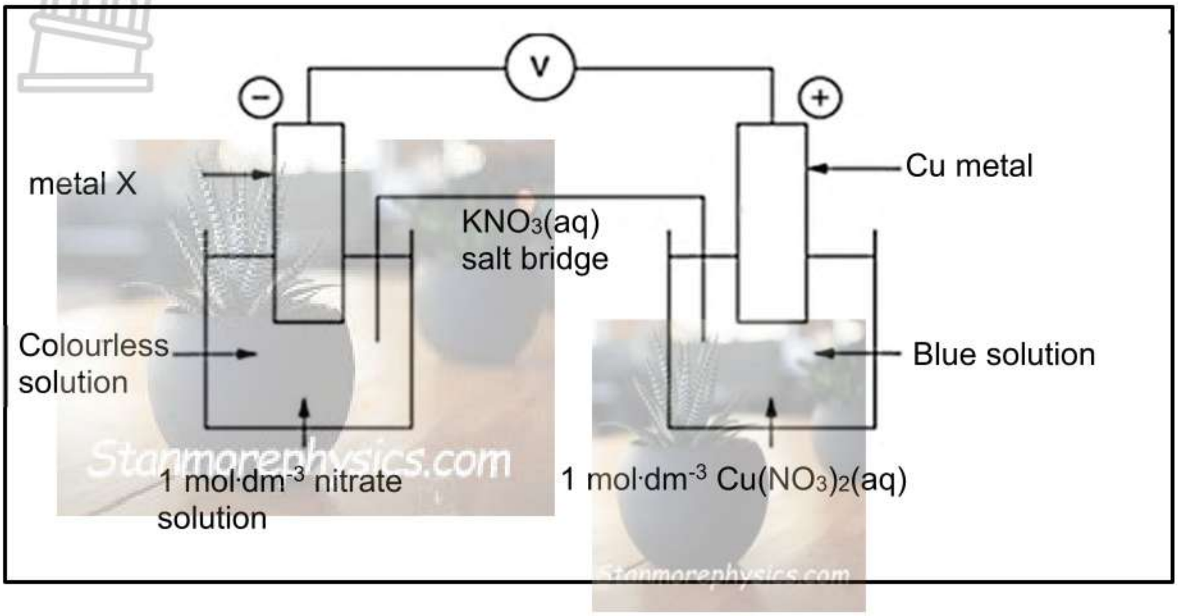
7.3.3 Use the table of results to calculate the mass of magnesium carbonate used in this reaction. (3)

7.3.4 Calculate the pH of the final solution in the conical flask. (7)

[21]

QUESTION 8 (Start on a new page.)

Use the galvanic cell shown below to answer the questions that follow. The two electrodes are the metal **X** and copper, each in its respective electrolytic solutions.



8.1 Is metal **X,** the anode or the cathode? Give a reason for the answer. (2)

8.2 Write down the equation for the half-reaction taking place at the copper electrode. (2)

8.3 Use a calculation to identify metal **X** if the electrode potential of this cell is 2 V under standard conditions. (4)

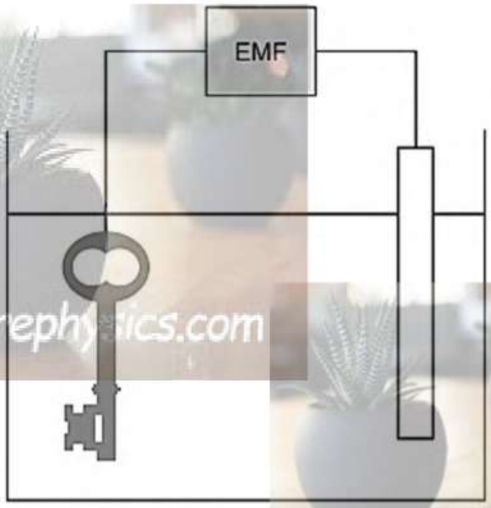
8.4 The mass of one of the electrodes decreases during this reaction. Choose from COPPER or METAL **X** to identify the electrode that undergoes this decrease in mass. Give a reason for the answer. (2)

8.5 The electrode mentioned in QUESTION 8.4 decreases by 1,6 g during the electrochemical reaction, calculate the increase in mass of the other electrode. (4)

[14]

QUESTION 9 (Start on a new page.)

A solution that contains a mixture of silver nitrate, $AgNO_3$(aq) and potassium cyanide KCN(aq), is used to plate a key with silver, as shown below.



The potassium cyanide increases the electrical conductivity of the electrolyte and keeps the silver ion concentration constant.

9.1 Write down the NAME or FORMULA of the substance that acts as the anode. (1)

9.2 Write down the oxidation half-reaction for the cell. (2)

9.3 If the mass of the key increased by 0,54 g after a time **T**, calculate the number of electrons that moved through the external circuit during this time. (4)

9.4 Why does the silver ion concentration remain constant? (2)

9.5 Should the power source used be a DC source or an AC source? Give a reason for the answer. (2)

[11]

TOTAL: 150

END

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*	q_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	
$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ / $E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$ $E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ / $E^\theta_{sel} = E^\theta_{reduksie} - E^\theta_{oksidasie}$ $E^\theta_{cell} = E^\theta_{oxidising\ agent} - E^\theta_{reducing\ agent}$ / $E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$	

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

KEY/*SLEUTEL*

Atomic number/*Atoomgetal*: 29

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)
2,1 1 H 1																	2 He 4
1,0 3 Li 7	1,5 4 Be 9											2,0 5 B 11	2,5 6 C 12	3,0 7 N 14	3,5 8 O 16	4,0 9 F 19	10 Ne 20
0,9 11 Na 23	1,2 12 Mg 24											1,5 13 Aℓ 27	1,8 14 Si 28	2,1 15 P 31	2,5 16 S 32	3,0 17 Cℓ 35,5	18 Ar 40
0,8 19 K 39	1,0 20 Ca 40	1,3 21 Sc 45	1,5 22 Ti 48	1,6 23 V 51	1,6 24 Cr 52	1,5 25 Mn 55	1,8 26 Fe 56	1,8 27 Co 59	1,8 28 Ni 59	1,9 29 Cu 63,5	1,6 30 Zn 65	1,6 31 Ga 70	1,8 32 Ge 73	2,0 33 As 75	2,4 34 Se 79	2,8 35 Br 80	36 Kr 84
0,8 37 Rb 86	1,0 38 Sr 88	1,2 39 Y 89	1,4 40 Zr 91	41 Nb 92	1,8 42 Mo 96	1,9 43 Tc	2,2 44 Ru 101	2,2 45 Rh 103	2,2 46 Pd 106	1,9 47 Ag 108	1,7 48 Cd 112	1,7 49 In 115	1,8 50 Sn 119	1,9 51 Sb 122	2,1 52 Te 128	2,5 53 I 127	54 Xe 131
0,7 55 Cs 133	0,9 56 Ba 137	57 La 139	1,6 72 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	1,8 81 Tℓ 204	1,8 82 Pb 207	1,9 83 Bi 209	2,0 84 Po	2,5 85 At	86 Rn
0,7 87 Fr	0,9 88 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: STANDAARDREDUKSIEPOTENSIALE

Increasing oxidising ability/*Toenemende oksiderende vermoë*

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

Increasing reducing ability/*Toenemende reduserende vermoë*

TABLE 4B: STANDARD REDUCTION POTENTIALS
TABEL 4B: STANDAARDREDUKSIEPOTENSIALE

Increasing oxidising ability/*Toenemende oksiderende vermoë* ↓

Increasing reducing ability/*Toenemende reduserende vermoë* ↑

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

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

2026

MARKING GUIDELINES
NASIENRIGLYNE

10842

PHYSICAL SCIENCES: CHEMISTRY
FISIESE WETENSKAPPE: CHEMIE

(PAPER/*VRAESTEL* 2)

15 pages/*bladsye*

QUESTION/*VRAAG* 1

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

[20]

QUESTION/*VRAAG* 2

2.1 Compounds with one or more multiple bonds between C atoms in the hydrocarbon chain. (2 or 0)
Verbindings met een of meer meervoudige bindings tussen C-atome in die koolwaterstofkettings. (2 of 0)

OR/*OF* A hydrocarbon with two or more bonds between the C-atoms./
'n Koolwaterstof met twee of meer bindings tussen die C-atome.

OR/*OF* Hydrocarbons containing not only single bonds between C atoms.
Koolwaterstowwe wat nie slegs enkelbindings tussen die C-atome bevat nie.

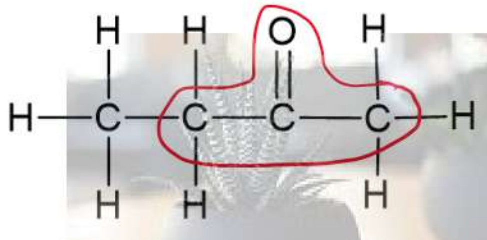
(2)

2.2 Propyl ethanoate/*propieletanoaat*

Marking criteria/*Nasienkriteria*:
- Correct stem, i.e. ethanoate/ *Korrekte stam d.i. ethanoaat* ✓
- Correct prefix propyl/*Korrekte voorvoegsel propiel* ✓

(2)

2.3



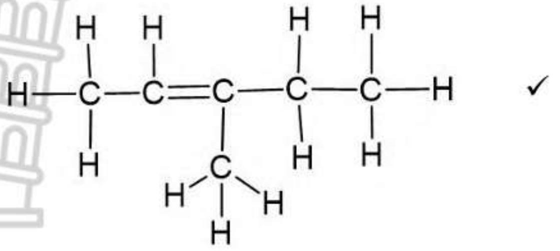
Marking criteria/*Nasienkriteria*:
- Functional group correct. ✓/ *Funksionele groep korrek.*
- Whole structure correct. ✓/*Hele struktuur korrek.*

(2)

✓ ✓

2.4 2-bromobutane/*2-bromobutaan* (first part and second part of name)
(eerste deel en tweede deel van naam) (2)

2.5 3-methylpent-2-ene OR 3-methyl-2-pentene ✓
3-metielpent-2-een OF 3-metiel-2-penteen



(2)

2.6 G ✓ accept/*aanvaar*: CH_3CH_2OH (1)

2.7 The difference is that the <u>carbonyl group/functional group</u> is <u>on different carbon atoms</u>. ✓✓

Die verskil is dat die <u>karbonielgroep/funksionele groep</u> op <u>verskillende koolstofatome is.</u> (2)

2.8 C_nH_{2n} ✓ (1)
[14]

QUESTION/*VRAAG* 3

3.1 Organic molecules with the same molecular formula, but different types of chain. ✓
Organiese molekule met dieselfde molekulêre formule, maar verskillende tipes kettings. (1)

3.2.1 P:
2,2-dimethylpropane OR dimethylpropane ✓
2,2-dimetielpropaan OR dimetielpropaan

Q:
2-methylbutane OR methylbutane ✓
2-metielbutaan OR metielbutaan

(2)

3.2.2

Marking criteria:
- Compare branches of molecules and the surface area ✓
- Compare the intermolecular forces ✓
- Mention the energy required to overcome the intermolecular forces. ✓

Accept if explained in terms of less compact and increased surface area.

Nasienkriteria:
- *Vergelyk vertakking van die molekule en die kontakoppervlakte*
- *Vergelyk die intermolekulêre kragte*
- *Noem die energie wat benodig word om die intermolekulere kragte te oorkom*

Aanvaar indien verduidelik in terme van minder kompak en groter kontakarea.

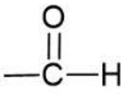
- More branching in P makes the molecule **more compact**, reducing the **surface area** and ✓
- Weaker London forces/induced dipole forces/intermolecular forces in P compared to Q ✓
- Therefore least amount of energy required for P to overcome the intermolecular forces. ✓

- *Meer vertakkings in P maak die molekule meer kompak, en dit verminder die oppervlak*
- *Swakker Londonkragte/geïnduseerde dipoolkragte/intermolekulêre kragte in P in vergelyking met Q*
- *Laer hoeveelheid energie benodig in P om die intermolekulêre kragte te oorkom* (3)

3.3.1 The functional group for ketones, carbonyl, must have a carbon on each side. ✓
OR If there are fewer than three carbon atoms then it is an aldehyde.

Die funksionele groep vir ketone moet 'n koolstofatoom aan elke kant hê.
OF Indien daar minder as drie koolstofatome is, dan is dit 'n aldehied. (1)

3.3.2



$$—\overset{\overset{\displaystyle O}{||}}{C}—H$$

✓✓ (2)

3.3.3

Marking criteria:

- Mention the trend of the chain length ✓
- Refer to the London forces that increase ✓
- Compare the energy required to overcome the intermolecular forces. ✓

***Nasienkriteria*:**

- *Stel die tendens van die kettinglengte*
- *Verwys na die Londonkragte wat toeneem*
- *Vergelyk die energie wat benodig word om die intermolekulêre kragte te oorkom.*

- Boiling point increases as the chain length/molar mass/surface area increases. ✓
- All the compounds have dipole-dipole forces, but as the carbon chain increases the melting point increases due to the increase in the strength of the London forces/The increase in chain length increases the strength of intermolecular forces. ✓
- More energy is needed to overcome the intermolecular forces of the longer carbon chain. ✓

- *Die kookpunt neem toe namate die kettinglengte/molêre massa/oppervlakte toeneem.*
- *Al die verbindings het dipool-dipoolkragte, maar soos wat die koolstofketting toeneem, neem die smeltpunt toe as gevolg van die toename in sterkte van die Londonkragte/die toename in kettinglengte verhoog die sterkte van intermolekulêre kragte.*
- *Meer energie word benodig om die intermolekulêre kragte van die langer koolstofketting te oorkom.* (3)

3.3.4 Propanal ✓

Weaker intermolecular forces ✓ therefore less energy ✓ and more particles in the gaseous phase.

OR

The lower boiling point ✓ indicates the weaker intermolecular forces. ✓

Propanaal

Swakker intermolekulêre kragte dus minder energie nodig en meer deeltjies in die gasfase.

OF

Die laer kookpunt dui op swakker intermolekulêre kragte. (3)

[15]

QUESTION/*VRAAG* 4

4.1.1 Esterification OR condensation ✓

Esterifikasie OF kondensasie (1)

4.1.2 Do not have contact with acid – wear protective gloves ✓
Work in a well ventilated room – keep windows open while doing experiment. ✓
Use a waterbath and not an open flame (Alcohol is very flammable)

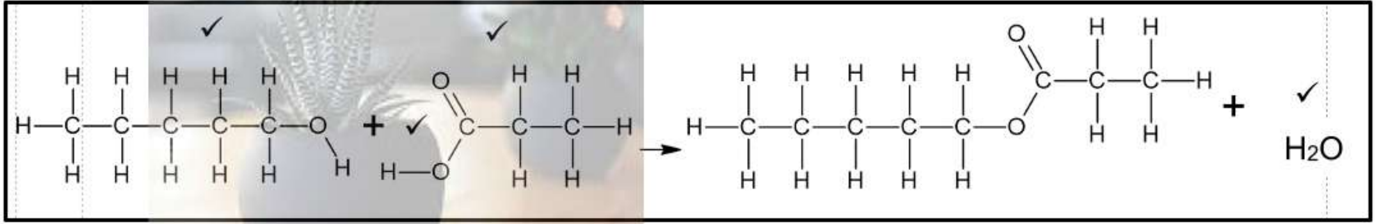
Any two answers/*enige twee antwoorde*

Vermy velkontak met die suur – dra beskermende handskoene
Werk in 'n goed geventileerde kamer – hou die vensters oop terwyl die eksperiment gedoen word.
Gebruik 'n waterbad en nie 'n oop vlam nie (Alkohol is baie vlambaar) (2)

4.1.3 **Marking criteria/Nasienkriteria:**

- Alcohol with 5 C atoms and OH at the first carbon atom /*Alkohol met 5 C atome en OH aan die eerste koolstofatoom* ✓
- functional group of **carboxylic acid** correct/*funksionele groep van* ***karboksielsuur*** *korrek* ✓
- Carboxylic acid with 3 carbons/*Karboksielsuur met 3 koolstowwe* ✓
- water/*water* ✓ accept: structural formula for water *aanvaar: struktuurformule vir water*

(4)



4.1.4 (Concentrated) sulphuric acid/(gekonsentreerde) swawelsuur ✓ (1)

4.2.1 Dehydration/*dehidrasie* ✓ (1)

4.2.2 **Marking criteria/Nasienkriteria:**

- Whole condensed structural formula of alkene correct. ✓
  Hele gekondenseerde struktuurformule van die alkeen korrek.
- Both reactants correct./*Beide reaktanse korrek* ✓
- Whole condensed structural formula of alkane correct
  Hele gekondenseerde struktuurformule vir alkaan korrek ✓

NOTE/*LET WEL:*
Max 2/3 if structural formula used/*Maksimum 2/3 indien struktuurformule gebruik*

$CH_3CHCHCH_2CH_3 + H_2 \rightarrow CH_3CH_2CH_2CH_2CH_3$ (3)

4.2.3 $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$

Marking criteria/*Nasienkriteria*:

- Reactants ✓ *Reaktanse* Products ✓ *Produkte* Balancing: ✓ *Balansering*
- Ignore double arrows./*Ignoreer dubbelpyle.*
- Marking rule 6.3.10/*Nasienreël 6.3.10.*

(3)

4.3.1 Tertiary ✓
The carbon atom bonded to the hydroxyl group is bonded to 3 other carbon atoms. ✓

Tersiêre
Die koolstofatoom gebind aan die hidroksielgroep is gebind aan drie ander koolstofatome. (2)

4.3.2 Room temperature/*Kamertemperatuur* ✓ (1)

4.3.3 Substitution/*substitusie* ✓ (1)

4.3.4 Hydrogen chloride/hydrochloric acid *Waterstofchloried/soutsuur* ✓ (1)

4.3.5 Dilute strong base (NaOH/KOH/LiOH)
Verdunde sterk basis/(NaOH/KOH/LiOH) ✓

Accept: excess water
Aanvaar: oormaat water (1)

[21]

QUESTION/*VRAAG* 5

5.1 The change in concentration of reactants or products per unit time. ✓✓

Die verandering in die konsentrasie van reaktanse of produkte per eenheid tyd.
(2 or/*of* 0) (2)

5.2 Final answer in range 4,4 to 5,2/*Finale antwoord gebied 4,4 to 5,2*

Accept any TWO sets of co-ordinates from the straight line tangent.
Aanvaar enige TWEE stelle ko-ordinate vanaf die reguitlyn raaklyn.

Rate of change/*Tempo van verandering* $= \frac{\Delta V}{\Delta t}$

$= \frac{440-150\ ✓}{60-0\ ✓}$

$= 4{,}83\ (cm^3 \cdot s^{-1})$ ✓ (3)

5.3

Marking criteria:	***Nasienkriteria:***
(a) Mole calculation of H_2. ✓	(a) *Mol berekening van H_2*
(b) Ratio of H_2 and Mg ✓	(b) *Verhouding H_2 en Mg*
(c) Calculate mass/mole of Magnesium ✓	(c) *Bereken massa/mol van Magnesium*
(d) Calculate % purity ✓	(d) *Bereken % suiwerheid*
(e) Answer ✓ (Range 37,6 → 38)	(e) *Antwoord* (Gebied 37,6 → 38)

For/*Vir* H_2: $n = \frac{V}{V_m}$

$= \frac{0,4}{25,4}$ ✓**(a)**

$= 0,0157$ mol

Ratio H_2:Mg

1 : 1 ✓ **(b)**

0,0157 : 0,0157

Mass of Mg = nM

= 0,0157(24) ✓ **(c)**

= 0,3768 g

% purity = $\frac{\text{actual mass}/\textit{werklike massa}}{\text{theoretical mass}/\textit{teoretiese massa}} \text{ x } 100$

$= \frac{0,3678}{1} \text{ x } 100$ ✓ **(d)**

= 37,795% ✓ **(e)** (5)

5.4 The graph will have a <u>steeper gradient</u> ✓ that will <u>reach completion faster</u> ✓ and the same final volume.

Die grafiek sal 'n steiler helling hê wat vinniger voltooi sal word en sal dieselfde finale volume hê. (2)

5.5

- The concentration of the hydrochloric acid is more, thus more particles per unit volume. ✓
- More particles have kinetic energy (Ek) larger or equal to activation energy. Ek ≥ Ea ✓
- More effective collisions per unit time ✓
- Resulting in a higher rate of reaction. ✓

- *Die konsentrasie van die soutsuur verhoog, dus meer deeltjies per eenheid volume.*
- *Meer deeltjies het kinetiese energie (Ek) hoër of gelyk aan die aktiveringsenergie. Ek ≥ Ea*
- *Meer effektiewe botsings per eenheid tyd*
- *Wat dus lei tot 'n hoër reaksietempo.*

(4)

[16]

QUESTION/*VRAAG* 6

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

When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will oppose the disturbance. ✓✓

Wanneer die ewewig in 'n geslote sisteem versteur word, stel die sisteem 'n nuwe ewewig in deur die reaksie wat die versteuring teenwerk, te bevoordeel. (2)

6.2.1 DECREASES/*VERLAAG* ✓ (1)

6.2.2 The reverse reaction will be favoured ✓ to increase the concentration ✓of the methane (reactants).

Die terugwaartse reaksie sal bevoordeel word om die konsentrasie van die metaan (reaktanse) te verhoog (2)

6.3.1 EXOTHERMIC/*EKSOTERMIES* ✓ (1)

6.3.2
- As the temperature increases, the endothermic reaction is favoured. ✓
- The moles/amount of H_2 present at equilibrium decreases, ✓
- The reverse reaction is favoured, ✓therefore the forward reaction is exothermic.

- *Wanneer die temperatuur verhoog sal die endotermiese reaksie bevoordeel word.*
- *Die mol/hoeveelheid H_2 teenwoordig by ewewig verminder*
- *Die terugwaartse reaksie word bevoordeel dus is die voorwaartse reaksie eksotermies.* (3)

6.3.3

Marking criteria

(a) n_{H_2} at equilibrium ✓
(b) Using the mole ratio of $1H_2S:2H_2$. ✓
(c) Using the mole ratio of $1CH_4:4H_2$ ✓
(d) Calculating the equilibrium mole of H_2S ✓
(e) Calculating the equilibrium mole of CH_4 ✓
(f) Divide by volume of 3 dm^3 ✓
(g) Correct Kc expression ✓
(h) Substitute concentration values and K_c ✓
(i) Final answer 0,957 mol ✓

Nasienkriteria:

(a) n_{H_2} by ewewig
(b) Gebruik die mol verhouding van $1H_2S:2H_2$.
(c) Gebruik die mol verhouding van $1CH_4:4H_2$
(d) Bereken die ewewig mol van H_2S
(e) Bereken die ewewig mol van CH_4
(f) Deel deur die volume van 3 dm^3
(g) Korrekte Kc uitdrukking
(h) Vervang konsentrasie waardes en K_c
(i) Finale antwoord 0,957 mol

	$2\ H_2S(g)$	+ $CH_4(g)$	$\leftrightharpoons CS_2(\ell)$	+ $4\ H_2(g)$
Initial/ *Aanvanklik*	x	0,2		
Change/ *Verandering*	0,15 x 2 ✓(b) = –0,3	0,6/4 = –0,15✓(c)		+0,6
Equilibrium/ *Ewewig*	x – 0,3✓(d)	0,2 – 0,15 = 0,05✓(e)		0,6 ✓(a)
Concentration/ *Konsentrasie*	$\frac{x-0,3}{3}$ ✓(f)	$\frac{0,05}{3}$		$\frac{0,6}{3}$

$$K_C = \frac{[H_2]^4}{[H_2S]^2[CH_4]} ✓(g)$$

$$2 = \frac{(\frac{0,6}{3})^4}{(\frac{x-0,3}{3})^2(\frac{0,05}{3})^2} ✓(h)$$

$$x = 0,957 ✓(i)$$

Wrong Kc expression max 6/9
No Kc expression, correct substitution max 8/9

Verkeerde Kc uitdrukking maks 6/9
Geen Kc uitdrukking, korrekte substitusie maks 8/9

(9)
[18]

QUESTION/*VRAAG* 7

7.1 Weak base/*Swak basis.* ✓

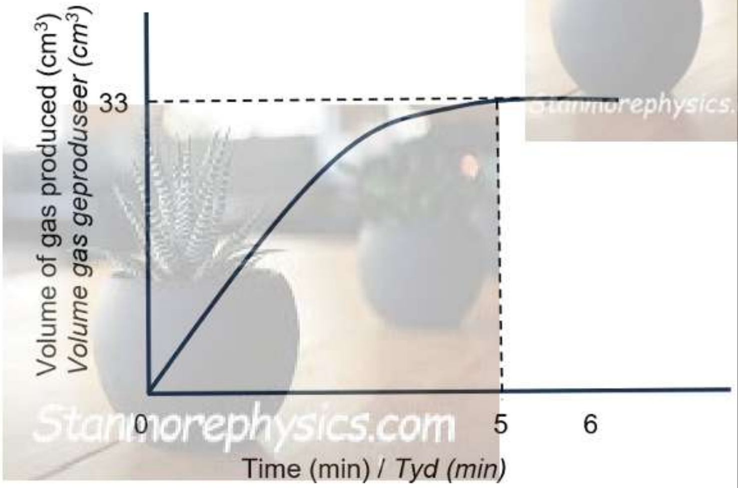
A weak base and a strong acid will give a red orange colour./*'n Swak basis en 'n sterk suur sal 'n rooi oranje kleur gee.* ✓
OR/*OF*
A weak base undgoes incomplete dissociation in water to form a low concentration of hydroxide (OH^-) ions.
'n Swak basis sal onvolledig dissosieer in water om 'n lae konsentrasie hidroksied (OH^-) ione te vorm. (2)

7.2 Below 7 ✓ because hydrolysis took place✓
Onder 7, want hidrolisie vind plaas.

OR/*OF*

The salt formed from a strong acid reacting with a weak base./*Die sout vorm as a sterk suur reageer met 'n swak basis.* (2)

7.3.1



Marking criteria:
- Values of 33 cm^3 and 5 or 6 min showing the completion of the reaction. ✓
- Label and unit – for both axes ✓
- Correct shape ✓✓
- Axes switched – 0/4

Nasienkriteria:
- *Waardes van 33 cm^3 en 5 of 6 min wys die voltooiing van die reaksie.*
- *Byskrif en eenheid – beide asse*
- *Korrekte vorm*
- *Asse omgeruil – 0/4*

(4)

7.3.2 After 5 mins the graph remains parallel (flattens out) to the X axis ✓
The volume of the gas produced remains constant ✓
The reaction has stopped ✓
The limiting reactant is used up
The gradient is zero

Na 5 min is die grafiek parallel (raak plat) met die x-as
Die volume van die gas wat geproduseer is bly konstant
Die reaksie het gestop
Die beperkende reaktans is opgebruik
Die gradiënt is nul

Any three/ *enige drie* (3)

7.3.3 $n_{(CO2)} = \frac{V}{V_M}$

$$= \frac{\frac{33}{1000}✓}{25}$$

$$= 0{,}00132\text{mol}$$

ratio of/*vervanging van* $MgCO_3 : CO_2$

1 : 1

$m_{(MgCO3)}$ = n x M

$= \underline{0{,}00132\ x\ 84\ ✓}$

$= 0{,}11\text{g}$ ✓

(3)

7.3.4 **POSITIVE MARKING FROM QUESTION 7.3.3 (0,00132 mol)/*POSITIEWE NASIEN VANAF VRAAG 7.3.3 (0,00132 mol)***

Marking criteria:
(a) Use a mole ratio ✓
(b) Use the formula $c = \frac{n}{V}$ with a volume of 0,03 dm^3✓
(c) Ratio of $HNO_3 : H_3O^+$✓
(d) Calculate exess number of mole or concentration ✓✓
(e) pH formula✓
(f) Final answer 0,385 ✓ (Range: 0,37 – 0,4)

Nasienkriteria:
(a) Gebruik die mol verhouding
(b) Gebruik die formule $c = \frac{n}{V}$ met 'n volume van 0,03 dm^3
(c) Verhouding $HNO_3 : H_3O^+$
(d) Bereken die oormaat aantal mol of die konsentrasie
(e) pH formule
(f) Finale antwoord 0,385 (Gebied: 0,37 – 0,4)

OPTION/*OPSIE* 1

ratio of/*verhouding van*
$MgCO_3 : HNO_3$

1 : 2✓(a)
0,00132: 2(0,00132)
n_{HNO3} used/*gebruik* = 0,00264mol

n_{HNO3} initial/*aanvanklik*
= c x V
= 0,5 x 0,03 ✓(b)
= 0,015 mol

n_{HNO3} excess/*oormaat* = n_{HNO3} initial/*aanvanklik* – n_{HNO3} used/*gebruik*
= 0,015 – 0,00264 ✓✓(d)
= 0,01236 mol

$c_{HNO3} = \frac{n}{V}$
$= \frac{0,01236}{0,03}$
= 0,412 $mol.dm^{-3}$

ratio of/*verhouding van* $HNO_3 : H_3O^+$
1 : 1 ✓(c)
$[H_3O^+]$= 0,412 $mol.dm^{-3}$

OPTION/*OPSIE* 2

n_{CO2} = 0,00132 mol

ratio of/*verhouding van* $HNO_3 : CO_2$
2 : 1 ✓(a)
n_{HNO3} used/*gebruik* = 0,00264mol

$c_{HNO3} = \frac{n}{V}$
$= \frac{0,0264}{0,03}$ ✓(b)
= 0,088 $mol.dm^{-3}$

ratio of/*verhouding van* $HNO_3 : H_3O^+$
1 : 1 ✓(c)

$[H_3O^+]_{used/gebruik}$= 0,088 $mol.dm^{-3}$

$[H_3O^+]_{excess/oormaat}$ =$[H_3O^+]$initial/*aanvanklik* – $[H_3O^+]$ used/*gebruik*
= 05 – 0,088 ✓✓(d)
= 0,0412 $mol.dm^{-3}$

pH = –log$[H_3O^+]$ ✓(e)
= –log(0,412)
= 0,385✓(f) (7)

[21]

QUESTION/*VRAAG* 8

8.1 Anode/*Anode*✓

It is the negative electrode./*Dis die negatiewe elektrode.* ✓ (2)

8.2 $Cu^{2+} + 2e^- \rightarrow Cu$ ✓✓ (2)

Marking criteria/*Nasienkriteria:*

- $Cu^{2+} + 2e^- \rightleftharpoons Cu$ ($\frac{1}{2}$) $Cu \leftarrow Cu^{2+} + 2e^-$ ($\frac{2}{2}$)
- $Cu + 2e^- \leftarrow Cu^{2+}$ ($\frac{0}{2}$) $Cu \rightleftharpoons Cu^{2+} + 2e^-$ ($\frac{0}{2}$)
- Ignore if charge omitted on electron./*Ignoreer indien lading weggelaat op elektron.*
- If charge (2+) omitted on Cu^{2+} *Indien lading (2+) weggelaat op* Cu^{2+}

  Example/*Voorbeeld:* $Cu + 2e^- \rightarrow Cu$ Max./*Maks:* $\frac{1}{2}$

8.3 Notes/*Aantekeninge*

- Accept any other correct formula from the data sheet./*Aanvaar enige ander korrekte formule vanaf gegewensblad.*
- Any other formula using unconventional abbreviations e.g. OA or RA followed by correct substitution. / *Enige ander formule wat onkonvensionele afkortings gebruik, bv. OM en RM gevolg deur korrekte vervangings* ¾

E^0cell = E^0cathode/*katode* – E^0anode ✓

2 = +0,34 – x ✓

= –1,66 (V) ✓

METAL/*METAAL* X is Aluminium ✓ (4)

8.4 Metal X/*Metaal* X ✓ (accept/*aanvaar*: aluminium)

as it undergoes oxidation/loses electrons/is the reducing agent./
aangesien dit oksidasie ondergaan/elektrone verloor/die reduseermiddel is ✓ (2)

8.5 $2Al + 3Cu^{2+} \rightarrow 2Al^{3+} + 3Cu$

$n_{Al} = \frac{m}{M}$

$= \frac{1,6}{27}$ ✓

$= 0,0593$ mol

Molar ratio/*Molverhouding* of Al : Cu^{2+}

2 : 3

$n_{Cu^{2+}} = \frac{0,0593}{2} \times 3$ ✓

$= 0,089$ mol

$m_{(Cu^{2+})} = n \times M$

$= 0,089 \times 63,5$ ✓

$= 5,64\ g$ ✓ (4)

[14]

QUESTION/*VRAAG* 9

9.1 Ag/Silver/*Ag/Silwer*✓ (1)

9.2 $Ag \rightarrow Ag^+ + e^-$ ✓✓

(2)

Marking criteria/*Nasienkriteria:*

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

9.3 $n\ Ag = \frac{m}{M}$

$= \frac{0,54}{108}$ ✓

$= 0,005\ mol$

$n = \frac{N}{N_A}$ ✓

$0,005 = \frac{N}{6,02 \text{ X } 10^{23}}$ ✓

$= 3,01\text{x } 10^{21}$ electrons/*elektrone* ✓

(4)

9.4 For every silver atom that goes in the solution there is one silver atom that forms on the key. ✓✓
Vir elke silwer atoom wat in die oplossing gaan is een silwer atoom wat vorm op die sleutel
OR/*OF*
The rate of oxidation is equal to the rate of reduction.
Die tempo van oksidasie is gelyk aan die tempo van reduksie

(2)

9.5 DC source/*GS bron*✓
So that the ions flow in the same direction./*Sodat die ione in dieselfde rigting vloei* ✓
OR/*OF*
So that the cations move from the anode to the cathode./*Sodat die katione van die anode na die katode beweeg.*
OR/*OF*
So that the electron flow/current is in the same direction all the time/*Sodat die elektrone/stroom die heeltyd in dieselfde rigting vloei*
OR/*OF*
To ensure that reduction occurs at the cathode (key) only./*Om te verseker dat die reduksie slegs by die katode (sleutel) plaasvind.* (2)

[11]

TOTAL/*TOTAAL*: 150