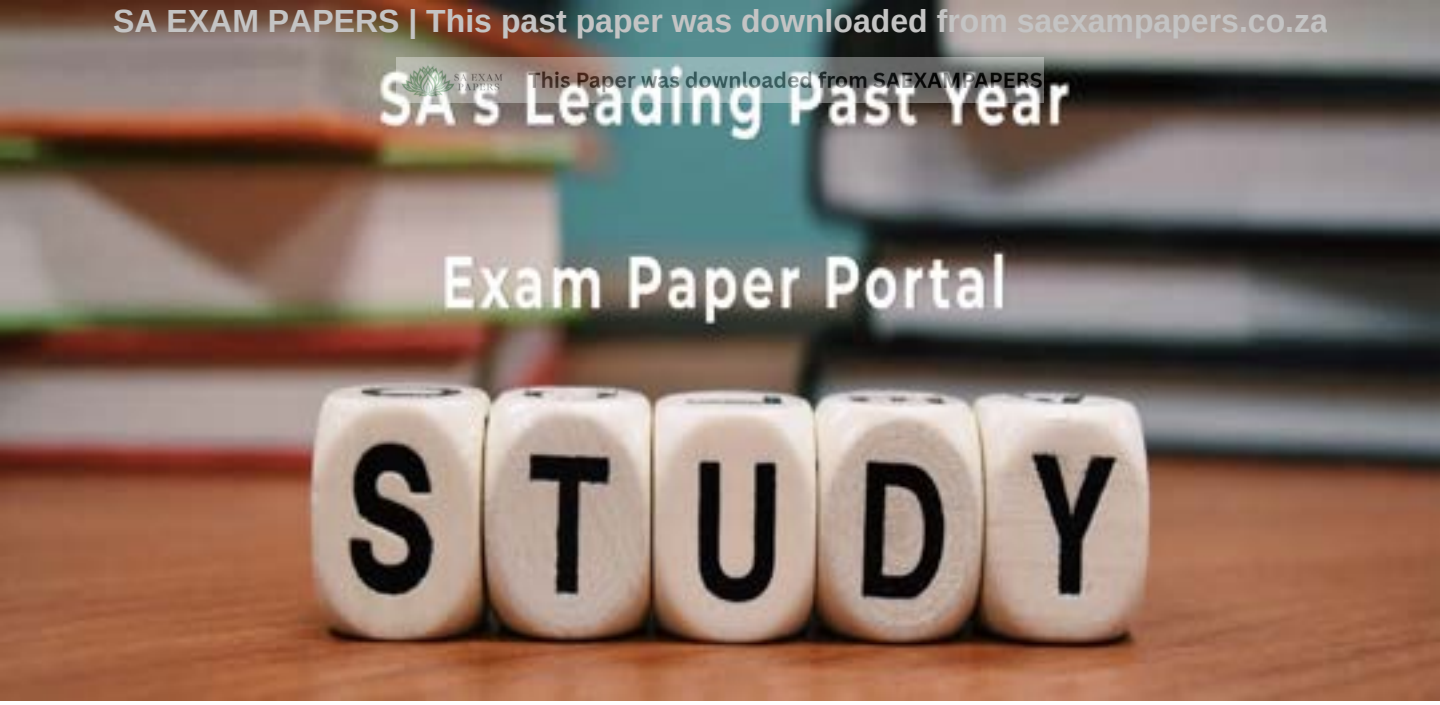


GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2025

10842

PHYSICAL SCIENCES: CHEMISTRY

(PAPER 2)

PHYSICAL SCIENCES: Paper 2

10842E

TIME: 3 hours

MARKS: 150

15 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. Start EACH question on a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between subquestions, for example, between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. Round-off your final numerical answers to a minimum of TWO decimal places.
9. Show ALL formulae and substitutions in ALL calculations.
10. You are advised to use the attached DATA SHEETS.
11. Give brief motivations, discussions, etc. where required.
12. Write neatly and legibly.

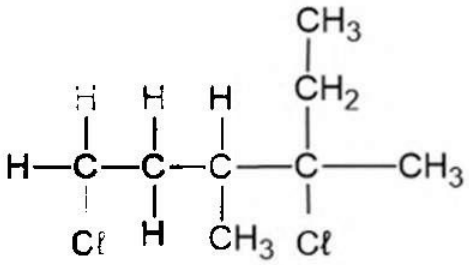
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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 E.

1.1 Which of the following compounds has a formyl group as its functional group?

A Propan-1-ol
B Propanoic acid
C Prop-1-ene
D Propanal (2)

1.2 The correct IUPAC name for the structure shown below is:



A 1,4-dichloro-4-ethyl-3-methylpentane
B 2,4-dichloro-2-ethyl-3-methylpentane
C 3,6-dichloro-3,4-dimethylhexane
D 1,4-dichloro-3,4-dimethylhexane (2)

1.3 Consider the following reaction:

Step 1: $CH_3CHCHCH_3 + HBr \rightarrow$ compound **P**
Step 2: Compound **P** + NaOH(aq) → compound **X** + NaBr

The IUPAC name for compound **X** is:

A Butan-2-ol
B But-2-ene
C 2-bromobut-2-ene
D 2-bromobutane (2)

1.4 Consider the organic compound propanal.

Which of the following is CORRECT for the homologous series and intermolecular forces between the molecules of the compound?

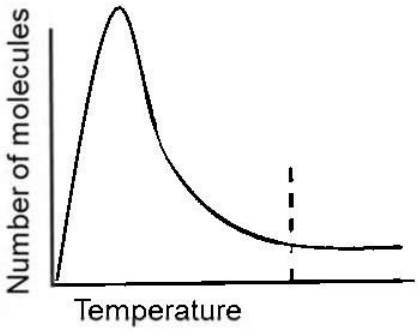
	HOMOLOGOUS SERIES	INTERMOLECULAR FORCES
A	Aldehyde	Hydrogen bonds
B	Ketone	Dipole-dipole forces
C	Aldehyde	Dipole-dipole forces
D	Alcohol	Hydrogen bonds

(2)

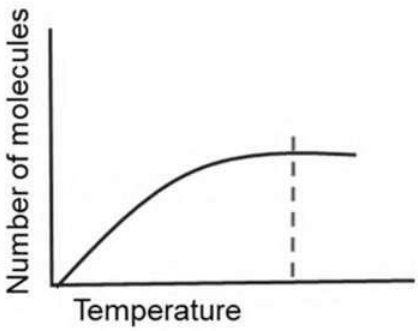
1.5 The graphs below illustrate the distribution of the same amount of four different O_2 gas samples. Each sample is at a different temperature.

Which gas is at the highest temperature?

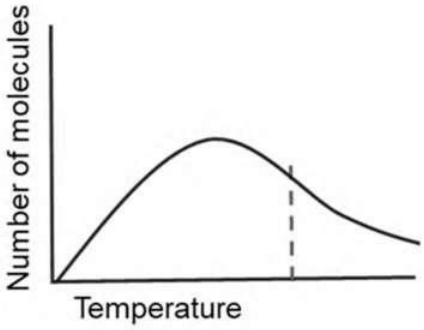
A



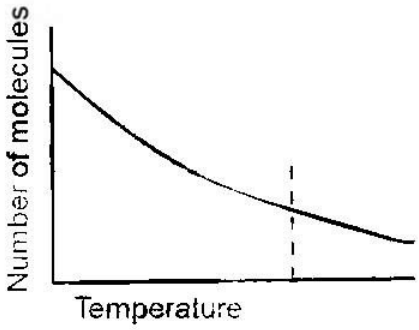
B



C



D

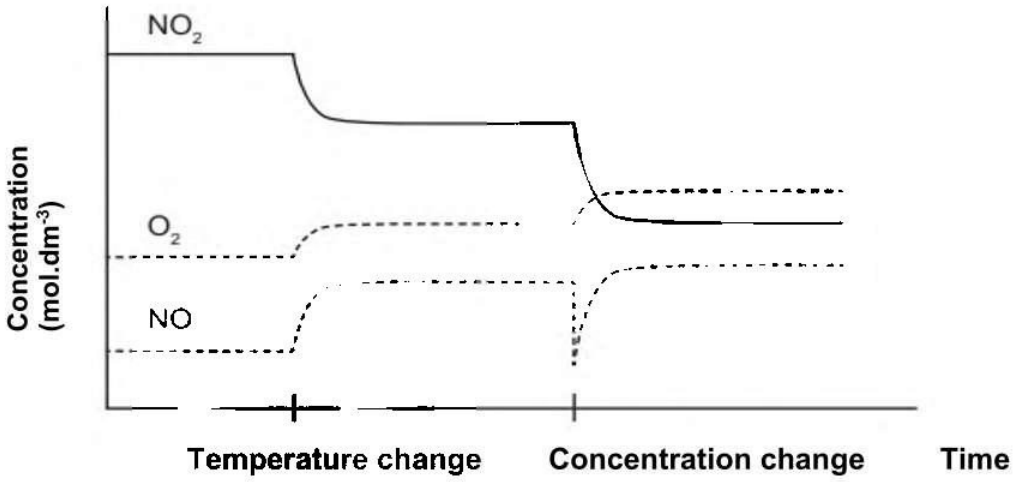


(2)

1.6 Consider the chemical reaction shown below:

$$2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g) \qquad \Delta H = -62\ kJ{\cdot}mol^{-1}$$

A change was applied to the equilibrium of the gas mixture. The mixture returned to equilibrium and a second change was applied. The following graph shows the effects of the two changes.



Identify the applied changes that best account for the shape of the graph.

	TEMPERATURE CHANGE	CONCENTRATION CHANGE
A	decreased	O_2 increased
B	decreased	NO decreased
C	increased	O_2 increased
D	increased	NO decreased

(2)

1.7 Which of the following statements about water is TRUE?

(i) It is a weak electrolyte that undergoes auto-ionisation.
(ii) The equilibrium constant for the ionisation of water at room temperature is 1×10^{-14}.
(iii) It ionises completely at room temperature, hence $[H_3O^+] = [OH^-]$.
(iv) The ionisation of water produces twice as many hydronium ions as compared to hydroxide ions.

A i and ii only

B ii and iii only

C iii and iv only

D i, ii, iii and iv (2)

1.8 A laboratory assistant prepares solutions of nitrous acid and hydrogen cyanide acid, both at the same concentration.

The K_a values of these acidic solutions are:

- nitrous acid (HNO_2) = $4,6 \times 10^{-4}$
- hydrogen cyanide acid (HCN) = $6,17 \times 10^{-10}$

Which of these two acids is the stronger acid, and which has the higher pH?

	STRONGER ACID	HIGHER pH
A	HNO_2	HNO_2
B	HNO_2	HCN
C	HCN	HCN
D	HCN	HNO_2

(2)

1.9 Calcium metal reacts quickly with hot water to produce calcium hydroxide and hydrogen:

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

Identify the oxidising and reducing agents in this reaction:

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

(2)

1.10 The following half-reactions show some predicted standard reduction potentials for the oxides of a hypothetical element X.

$2XO_3(s) + 2H^+(aq) + 2e^- \rightleftharpoons X_2O_5(s) + H_2O(\ell)$ $E^\circ = - 0,46$ V

$X_2O_5(s) + 2H^+(aq) + 2e^- \rightleftharpoons 2XO_2(s) + H_2O(\ell)$ $E^\circ = + 0,11$ V

$XO_2(s) + 4H^+(aq) + e^- \rightleftharpoons X^{3+}(aq) + 2H_2O(\ell)$ $E^\circ = - 1,34$ V

The strongest reducing agent is:

A XO_3

B X_2O_5

C XO_2

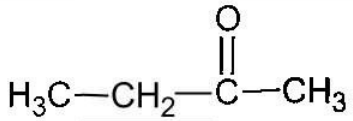
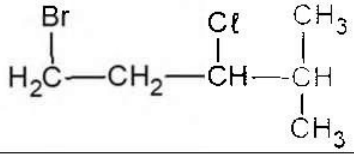
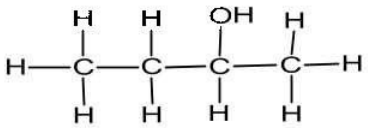
D X^{3+}

(2)

[20]

QUESTION 2 (Start on a new page.)

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

A		**B**	$CH_3CH(CH_3)CH_2CH_3$
C		**D**	CH_3COOH
E	Ethyne	**F**	

2.1 Name the homologous series to which each of the following compounds belong:

2.1.1 **A** (1)

2.1.2 **C** (1)

2.2 Write down the IUPAC name of compound **C**. (3)

2.3 Write down the letter for the compound that has a carbonyl group. (1)

2.4 Write down the structural formula for the:

2.4.1 Functional isomer of compound **A** (2)

2.4.2 Ester with the same molecular formula as compound **D** (2)

2.4.3 Tertiary alcohol of compound **F** (2)

2.5 Explain why compound **A** is not an unsaturated hydrocarbon. (2)

2.6 Which letter in the table above represents:

2.6.1 An unsaturated hydrocarbon (1)

2.6.2 The compound with the general formula $C_nH_{2n}O$ (1)

2.7 Using molecular formulae, write down a balanced chemical equation for the combustion of compound **B** in excess oxygen. (3)

2.8 A compound is analysed and found to have an empirical formula of CH_2O. The molar mass of the compound is found to be 150 $g \cdot mol^{-1}$.

What is the molecular formula of the compound? (2)

[21]

QUESTION 3 (Start on a new page.)

During an investigation, a table of data was collected for four organic compounds **A, B, C** and **D**. The compounds have different functional groups.

	COMPOUND	MOLAR MASS	BOILING POINT (°C)
A	$CH_3CH_2CH_2CH_2CH_3$	72	36,1
B	$CH_3CH_2CH_2CHO$	72	74,8
C	$CH_3COCH_2CH_3$	72	79,64
D	CH_3CH_2COOH	74	163,5

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

3.2 In the investigation **above**, name the independent variable. (1)

3.3 Explain the trend in the boiling points among **A**, **B**, and **C** as shown in the table above. (4)

3.4 Which compound, **C** or **D**, would have the lowest vapour pressure?

Give a reason for the answer. (2)

3.5 Write down the following:

3.5.1 The phase of compound **A** at room temperature (1)

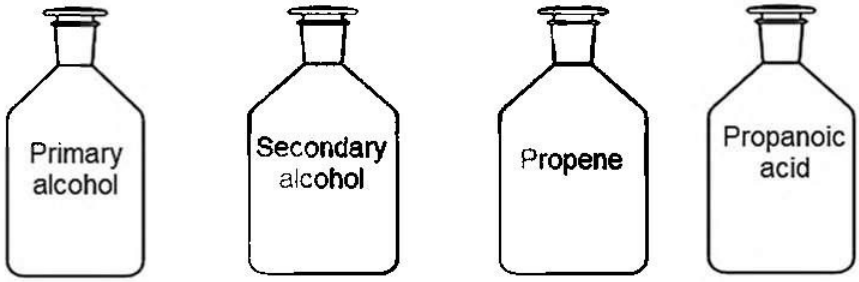
3.5.2 The structural formula of the functional group of **B** (1)

3.5.3 The IUPAC name of compound **C** (1)

[12]

QUESTION 4 (Start on a new page.)

Four bottles containing organic compounds are found in the laboratory. The chemicals are used in various reactions.



Bottle A **Bottle B** **Bottle C** **Bottle D**

4.1 Identify the type of reaction that occurs when each of the following reactants are used:

4.1.1 Bottle **A** and bottle **D** (1)

4.1.2 Bromine water and bottle **C** (1)

4.1.3 Bottle **B** and concentrated sulphuric acid (1)

4.2 Give the structural formula of the alcohol in bottle **B** if the alcohol has a prefix of hex. (2)

4.3 Use structural formulae to represent the chemical equation for the formation of the ester called butyl propanoate while using the primary alcohol in bottle **A**.

Include the IUPAC names for the reactants. (6)

4.4 Concentrated sulphuric acid is added to the reaction in QUESTION 4.3.

What is the function of the acid? (1)

4.5 Give the name of the functional group for bottle **B**. (1)

4.6 Bottle **C** is used to produce an alcohol.

4.6.1 Name the reaction conditions required. (1)

4.6.2 Give the structural formula of the major product that forms. (2)

4.6.3 Name the type of addition reaction that occurs. (1)

4.6.4 Two products are formed during this reaction. The products can be separated through distillation.

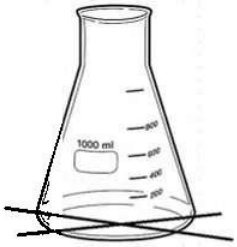
Which property of the compounds allows this separation? (1)

[18]

QUESTION 5 (Start on a new page.)

5.1 Define the term *heat of reaction.* (2)

5.2 The reaction between sodium thiosulfate and hydrochloric acid is investigated. A conical flask is placed over a cross on a piece of paper. The time is measured from the moment the acid is added to the sodium thiosulfate until the cross disappears.



The equation of the reaction is given:

$$Na_2S_2O_3(aq) + 2HC\ell(aq) \rightarrow 2NaC\ell(aq) + H_2O(\ell) + SO_2(g) + S(s) \quad \Delta H>0$$

The reaction is carried out with solutions of different concentrations of sodium thiosulfate.

The table below shows the data collected.

CONCENTRATION OF $Na_2S_2O_3$ ($mol \cdot dm^{-3}$)	TIME TAKEN UNTIL THE CROSS COULD NOT BE SEEN (IN SECONDS)			
	TRIAL 1	TRIAL 2	TRIAL 3	AVERAGE
0,040	71	67	69	69
0,060	42	45	45	44
0,080	31	41	33	X

5.2.1 Identify the independent variable. (1)

5.2.2 Calculate the average rate of reaction, in $mol \cdot dm^{-3} \cdot s^{-1}$, for the highest concentration used. (3)

5.2.3 Give the reason for the disappearance of the cross. (1)

5.2.4 Use the collision theory and explain the trend observed in this experiment. (3)

5.3 The activation energy for this reaction is 27,3 kJ.

5.3.1 Define the term *activation energy*. (2)

5.3.2 Draw a fully-labelled sketch graph of the potential energy graph for this reaction. (2)

[14]

QUESTION 6 (Start on a new page.)

6.1 Consider the following chemical equilibrium:

$$2CrO_4^{2-}(aq) + 2H^+(aq) \rightleftharpoons 2Cr_2O_7^{2-}(aq) + H_2O(\ell) \qquad \Delta H = -895\ kJ{\cdot}mol^{-1}$$

yellow *orange*

6.1.1 What is meant by the term *chemical equilibrium*? (2)

6.1.2 Using Le Chatelier's principle, explain how an increase in temperature will change the colour of the solution. (3)

6.1.3 A concentrated solution of hydrochloric acid is added to the equilibrium mixture. What is the effect on the concentration of the dichromate ions $(Cr_2O_7^{2-})$, and hence on the colour of the solution?

Write only INCREASE, DECREASE or REMAIN THE SAME. Explain the answer. (3)

6.2 Consider the following chemical reaction:

$$2CO(g) \rightleftharpoons CO_2(g) + C(s) \qquad Kc = 10{,}00 \text{ at } 1095\ K$$

A 1,0 dm^3 sealed vessel at a temperature of 1 095 K contains CO and CO_2 gas. An excess of solid carbon is formed. The concentration of CO is $1{,}10 \times 10^{-2}$ $mol{\cdot}dm^{-3}$, and the concentration of CO_2 is $1{,}21 \times 10^{-3}$ $mol{\cdot}dm^{-3}$.

6.2.1 Is the system at equilibrium? Support the answer with a calculation. (3)

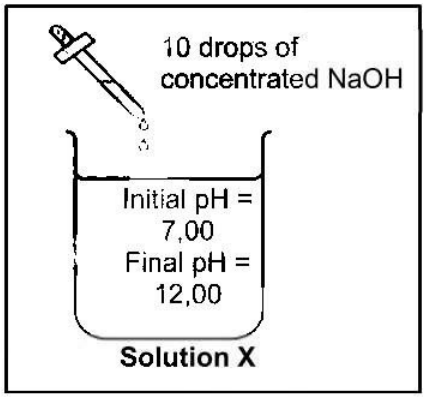
6.2.2 Carbon dioxide gas is added to the system and the mixture reaches a new equilibrium. The equilibrium concentrations of CO(g) and CO_2(g) are now equal. The temperature remains constant at 1 095 K.

Calculate the amount (in mol) of carbon dioxide that was added to the system. (7)

[18]

QUESTION 7 (Start on a new page.)

7.1 The pH of a solution **X** is measured before and after adding 10 drops of concentrated sodium hydroxide solution (NaOH) to it.



7.1.1 What is meant by a "concentrated NaOH solution"? (1)

7.1.2 What happens to the concentration of the hydronium ions in solution **X**?

Write only INCREASES, DECREASES or REMAINS THE SAME.
Explain the answer in terms of the ionisation constant of water (Kw). (3)

7.1.3 Calculate the concentration of the OH^- ions in the final solution. (4)

7.2 A learner titrates a sodium hydroxide solution with a standard hydrochloric acid solution with a concentration of 0,0958 $mol \cdot dm^{-3}$.

$$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(\ell)$$

The learner uses a pipette to transfer 20 cm^3 of the sodium hydroxide solution into a conical flask and adds 2 drops of indicator. The solution is then titrated with the hydrochloric acid until the endpoint is reached. The titration is repeated three times. A table of the learner's results is as follows:

TITRATION NUMBER	VOLUME OF HCl ADDED (cm^3)
1	20,05
2	20,15
3	20,10

7.2.1 Calculate the average volume of hydrochloric acid added. (1)

7.2.2 Prove, with a calculation, that the initial concentration of the sodium hydroxide solution was 0,0963 mol·dm^{-3}. (4)

The standard sodium hydroxide solution is used to determine the percentage by mass of phosphoric acid (H_3PO_4) in a commercial brand of a rust remover.

A 10 g sample of the rust remover is weighed off and transferred to a volumetric flask. Thereafter, the flask is filled with distilled water up to 250 cm^3.

10 cm^3 of this diluted solution of the rust remover is titrated with 24,45 cm^3 of the sodium hydroxide solution.

The balanced chemical reaction is as follows:

$$3NaOH + H_3PO_4 \rightarrow Na_3PO_4 + 3H_2O$$

7.2.3 Calculate the percentage by mass of phosphoric acid in the original undiluted rust remover. (7)

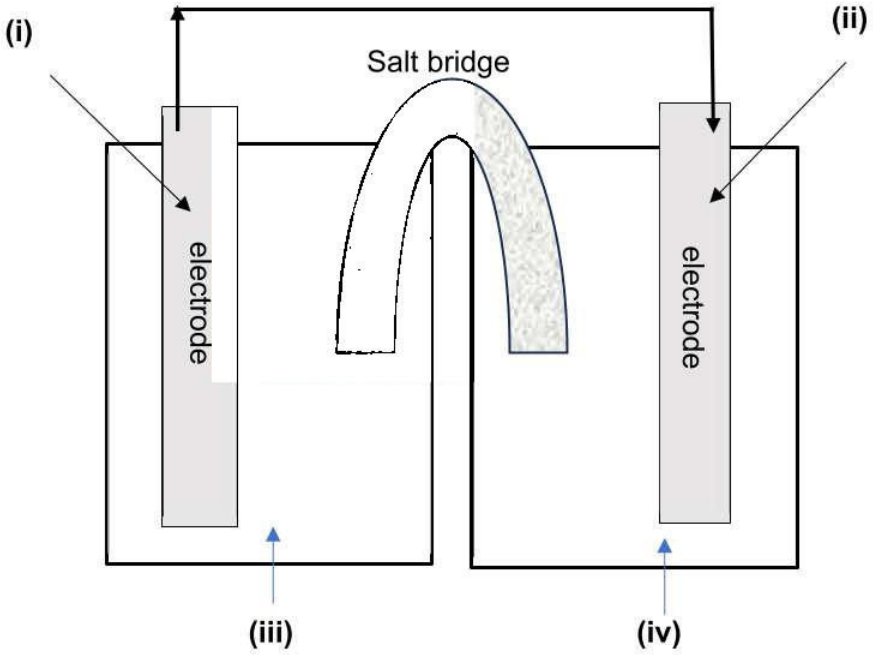
[20]

QUESTION 8 (Start on a new page.)

A learner was asked to build a functioning galvanic cell. The following are provided:

- A magnesium rod
- A copper rod
- A 1 mol·dm^{-3} sodium carbonate solution
- A 1 mol·dm^{-3} magnesium sulfate solution
- A 1 mol·dm^{-3} copper(II)sulfate solution

A partially labelled galvanic cell built by the learner is shown below.



8.1 If the electrons move from the left electrode to the right electrode, label the parts **(i)** to **(iv)** using the information provided above. (4)

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

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

8.4 State ONE function of the salt bridge. (1)

8.5 How will the following changes affect the initial emf of the cell?

Write only INCREASE, DECREASE or REMAIN THE SAME.

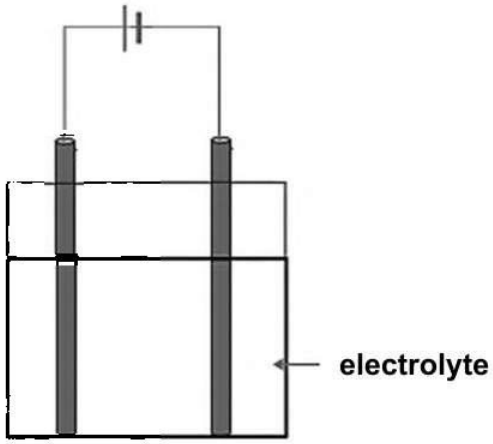
8.5.1 The concentration of the Mg^{2+} ions is increased. (2)

8.5.2 The area of the copper rod is increased. (1)

[14]

QUESTION 9 (Start on a new page.)

Impure copper is refined using an electrolytic process, as shown in the diagram below.



9.1 Define the term *electrolyte.* (2)

9.2 Name a suitable solution that can be used as an electrolyte in this process. (1)

9.3 Write down the equation for the half-reaction taking place at the anode. (2)

9.4 A precious metal, such as silver, which is usually part of the impure anode, sinks to the bottom of the cell. Explain this observation referring to the relative strength of the reducing agents. (3)

9.5 After 10 minutes, 1,6 g of pure copper is deposited on the electrode. Calculate the number of electrons that flowed through the circuit while this mass of copper was deposited. (5)

[13]

TOTAL: 150

END

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 2 (CHEMIE)

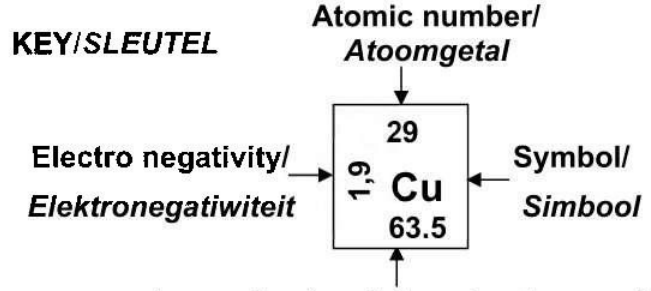
TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

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 $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	pH = -log[H_3O^+]
Kw = [H_3O^+][OH^-] = 1 x 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*



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