GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
GRADE 12

2024

PHYSICAL SCIENCES: CHEMISTRY
(PAPER 2)

TIME: 3 hours

MARKS: 150

17 pages + 4 data sheets

PHYSICAL SCIENCES P2

C2842E

X05

INSTRUCTIONS AND INFORMATION

1. This question paper consists of EIGHT questions. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line open between two subquestions, e.g., between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
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 discussions, et cetera 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 given 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.

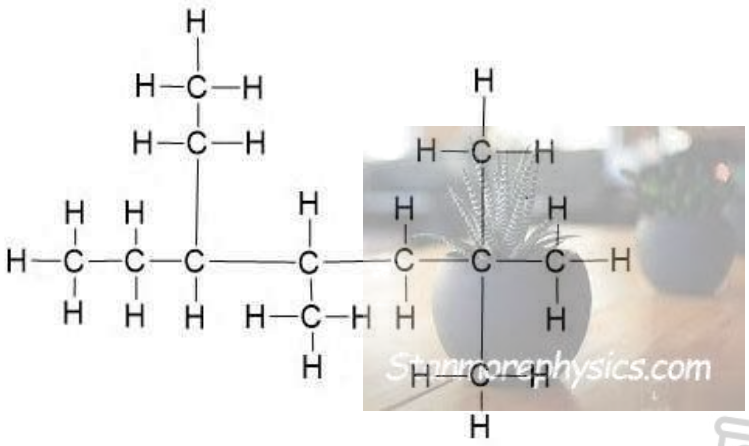
1.1 Consider the condensed structural formula below:

$$CH_3CH_2CH_2OH$$

What is the name of the functional group?

A Hydroxyl group
B Carbonyl group
C Formyl group
D Carboxyl group (2)

1.2 Consider the compound below:



Which of the following is the IUPAC name of this compound?

A 2,2,4-trimethyl-5-ethylheptane
B 4,6,6-trimethyl-3-ethylheptane
C 5-ethyl-2,2,4-trimethylheptane
D 3-ethyl-4,6,6-trimethylheptane (2)

1.3 Ethanal, ethanol, ethanoic acid, and ethane are compounds that are found in a laboratory.

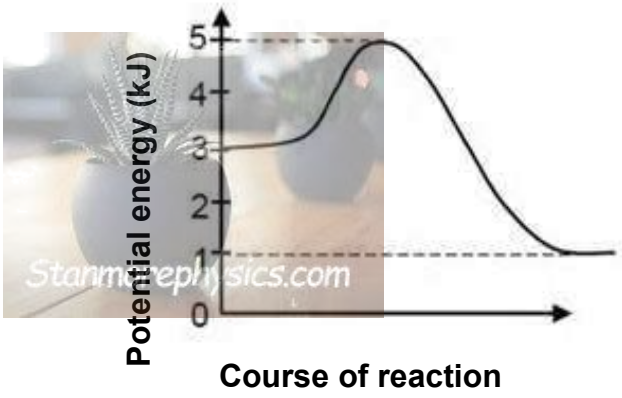
Arrange the compounds mentioned above in decreasing order of vapour pressure.

A Ethanoic acid, ethanol, ethanal, ethane
B Ethane, ethanal, ethanol, ethanoic acid
C Ethanoic acid, ethanal, ethanol, ethane
D Ethane, ethanol, ethanal, ethanoic acid (2)

1.4 Which of the following reaction types will be used to prepare ethene and propane from pentane under high temperatures and pressures?

A Combustion
B Esterification
C Catalytic cracking
D Thermal cracking (2)

1.5 The graph below represents the relationship between potential energy and course of reaction for a certain chemical reaction.



The heat of reaction for the reverse reaction is:

A 2 kJ
B 4 kJ
C -2 kJ
D -5 kJ (2)

1.6 The equation below represents the decomposition of calcium carbonate.

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

Which of the following factors will NOT affect the initial rate of decomposition of calcium carbonate?

A Increase in temperature
B Using powdered calcium carbonate
C Adding a catalyst
D Increasing the mass of calcium carbonate (2)

1.7 The reaction represented by the equation below reaches equilibrium.

$$\underset{\text{pink}}{Co(H_2O)_6^{+2}}\ (aq) + 4C\ell^-\ (aq) \rightleftharpoons \underset{\text{blue}}{CoC\ell_4^{-2}}\ (aq) + 6H_2O(\ell) \qquad \Delta H > 0$$

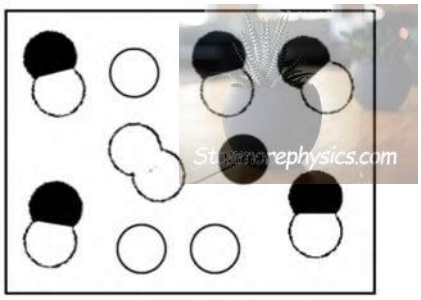
Which of the following changes to the reaction mixture will change its colour from pink to blue?

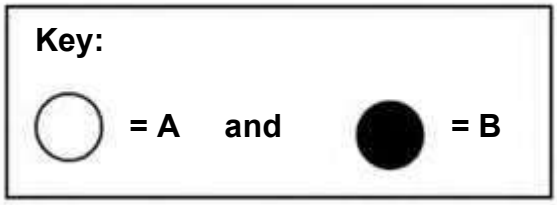
A Add a catalyst.
B Place the reaction mixture in a container with cold water.
C Add a few drops of concentrated hydrochloric acid to the reaction mixture.
D Add water to the reaction mixture. (2)

1.8 The following hypothetical reaction is at equilibrium at 500 K:

$$A_2(g) + B(g) \rightleftharpoons A(g) + AB(g)$$

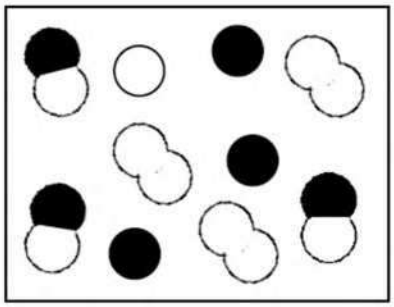
The diagram below shows the molecules involved in this chemical equilibrium at 500 K.





The temperature is decreased to 300 K.

The diagram below represents the same equilibrium mixture at 300 K.



Which of the following statements is CORRECT?

A The forward reaction is exothermic.
B The concentration of **AB** is lower at a lower temperature.
C The forward reaction is endothermic.
D The concentration of **B** is higher at a lower temperature. (2)

1.9 Which of the following is the CORRECT description for a 10 mol·dm^{-3} hydrochloric acid solution?

A Dilute strong acid
B Dilute weak acid
C Concentrated weak acid
D Concentrated strong acid (2)

1.10 Consider the reaction represented by the following equation:

$$2Ag^{+}(aq) + Cu(s) \rightarrow 2Ag(s) + Cu^{2+}(aq)$$

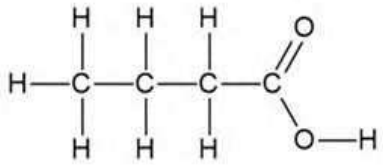
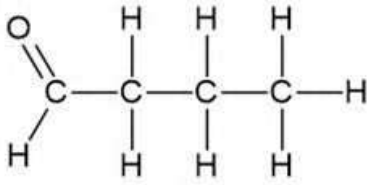
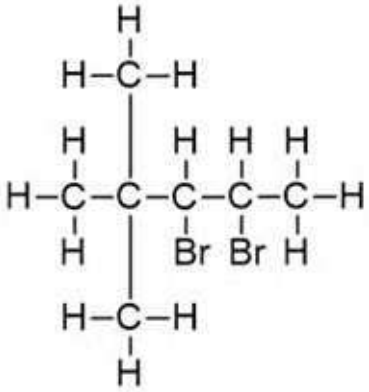
Which of the following represents the oxidising agent in the above reaction?

A Ag^{+}
B Cu
C Ag
D Cu^{2+} (2)

[20]

QUESTION 2 (Start on a new page.)

A to **H** in the table below represents eight organic compounds.

A		**B**	2-methylbutan-2-ol
C	Pentan-2-one	**D**	$CH_3CH_2COCH_2CH_3$
E	Butan-2-ol	**F**	Methyl propanoate
G		**H**	

Use the table above to answer the following questions.

2.1 Define the term *homologous series*. (2)

2.2 Consider the organic compound **G**.

2.2.1 Write down the homologous series to which this compound belongs. (1)

2.2.2 Write down the CONDENSED STRUCTURAL FORMULA. (1)

2.2.3 Write down the IUPAC name of the functional isomer of **G**. (2)

2.3 Write down the:

2.3.1 IUPAC name of compound **H** (3)

2.3.2 GENERAL FORMULA of the homologous series to which compound **A** belongs (1)

2.4 Write down the letter(s) of the compound(s) that represent(s):

2.4.1 The positional isomers (2)

2.4.2 An ester (1)

2.5 Consider the organic compound **B.**

2.5.1 Write down the STRUCTURAL FORMULA. (2)

2.5.2 Is compound **B** a PRIMARY, SECONDARY or TERTIARY alcohol? (1)

2.5.3 Explain the answer to QUESTION 2.5.2. (2)

2.6 Hydrocarbons are the principal constituents of petroleum and natural gas.
A hydrocarbon consists of 81,82% carbon and 18,18% hydrogen.

Calculate the empirical formula of this hydrocarbon. (4)
[22]

QUESTION 3 (Start on a new page.)

A group of learners decide to conduct an investigation to compare the boiling points of the first three haloalkanes, namely chloromethane, chloroethane and 1-chloropropane.

The table below shows the results obtained from the investigation.

COMPOUND	IUPAC NAME	BOILING POINT (°C)
A	chloromethane	-24,2
B	chloroethane	12,3
C	1-chloropropane	46,6

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

3.2 Identify the:

3.2.1 Independent variable (1)

3.2.2 Dependent variable (1)

3.2.3 Controlled variable (1)

3.3 Write down a suitable investigative question. (2)

3.4 Chloromethane is highly flammable.

Write down ONE precaution that should be taken when working with this substance in the laboratory. (1)

3.5 Which ONE of these substances (**A**, **B**, or **C**) has the lowest vapour pressure? Give a reason for the answer. (2)

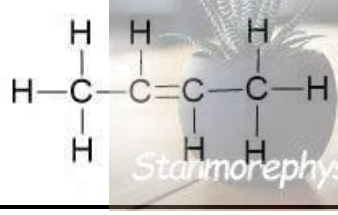
3.6 The learners find 1-chlorobutane in the laboratory.

How would the boiling point of 1-chlorobutane compare to that of 1-chloropropane?

Write only HIGHER THAN, LOWER THAN or EQUAL TO. (1)

3.7 Explain the answer to QUESTION 3.6 by referring to the type of intermolecular forces, strength, and energy. (3)

3.8 The learners decide to do another investigation with compounds **J** and **K**.

J		**K** Butane

Bromine water is used to distinguish between compounds **J** and **K** by adding it to each compound in two separate test tubes.

The learners observe that one compound decolourises the bromine water immediately, while the other substance only reacts after placing the test tube in direct sunlight.

Write down:

3.8.1 The letter (**J** or **K**) of the compound that will immediately decolourise the bromine water (1)

3.8.2 The reason that the other substance only reacts when placed in direct sunlight (1)

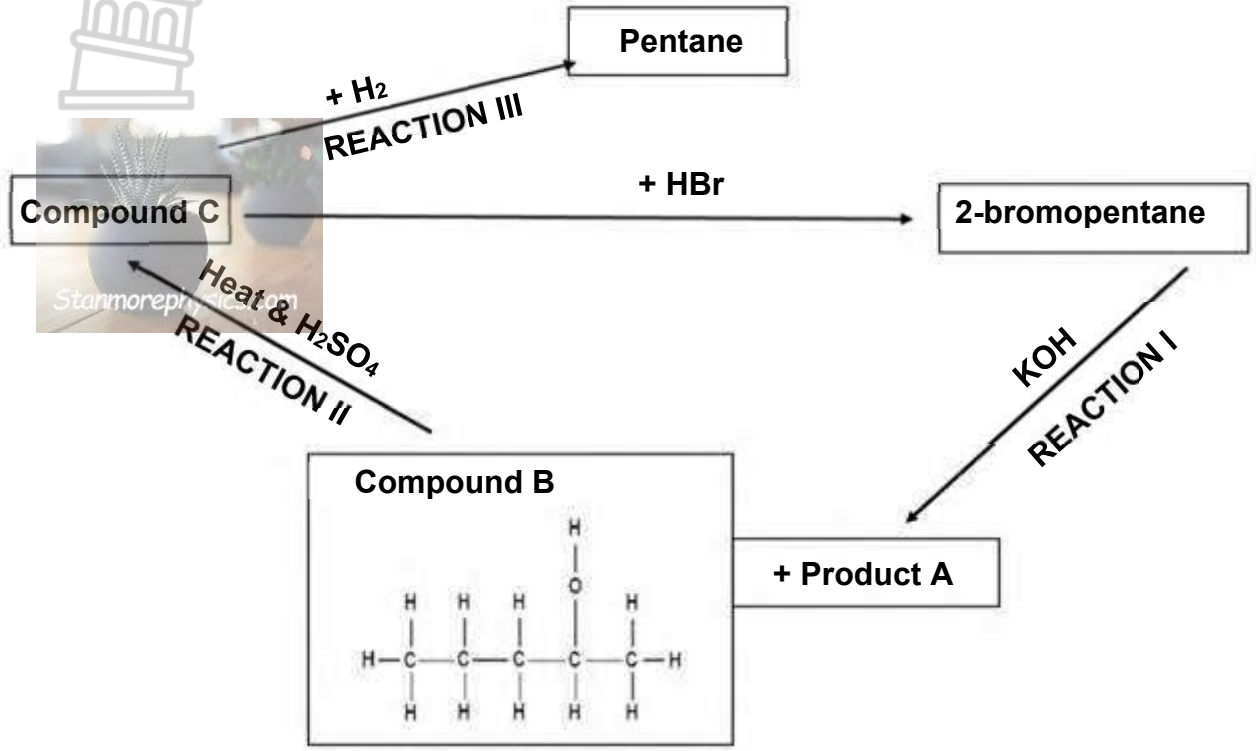
3.8.3 The MOLECULAR FORMULA of the organic product formed in the test tube containing compound **J** (2)

3.8.4 A balanced chemical equation when compound **K** undergoes complete combustion (3)

[21]

QUESTION 4 (Start on a new page.)

The flow diagram below shows three organic reactions, namely Reactions I, II and III. Various organic and inorganic products are formed as a result of these reactions.



Use the flow diagram above to answer the following questions.

4.1 Define the term *saturated compound*. (2)

4.2 2-bromopentane undergoes hydrolysis.

4.2.1 Name the type of reaction represented in Reaction I. (1)

4.2.2 Name the inorganic product **A** that is formed in the reaction. (1)

4.2.3 Give ONE reaction condition. (1)

4.3 Consider compound **B**.

4.3.1 Write down the IUPAC name. (2)

4.3.2 Name the type of reaction represented in Reaction II. (1)

4.3.3 Write down the STRUCTURAL FORMULA of the major product **C**. (2)

4.3.4 Write down the CHEMICAL FORMULA of the inorganic product formed in Reaction II. (1)

4.4 Consider Reaction III.

4.4.1 Name the type of addition reaction. (1)

4.4.2 Give the CHEMICAL FORMULA of the catalyst needed for this reaction. (1)

4.5 Esterification is one of the most important reactions in both organic synthesis and the chemical industry. When making an ester, 60 g of propan-1-ol reacts with excess ethanoic acid which produces 90,78 g of an ester and water.

The balanced chemical equation below shows the reaction that takes place.

$$C_3H_8OH\ (\ell) + CH_3COOH\ (aq) \rightarrow C_5H_{10}O_2\ (\ell) + H_2O\ (\ell)$$

4.5.1 Write down the STRUCTURAL FORMULA for the ester produced. (3)

4.5.2 Give the IUPAC name for the ester. (2)

4.5.3 Give the chemical name of the catalyst used. (1)

4.5.4 Calculate the percentage purity of propan-1-ol. (5)

[24]

QUESTION 5 (Start on a new page.)

A group of learners use the reaction between excess hydrochloric acid and magnesium ribbon to investigate one of the factors that influences the rate of a chemical reaction. The reaction that takes place is:

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

The learners follow the method shown below to conduct the investigation at room temperature. A diagram of the apparatus is given below.

Method – Experiment 1:

Step 1: Place a piece of magnesium ribbon in a conical flask and add 50 cm^3 $HC\ell$ (aq) of known concentration.

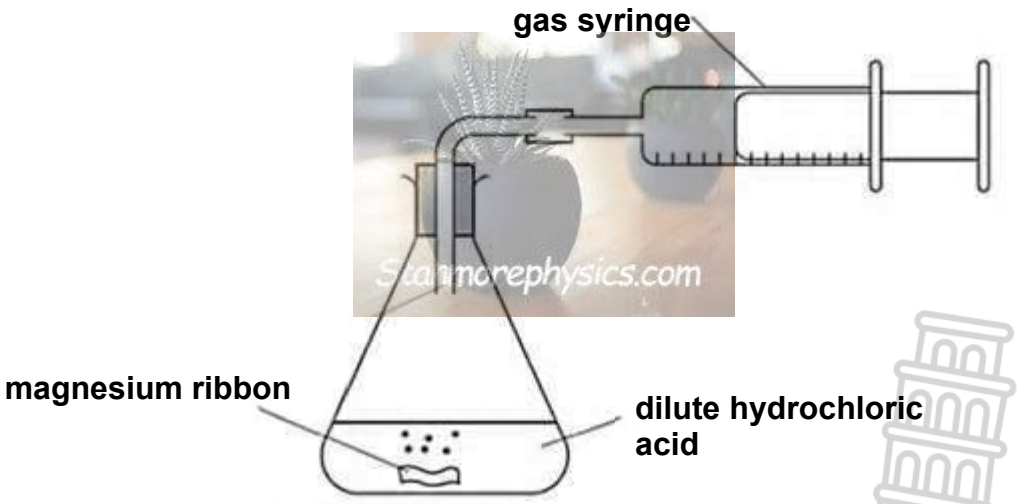
Step 2: Simultaneously start the stopwatch and close the flask with the rubber stopper containing the delivery tube.

Step 3: Measure the volume of the $H_2(g)$ formed in time intervals of 20 seconds.

Method – Experiment 2:

Repeat steps 1 to 3 above, but use only 15 cm^3 of the same $HC\ell$ (aq) diluted with 50 cm^3 distilled water.

Apparatus:



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

5.2 Write down a conclusion for this investigation. (2)

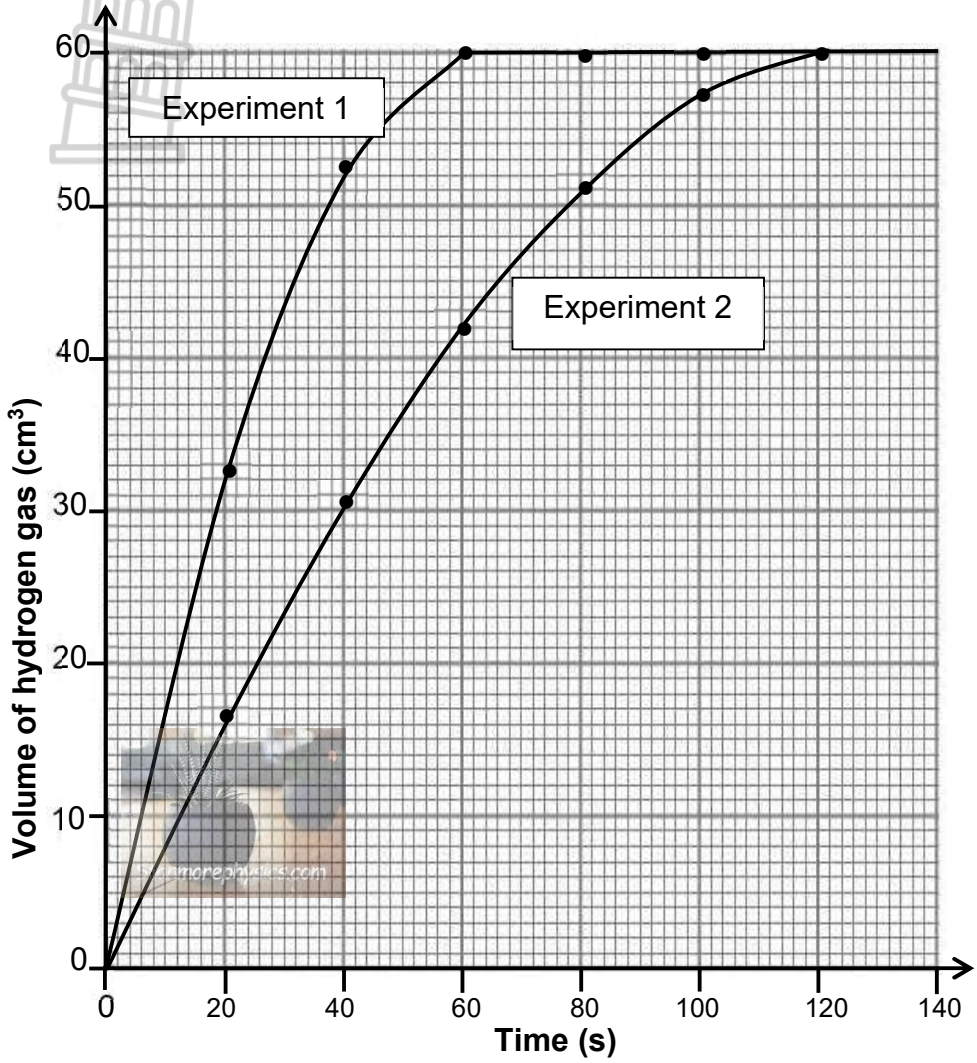
5.3 The concentration of the hydrochloric solution is 2 $mol \cdot dm^{-3}$.

Calculate the concentration used in Experiment **2**. (3)

5.4 Name TWO conditions that learners had to keep the same to ensure that this is a fair test. (2)

After completing the investigation, the learners represented the results obtained during each experiment on the graph below.

Graph of volume of hydrogen gas versus time



5.5 Give a reason why the same volume of hydrogen gas is formed in both experiments. (1)

5.6 Write down the volume of hydrogen gas formed during the first minute in:

5.6.1 Experiment **1** (1)

5.6.2 Experiment **2** (1)

5.7 Which ONE of the experiments (Experiment **1** or Experiment **2**) took place at a faster rate? Use the graph to explain the choice. (3)

5.8 Calculate the average reaction rate with respect to the magnesium, in $g \cdot s^{-1}$, in Experiment **1** if the molar volume at room temperature is 24 dm^3. (5)

[20]

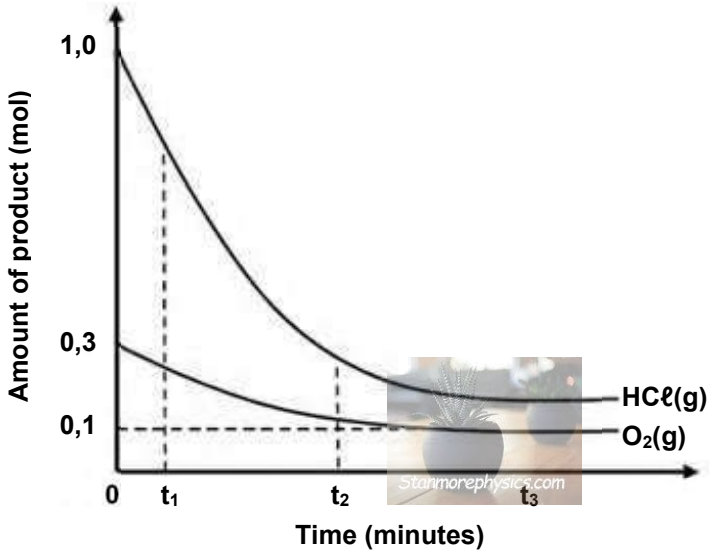
QUESTION 6 (Start on a new page.)

The reaction between steam and chlorine gas reaches equilibrium in a closed container according to the following balanced equation:

$$2H_2O(g) + 2C\ell_2(g) \rightleftharpoons 4HC\ell(g) + O_2(g) \qquad \Delta H = +113 \text{ kJ}$$

6.1 Is this reaction EXOTHERMIC or ENDOTHERMIC? Give a reason for the answer. (2)

6.2 The graphs below, not drawn to scale, show how the amount of products present in the container change with time at a specific temperature. The volume of the container is 5 dm^3.



6.2.1 Which reaction is favoured? Choose from FORWARD or REVERSE? Give a reason for the answer. (2)

6.2.2 How do the rates of the forward and the reverse reactions compare at time t_3?

Write down only GREATER THAN, SMALLER THAN or EQUAL TO. (1)

6.2.3 Calculate the equilibrium constant (Kc) for this reaction at this temperature if there was initially 5 g of water and 5 g of chlorine. (9)

6.3 The pressure is NOW increased. How will this change affect the value of the equilibrium constant?

Write down only INCREASE, DECREASE or REMAINS THE SAME. Give a reason for the answer (2)

6.4 The reaction is repeated with a catalyst. Draw a potential energy diagram of this reaction and indicate the non-catalysed reaction (**B**) and catalysed reaction (**A**) on the same graph. (4)

[20]

QUESTION 7 (Start on a new page.)

7.1 Sulphuric acid is a diprotic acid.

7.1.1 Define the term *ACID* in terms of the Arrhenius theory. (2)

7.1.2 Give a reason why sulphuric acid is referred to as a diprotic acid. (1)

7.2 The hydrogen carbonate ion can act as both an acid and a base. It reacts with water according to the following balanced equation:

$$HCO_3^-(aq) + H_2O(\ell) \rightleftharpoons H_2CO_3(aq) + OH^-(aq)$$

7.2.1 Write down ONE word for the underlined phrase above. (1)

7.2.2 Copy the equation above and indicate the conjugate acid-base pairs. (2)

7.3 A laboratory assistant was asked to prepare a 2 500 cm^3 solution of $HC\ell$ with a concentration of 0,25 $mol \cdot dm^{-3}$. The laboratory had a bottle of concentrated $HC\ell$ which had the following written on the label:

Chemical:	$HC\ell$
Density:	1,20 $g \cdot cm^{-3}$
% $HC\ell$ by mass in solution:	36%

7.3.1 Calculate the mass of $HC\ell$ contained in 2 500 cm^3 of a 0,25 $mol \cdot dm^{-3}$ solution. (4)

7.3.2 50 cm^3 of the 0,25 $mol \cdot dm^{-3}$ $HC\ell$ solution is used to neutralise 20 cm^3 of a sodium carbonate (Na_2CO_3) solution.

$$2HC\ell + Na_2CO_3 \rightarrow 2NaC\ell + H_2O + CO_2$$

Calculate the concentration of the carbonate solution. (4)

7.3.3 Name a suitable indicator that can be used for this titration. Give a reason for the answer. (2)

[16]

QUESTION 8 (Start on a new page.)

8.1 A clean piece of copper (Cu) is placed in a solution of silver nitrate ($AgNO_3$). The balanced net ionic equation is:

$$Cu\ (s) + 2\ Ag^+\ (aq) \rightarrow Cu^{2+}\ (aq) + 2\ Ag\ (s)$$

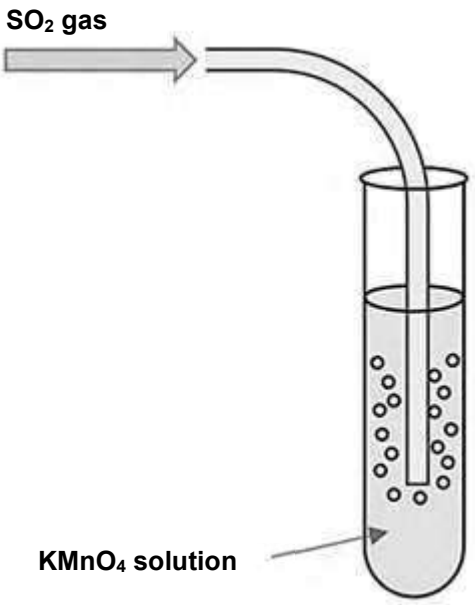
8.1.1 Define *oxidation* in terms of electron transfer. (2)

8.1.2 What type of reaction does copper (Cu) undergo in this equation?

Choose from OXIDATION or REDUCTION.

Explain the answer by referring to oxidation numbers. (3)

8.2 Sulphur dioxide gas (SO_2) is bubbled into an acidified solution of potassium permanganate as shown in the diagram below.



It is observed that the solution turns from purple to colourless due to the reduction of MnO_4^{2-} ions to Mn^{2+} ions. During the reaction SO_2 is oxidised to sulphate ions, SO_4^{2-}.

Determine the oxidation number of manganese, in the permanganate ion (MnO_4^{2-}). (2)

[7]

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

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

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 H 1																	2 He 4
1,0 Li 7	1,5 Be 9											2,0 B 11	2,5 C 12	3,0 N 14	3,5 O 16	4,0 F 19	10 Ne 20
0,9 Na 23	1,2 Mg 24											1,5 Aℓ 27	1,8 Si 28	2,1 P 31	2,5 S 32	3,0 Cℓ 35,5	18 Ar 40
0,8 K 39	1,0 Ca 40	1,3 Sc 45	1,5 Ti 48	1,6 V 51	1,6 Cr 52	1,5 Mn 55	1,8 Fe 56	1,8 Co 59	1,8 Ni 59	1,9 Cu 63,5	1,6 Zn 65	1,6 Ga 70	1,8 Ge 73	2,0 As 75	2,4 Se 79	2,8 Br 80	36 Kr 84
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	41 Nb 92	1,8 Mo 96	1,9 Tc	2,2 Ru 101	2,2 Rh 103	2,2 Pd 106	1,9 Ag 108	1,7 Cd 112	1,7 In 115	1,8 Sn 119	1,9 Sb 122	2,1 Te 128	2,5 I 127	54 Xe 131
0,7 Cs 133	0,9 Ba 137	57 La 139	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	1,8 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 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

KEY/*SLEUTEL*

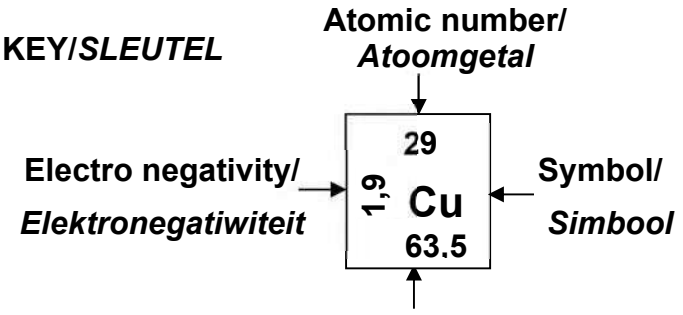


TABLE 4A: STANDARD REDUCTION POTENTIALS
TABEL 4A: STANDAARD-REDUKSIEPOTENSIALE

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

Increasing oxidising ability/*Toenemende oksiderende vermoë*

Increasing reducing ability/*Toenemende reduserende vermoë*

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

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

Increasing oxidising ability/*Toenemende oksiderende vermoë*

Increasing reducing ability/*Toenemende reduserende vermoë*

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
JUNIE EKSAMEN

GRADE/*GRAAD* 12

2024

MARKING GUIDELINES/
NASIENRIGLYNE

PHYSICAL SCIENCES: CHEMISTRY/
FISIESE WETENSKAPPE: CHEMIE

(PAPER/*VRAESTEL* 2)

13 pages/*bladsye*

QUESTION/*VRAAG* 1

1.1 A ✓✓ (2)

1.2 C ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A ✓✓ (2)

1.6 D ✓✓ (2)

1.7 C ✓✓ (2)

1.8 B or C or D ✓✓ (2)

1.9 D ✓✓ (2)

1.10 A ✓✓ (2)

[20]

QUESTION/*VRAAG* 2

2.1 A series of organic compounds that can be described by the same general formula.
OR
A series of organic compounds in which one member differs from the next with a CH_2 group. ✓✓ **(2 or 0)**

'n Reeks organiese verbindings wat deur dieselfde algemene formule beskryf kan word.
OF
'n Reeks organiese verbindings waarin die een lid van die volgende verskil met 'n CH_2-groep. (2)

2.2 2.2.1 Aldehydes/*Aldehiede* ✓ (1)

2.2.2 $CH_3CH_2CH_2C$**HO** ✓ OR/*OF* C**HO**$CH_2CH_2CH_3$ OR/*OF* C**HO(**$CH_2)_2CH_3$
(do not accept OH) *(moet nie OH aanvaar nie)* (1)

2.2.3 Butan-2-one/*Butan-2-oon* ✓✓
Accept: 2-butanone / butanone
Aanvaar 2-butanoon / butanoon (2)

Marking criteria/*Nasienriglyne*
- Correct functional group: -ONE/*Korrekte funksionele groep: EEN* ✓
- IUPAC name correct ✓

2.3 2.3.1 3,4-dibromo-2,2-dimethylpentane ✓✓✓
3,4-dibromo-2,2-dimetielpentaan

(3)

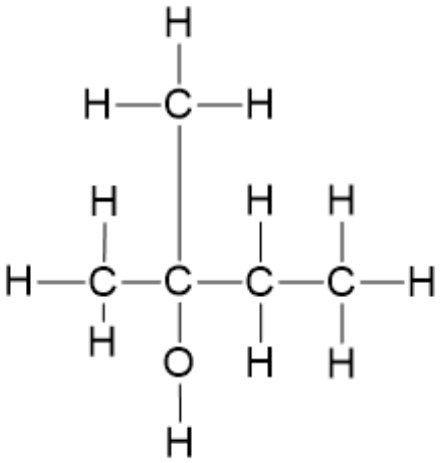
Marking criteria/*Nasienriglyne*
- Correct stem (pentane)/*korrekte stamnaam (pentaan)* ✓
- All substituents (bromo and methyl) were correctly identified./*Alle substituente (broom en metiel) is korrek geïdentifiseer.* ✓
- IUPAC name is completely correct including numbering, sequence, hyphens and commas./*IUPAC-naam is heeltemal korrek insluitend nommering, volgorde, koppeltekens en kommas* ✓

2.3.2 $C_nH_{2n+1}COOH$ OR/*OF* $C_nH_{2n}O_2$ ✓ (1)

2.4 2.4.1 C & D ✓✓ (must have both)/*(moet beide hê) (2 or 0)* (2)

2.4.2 F ✓ (1)

2.5 2.5.1



(2)

Marking criteria/*Nasienriglyne*
- Correct stem (butane)/*korrekte stam (butaan)* ✓/
- Functional group **OH** and **methyl** on the **second** carbon/*Funksionele groep OH en metiel op die tweede koolstof*✓

2.5.2 Tertiary/*Tersiêr* ✓ (1)

2.5.3 Three carbon atoms ✓ are bonded to the carbon atom to which the hydroxyl (OH)/functional group is bonded. ✓

Drie koolstofatome is verbind aan die koolstofatoom waaraan die hidroksielgroep (OH)/ funksionele groep verbind is. (2)

2.6

	% m = 100 g	M	n = $\frac{m}{M}$	Ratio/*Verhouding*	
Carbon/ *Koolstof*	81,82	12	$\frac{81,82}{12}$	$\frac{6,82}{6,82}$ = 1 ×3	3
H	18,18	1	$\frac{18,18}{1}$ ✓	$\frac{18,81}{6,82}$ =2,67 ×3 ✓ ✓	8

C_3H_8 ✓ (4)

Marking criteria/*Nasienriglyne*
- Substitute 12 and 1 respectively into n = $\frac{m}{M}$/*Vervang 12 en 1 onderskeidelik in* $n = \frac{m}{M}$ ✓
- Divide by the smallest amount of mols 6,82 ✓/*Deel deur die kleinste aantal mol 6,82*
- Multiply by 3 to get the smallest whole number ratio/*Vermenigvuldig met 3 om die kleinste heelgetal verhouding te kry* ✓
- Correct empirical formula C_3H_8/*Korrekte empiriese formule* C_3H_8 ✓

[22]

QUESTION/*VRAAG* 3

3.1 *Boiling point* – The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓✓

Kookpunt – Die temperatuur waarby die dampdruk van die stof gelyk is aan atmosferiese druk.

(2)

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 sleutel woorde/frases in die* ***korrekte konteks*** *uitgelaat is, trek 1 punt af.*

3.2 3.2.1 Chain length/molar mass/surface area ✓
(do not accept IUPAC name)

Kettinglengte/molêre massa/kontakoppervlakte
(moet nie IUPAC-naam aanvaar nie) (1)

3.2.2 Boiling point/*kookpunt* ✓ (1)

3.2.3 Homologous series ✓ type of intermolecular force
(do not accept same volume, same kind of apparatus)

Homoloë reeks / tipe intermolekulêre kragte
(moet nie aanvaar dieselfde volume, dieselfde soort apparaat nie) (1)

3.3 What is the relationship between chain length/molar mass/surface area and boiling point? ✓✓

Wat is die verwantskap tussen die kettinglengte/molêre massa/kontakoppervlakte en kookpunt?

(2)

Marking criteria/*Nasienriglyne*
- Must mention INDEPENDENT and DEPENDENT variables ✓
  Moet die ONAFHANKLIKE en AFHANKLIKE veranderlikes noem
- Answer to the question CANNOT be YES OR NO ✓
  Antwoord op die vraag mag nie JA of NEE wees nie.

3.4 (ONE reasonable answer)
Keep away from an open flame, OR work in a fume cupboard, OR heat in a water bath. ✓

(EEN redelike antwoord)
Hou weg van 'n oop vlam, OF werk in 'n dampkas, OF verhit in 'n waterbad. (1)

3.5 C ✓, it has the highest boiling point. ✓

C, dit het die hoogste kookpunt.

(2)

3.6 Higher than/*Hoër as* ✓ (1)

3.7
- INTERMOLECULAR FORCES and STRENGTH
  As the chain length increases, ✓ the strength of the London/ intermolecular forces increases, ✓
- ENERGY
  Therefore more energy is needed to overcome the intermolecular forces leading to a higher boiling point. ✓
- *INTERMOLEKULÊRE KRAGTE en STERKTE*
  As die kettinglengte verhoog, verhoog die sterkte van die London/ intermolekulêre kragte.
- *ENERGIE*
  Daarom word meer energie benodig om die intermolekulêre kragte te oorkom wat dan tot 'n hoër kookpunt lei.

(3)

Marking criteria/*Nasienriglyne*:
- Identify the type of intermolecular force./*Identifiseer die tipe intermolekulêre kragte.* ✓
- Refer to the strength of intermolecular forces./*Verwys na die sterkte van die intermolekulêre kragte.* ✓
- Mention the energy required to overcome intermolecular forces./*Noem die energie benodig om die intermolekulêre kragte te oorkom.* ✓

NO MARK if a learner says more energy required to BREAK BONDS/
GEEN PUNTE indien 'n leerder skryf meer energie benodig om BINDINGS TE BREEK NIE.

3.8 3.8.1 J ✓ (1)

3.8.2 The sunlight supplies sufficient energy (heat) to meet the activation energy of the reaction. ✓Will react with the UV of the sunlight.

Die sonlig verskaf genoeg energie (hitte) om gelyk te wees aan die aktiveringsenergie van die reaksie. Sal reageer met die UV van die son. (1)

3.8.3 $C_4H_8\mathbf{Br_2}$ ✓✓ (if only one Br is shown ½)
(indien slegs een Br gewys word ½) (2)

3.8.4 $2C_4H_{10}$ ✓ + $13O_2 \rightarrow 8CO_2 + 10H_2O$ ✓ bal ✓

Ignore phases and double arrows in answers / *Ignoreer fases en dubbel pyl in antwoord* (3)

[21]

QUESTION/*VRAAG* 4

4.1 Compounds in which there are no multiple bonds between carbon atoms in their hydrocarbon chain. ✓✓ (2 OR 0)
OR
A compound in which there are only single bonds between the carbon atoms in the chain.

Verbindings waarin daar geen meervoudige bindings tussen C-atome in hul koolwaterstofkettings is nie. (2 OF 0)
OF
'n Verbinding waarin daar slegs enkel bindings is tussen die koolstofatome in 'n ketting. (2)

4.2 4.2.1 Substitution/*Substitusie* ✓ (1)

4.2.2 Potassium bromide/KBr ✓ *Kaliumbromied/KBr* (1)

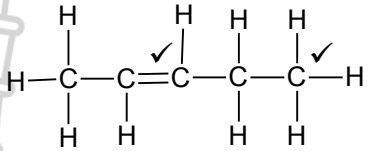
4.2.3 Dilute strong base OR mild heat ✓ OR KOH(aq)
Verdunde sterk basis OF matige hitte OF KOH(aq) (1)

4.3 4.3.1 Pentan-2-ol ✓✓
Pentan-2-ol
Accept 2-pentanol / *Aanvaar 2-pentanol* (2)

Marking criteria/*Nasienriglyne*
- Correct stem (pent**an**)/*Korrekte stam (pent**an**)* ✓
- IUPAC name is completely correct including numbering, sequence, hyphens and commas./
  IUPAC naam is heeltemal korrek met alle nommering, volgorde, koppeltekens en kommas. ✓

4.3.2 Elimination OR Dehydration/*Eliminasie OF Dehidrasie* ✓ (1)

4.3.3



(2)

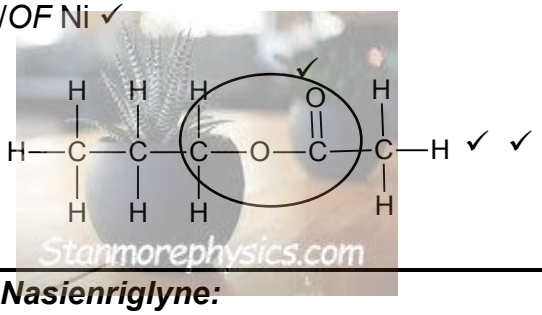
Marking criteria/*Nasienriglyne*
- 5 carbons in the chain/*5 koolstowwe in die ketting* ✓
- Functional group C = C/*Funksionele groep C = C* ✓

4.3.4 H_2O ✓ (1)

4.4 4.4.1 Hydrogenation/*Hidrogenasie of hidrogenering* ✓ (1)

4.4.2 Pt OR/*OF* Pd OR/*OF* Ni ✓ (1)

4.5 4.5.1



(3)

Marking criteria/*Nasienriglyne:*
- Functional group/*funksionele groep* ✓
- correct number of carbon on either side of the functional group/*korrekte hoeveelheid koolstowwe aan beide kante van die funksionele groep* ✓
- Whole structure is correct/*Hele struktuur is korrek* ✓

4.5.2 Propyl ✓ethanoate ✓
Propieletanoaat (2)

4.5.3 Sulphuric acid/ hydrogensulphate ✓
Swawelsuur / waterstofsulfaat (1)

4.5.4 **METHOD 1:**

$C_3H_8OH + CH_3COOH \rightarrow C_5H_{10}O_2 + H_2O$

$M(C_5H_{10}O_2) = 102\ g{\cdot}mol^{-1}$

$m = 90,78\ g$

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

$= \frac{90,78}{102}$ ✓

$= 0,89\ mol$

$n(C_5H_{10}O_2) : n(C_3H_8OH)$

1:1

0,89 : 0,89✓

$M(C_3H_8OH) = 61\ g{\cdot}mol^{-1}$

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

$0,89 = \frac{m}{61}$✓

$m = 54,29\ g$

Percentage purity/
Persentasie suiwerheid =

$\frac{Pure\ mass/Suiwer\ massa}{Impure\ mass/Onsuiwer\ massa} \times 100$

$= \frac{54,29}{60}$ ✓ ×100

= 90,48% ✓

METHOD 2:

$C_3H_7OH + CH_3COOH \rightarrow C_5H_{10}O_2 + H_2O$

$M(C_5H_{10}O_2) = 102\ g{\cdot}mol^{-1}$

$m = 90,78\ g$

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

$= \frac{90,78}{102}$ ✓

$= 0,89\ mol$

$n(C_5H_{10}O_2) : n(C_3H_8OH)$

1:1

0,89 : 0,89✓

$M(C_3H_7OH) = 60\ g{\cdot}mol^{-1}$

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

$0,89 = \frac{m}{60}$✓

$m = 53,4\ g$

Percentage purity/
Persentasie suiwerheid =

$\frac{Pure\ mass/Suiwer\ massa}{Impure\ mass/Onsuiwer\ massa} \times 100$

$= \frac{53,4}{60}$ ✓ ×100

= 89% ✓

(5)

Marking criteria/*nasienriglyne*

- Substitute 102 g·mol^{-1} into $n = \frac{m}{M}$ ✓
  Inveranging van 102 g·mol^{-1} in $n = \frac{m}{M}$
- Use the mol ratio: $n(C_5H_{10}O_2) : n(C_3H_8OH) = 1 : 1$ ✓
  Gebruik die mol verhouding: $n(C_5H_{10}O_2) : n(C_3H_8OH) = 1 : 1$
- Substitute 61 g·mol^{-1} into $n = \frac{m}{M}$ ✓
  Invervanging van 61 g·mol^{-1} in $n = \frac{m}{M}$
- Substitute 60 g as the impure mass ✓
  Invervanging van 60 g as die onsuiwer massa
- Final answer: 89 - 90,5% ✓
  Finale antwoord: 89 - 90,5%

[24]

QUESTION/*VRAAG* 5

5.1 Change in concentration of reactants or products per unit time ✓✓ (2 or 0)

Verandering in konsentrasie van reaktante of produkte per eenheid tyd. (2 of 0) (2)

5.2 As the concentration of the acid decreases, the rate of reaction will also decrease. ✓✓
OR
As the concentration of the acid increases, the rate of the reaction will increase.

Soos die konsentrasie van die suur afneem, sal die tempo van die reaksie ook afneem.
OF
Soos die konsentrasie van die suur toeneem sal die tempo van die reaksie ook toeneem.

(2)

Marking criteria/*Nasienriglyne:*
- Identify variables correct ✓
  Identifiseer die veranderlikes korrek
- Correct relationship ✓
  Korrekte verwantskappe

5.3

OPTION 1/*OPSIE 1*:	
$c = \frac{n}{V}$ $2 = \frac{n}{0,015}$ ✓ $n = 0,03 \text{ mol}$	$c = \frac{n}{V}$ $c = \frac{0,03}{0,065}$ ✓ $c = 0,46 \text{ mol.dm}^{-3}$ ✓

OPTION 2/*OPSIE 2*:
$c_1V_1 = c_2V_2$
(2)(0,015) ✓= c_2 (0,065) ✓
c_2 = 0,46 mol·dm^{-3} ✓ (3)

5.4 Learners should keep the state of division/surface area of the Mg-ribbon the same ✓ and the initial temperature. ✓

Leerders moet die toestand van verdeeldheid/die oppervlakarea van die Mg lint konstant hou en die aanvanklike temperatuur. (2)

5.5 The Mg is the limiting reagent and determines the amount of product. ✓
OR
The same mass of magnesium was used in each experiment.
DO NOT ACCEPT: HCℓ is in excess

Die Mg is die beperkende reagens en bepaal die hoeveelheid produkte wat vorm.
OF
Dieselfde massa magnesium is in elke eksperiment gebruik.
MOET NIE AANVAAR: HCℓ is in oormaat nie. (1)

5.6 5.6.1 60 (cm^3) ✓ (1)

5.6.2 42 (cm^3) ✓ (1)

5.7 Experiment 1 ✓
In the same time, more product ✓is produced and the gradient of the graph is steeper. ✓

Eksperiment 1
In dieselfde tyd word meer produkte geproduseer en die gradiënt van die grafiek is steiler. (3)

5.8

Marking criteria/*Nasienriglyne*
- Use volume of 60 cm^3/ 0,06 dm^3 in $n = \frac{V}{V_m}$
  Gebruik volume van 60 cm^3 in $n = \frac{V}{V_m}$
- Ratio 1:1/*Verhouding 1:1*
- Use M = 24/*Gebruik M = 24*
- Substitute in rate equation
  Vervang in tempo vergelyking
- Answer 0,001/*Antwoord 0,001*

$n = \frac{V}{V_m}$
$n = \frac{0,06}{24}$ ✓
n = 0,0025 mol

$n_{Mg} = n_{H_2}$ ✓
= 0,0025 mol

m_{Mg} = nxM
= 0,0025 x 24✓
= 0,06 g

Rate/*Tempo* = $-\frac{\Delta m}{\Delta t}$
$= -\frac{0-0,06}{60}$✓
= 0,001(g.s^{-1}) ✓

Answer must be positive/*Antwoord moet positief wees* (5)
[20]

QUESTION/*VRAAG* 6:

6.1 Endothermic ✓
ΔH is greater that zero/is positive ✓

Endotermies
ΔH is groter as nul/is positief (2)

6.2 6.2.1 Reverse✓
The amount of product decreases with time. ✓

Terugwaarts
Die hoeveelheid produkte verminder met tyd. (2)

6.2.2 Equal to/*Gelyk aan* ✓ (1)

6.2.3 $n_{(H2O)} = \frac{m}{M}$
$= \frac{5}{18}$
= 0,28mol

$n_{(C\ell 2)} = \frac{m}{M}$
$= \frac{5}{71}$
= 0,07mol

	H_2O	$C\ell_2$	$HC\ell$	O_2
Ratio *Verhouding*	2	2	4	1
Initial mole *Aanvanklike mol*	0,28✓	0,07✓	1	0,3✓
Change *Verandering*	+0,4	+0,4	-0,8	-0,2
Equilibrium *Ewewig*	0,68	0,47	0,2	0,1✓
$c = \frac{n}{V}$	$\frac{0,68}{5}$ =0,136	$\frac{0,47}{5}$ =0,094	$\frac{0,2}{5}$ =0,04	$\frac{0,1}{5}$✓ =0,02

Ratio ✓

$K_c = \frac{[HC\ell]^4[O_2]}{[H_2O]^2[C\ell_2]^2}$ ✓
$= \frac{(0,04)^4(0,02)}{(0,136)^2(0,094)^2}$ ✓
$= 0,0003$ ✓ $(3,15 \times 10^{-4})$ (9)

Marking criteria
- Calculate the mole of water. ✓
- Calculate the mole of $C\ell_2$ ✓
- Substitution of initial mole for both $HC\ell$ and O_2 ✓
- Correct use of ratio ✓
- Correct mol at equilibrium for O_2. ✓
- Divide by volume of 5 ✓
- Kc expression ✓ (Wrong Kc max 7/9)
- Substitution of values from Equilibrium concentration ✓
- Correct answer. ✓

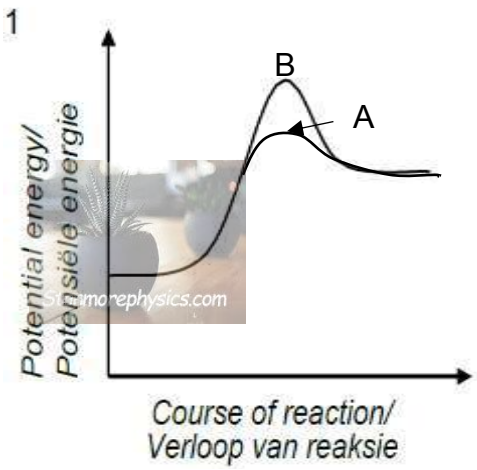
Nasienkriteria:

- *Bereken die mol water.* ✓
- *Bereken die mol $C\ell_2$* ✓
- *Vervang beide $HC\ell$ en O_2* ✓
- *Korrekte gebruik van verhouding* ✓
- *Korrekte mol by ewewig O_2.* ✓
- *Deel deur volume van 5* ✓
- *Kc uitdrukking* ✓ *(Verkeerde Kc maks 7/9)*
- *Vervanging van waardes van ewewigskonstante* ✓
- *Korrekte antwoord* ✓

6.3 Remains the same ✓
Only temperature affects K_c. ✓

Bly dieselfde
Slegs temperatuur affekteer Kc. (2)

6.4



Marking criteria/*Nasienkriteria:*

- Both axes correctly labelled./*Asse korrek benoem* ✓
- Shape of Ep curve for endothermic reaction as shown./*Vorm van kurwe vir endotermiese reaksie soos getoon.* (B) ✓✓
- Added catalyst/*Bygevoegde katalisator* ✓ (A)

(4)
[20]

QUESTION 7/*VRAAG 7*:

7.1 7.1.1 An acid is a substance that produces hydrogen ions (H^+) / hydronium ions (H_3O^+) when <u>in solution</u>. ✓✓

'n Suur is 'n stof wat waterstof ione produseer (H^+) hidroniuim ione (H_3O^+) wanneer <u>dit in oplossing is</u>. (2)

7.1.2 It ionises to form <u>2 protons</u>/*Dit ioniseer om <u>2 protone</u> te vorm.* ✓ (1)

7.2 7.2.1 Ampholyte or amphiprotic /*amfoliet of amfiproties* ✓ (1)

7.2.2 $HCO_3^-(aq) + H_2O(\ell) \rightleftharpoons H_2CO_3(aq) + OH^-(aq)$

b_1 ✓ a_2 a_1 ✓ b_2

(2)

7.3 7.3.1

OPTION 1/*OPSIE* 1:

$c = \frac{m}{MV}$ ✓

$0,25 = \frac{m}{(36,5)(2,5)}$ ✓✓

m = 22,82 g ✓

range/*gebied*: 22,82 – 23

OPTION 2/*OPSIE* 2:

$c = \frac{n}{V}$ ✓ $\quad n = \frac{m}{M}$

$n = (0,25)(2,5)$ ✓ $\quad 0,625 = \frac{m}{36,5}$ ✓

n = 0,625 m = 22,82 g ✓

range/*gebied*: 22,82 – 23

(4)

7.3.2

OPTION 1/*OPSIE 1*:

$\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$

$\frac{(0,25)(50)✓}{c_b(20)✓} = \frac{2}{1}✓$

c_b = 0,31 mol·dm^{-3}✓

OPTION 2/*OPSIE 2*:

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

n = (0,25)(0,05) ✓

n = 0,0125 mol

$n_b = ½n_a$✓

= 0,00625 mol

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

$c_b = \frac{0,00625}{0,02}$✓

c_b = 0,31 mol·dm^{-3}✓

(4)

7.3.3 Methyl orange. ✓
Strong acid reacts with weak base ✓

Metieloranje
Sterk suur reageer met 'n swak basis.

(2)
[16]

QUESTION/*VRAAG* 8:

8.1 8.1.1 Oxidation is the loss of electrons
Oksidasie is die verlies van elektrone. ✓✓ (2)

8.1.2 Oxidation/*Oksidasie* ✓
Cu^0 ✓→ Cu^{2+}✓ (3)

8.2 **METHOD 1**: MnO_4^{2-}
x + (4(-2)) = -2
x = +6 ✓✓

METHOD 2: MnO_4^-
x + (4(-2)) = -1
x = +7

(2)
[7]

TOTAL/*TOTAAL*: 150