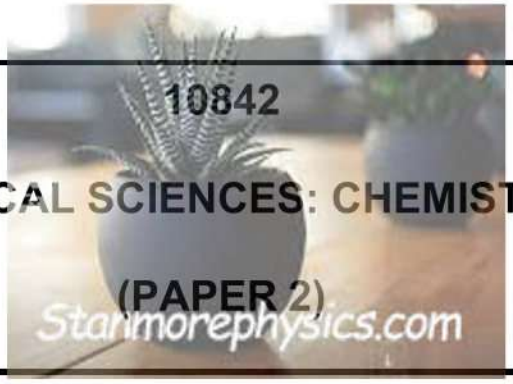
GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2024



10842

PHYSICAL SCIENCES: CHEMISTRY

(PAPER 2)

PHYSICAL SCIENCES: Paper 2

10842E

TIME: 3 hours

MARKS: 150

16 pages + 4 information sheets

X05

P.T.O.

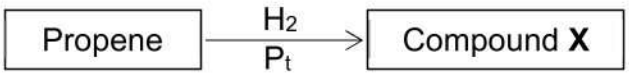
INSTRUCTIONS AND INFORMATION

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, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round-off your final numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions, etc. where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four 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 D.

1.1 Consider the flow diagram below:



Compound **X** is:

A Propyne

B Propan-1-ol

C Propane

D Propan-2-ol (2)

1.2 Which of the following compounds has the highest vapour pressure?

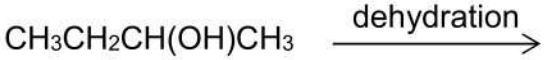
A Ethane

B Propane

C Butane

D Pentane (2)

1.3 During the dehydration of butan-2-ol represented below, a major organic compound (Y) is formed.



Which of the following is the correct condensed structural formula for compound **Y**?

A $CH_3CH_2CH_2CH_3$

B $CH_3CHCHCH_3$

C $CH_3CH_2CH(OH)CH_3$

D $CH_3CH_2CHCH_2$ (2)

1.4 The complete combustion of ONE MOLE of butane needs at least:

A 18 mol O_2

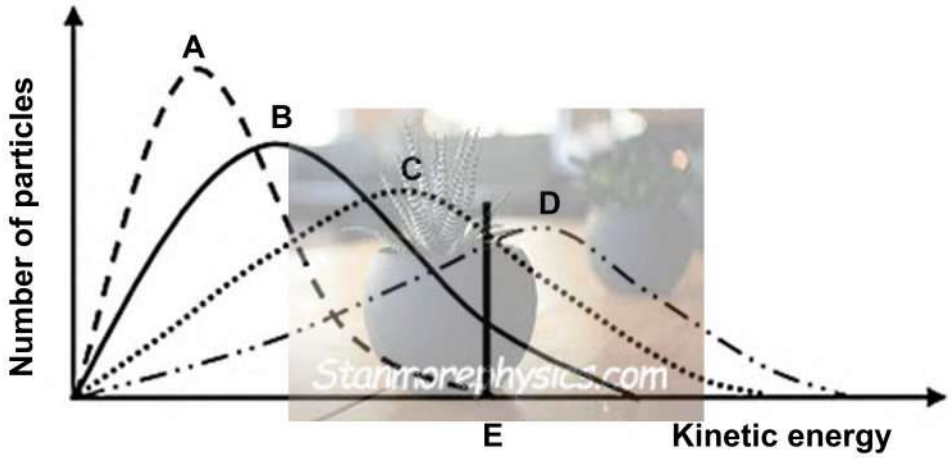
B 5 mol O_2

C 7 mol O_2

D 13 mol O_2 (2)

1.5 The Maxwell-Boltzmann energy distribution curves below show the number of particles as a function of their kinetic energy, for a reaction at four different temperatures.

The minimum kinetic energy needed for effective collisions to occur is represented by **E**.



Which of these curves represents the reaction with the highest rate?

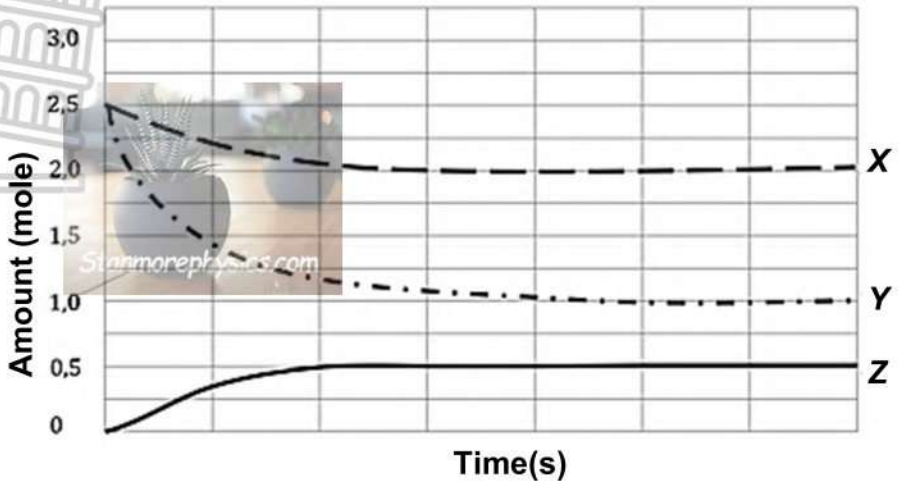
A Curve **A**

B Curve **B**

C Curve **C**

D Curve **D** (2)

1.6 The graph below shows the changes in **X**, **Y** and **Z** over time during a reaction.



Which of the following balanced chemical equations is correct for this reaction?

A $X + 3Y \rightarrow Z$

B $4X + 2Y \rightarrow Z$

C $5X + 3Y \rightarrow 2Z$

D $2X + 3Y \rightarrow 2Z$ (2)

1.7 HPO_4^{2-} is an ampholyte.

Which of the following pairs represents the conjugate acid and base of HPO_4^{2-}?

	CONJUGATE ACID	CONJUGATE BASE
A	PO_4^{3-}	$H_2PO_4^{1-}$
B	$H_2PO_4^{1-}$	PO_4^{3-}
C	$H_2PO_4^{1-}$	H_3PO_4
D	$H_2PO_4^{2-}$	PO_4^{2-}

(2)

1.8 If the concentration of a sulphuric acid solution is 1×10^{-3} mol·dm^{-3}, what will the pH and [OH^-] of the solution be, respectively?

	pH	[OH^-] (mol·dm^{-3})
A	2,7	1×10^{-11}
B	2,7	5×10^{-12}
C	3,0	5×10^{-12}
D	3,0	1×10^{-11}

(2)

1.9 Which of the following containers can be used to store an iron(II) sulphate solution?

A Aℓ

B Mg

C Ni

D Zn (2)

1.10 Consider the following reaction which takes place in a galvanic cell:

$$2Cr^{2+}(aq) + Sn^{4+}(aq) \rightleftharpoons 2Cr^{3+}(aq) + Sn^{2+}(aq)$$

The net cell potential (in V) when this cell reaches equilibrium will be …

A + 0,56.

B 0,00.

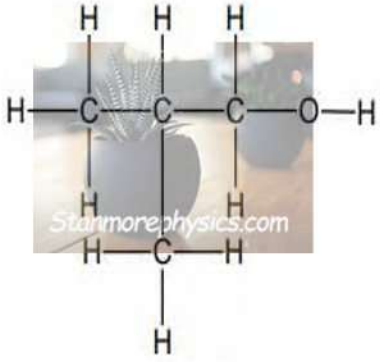
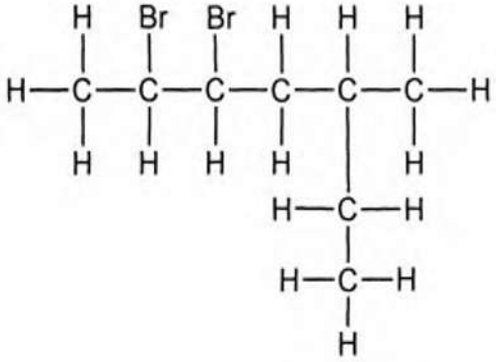
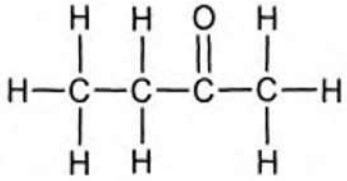
C – 0,26.

D – 0,56. (2)

[20]

QUESTION 2 (Start on a new page.)

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

A	$CH_3CH_2CH_2CH_3$	**B**	Butanal
C		**D**	
E		**F**	CxHyOz

2.1 Is compound **A**, a SATURATED or an UNSATURATED hydrocarbon? Give a reason for the answer. (2)

2.2 Write down the LETTER/S that represent(s) each of the following:

2.2.1 A ketone (1)

2.2.2 A haloalkane (1)

2.2.3 The two functional isomers (1)

2.3 Consider compound **C**:

2.3.1 Is compound **C** a PRIMARY, SECONDARY or TERTIARY alcohol? Give a reason for the answer. (2)

2.3.2 Write down the STRUCTURAL FORMULA and IUPAC name of a chain isomer of compound **C**. (2)

2.4 Write down the:

2.4.1 IUPAC name for compound **D** (2)

2.4.2 NAME of the functional group of compound **B** (1)

2.5 A sample of compound **F** contains 40% C; 53,3% O and X% H.

2.5.1 If the molar mass is 60 $g \cdot mol^{-1}$, calculate the MOLECULAR FORMULA of compound **F**. (4)

2.5.2 Write down the IUPAC names of the two organic compounds that will have this molecular formula. (2)

[18]

QUESTION 3 (Start on a new page.)

The table below shows the boiling points of four organic compounds, represented by the letters **A** to **D**, of comparable molecular masses.

COMPOUND	IUPAC NAME	MOLAR MASS ($g \cdot mol^{-1}$)	BOILING POINT (°C)
A	2,3-dimethylbutane	86	57,9
B	Hexane	86	68,7
C	Methyl propanoate	88	79,8
D	Pentan-1-ol	88	X or Y

3.1 Compounds **A** and **B** are structural isomers.

3.1.1 Define the term *structural isomers*. (2)

3.1.2 The boiling point of compound **B** is higher than the boiling point of compound **A**. Explain the difference in the boiling points. (3)

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

3.3 Which ONE of the compounds **B** or **C**, will have a higher vapour pressure? Give a reason for the answer. (2)

3.4 Consider compounds **C** and **D**.

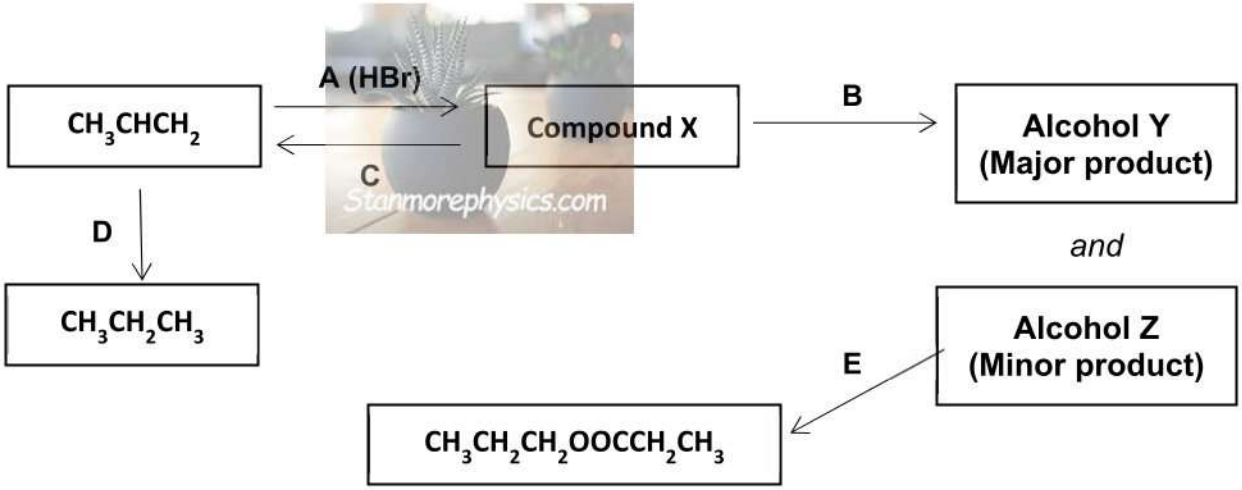
3.4.1 Will the boiling point of compound **D** be X = 75,5 °C OR Y = 135,5 °C? Write down only X or Y. (1)

3.4.2 Explain the answer to QUESTION 3.4.1. (3)

[13]

QUESTION 4 (Start on a new page.)

Consider the following sequence of organic reactions labelled **A** to **E**.



4.1 Write down the type of reaction that occurs at:

4.1.1 **A** (1)

4.1.2 **C** (1)

4.2 Write down the NAME or FORMULA of the catalyst for reaction **D**. (1)

4.3 Reaction **B** is a substitution reaction that takes place in the presence of water.

Write down the:

4.3.1 Type of substitution reaction for **B** (1)

4.3.2 TWO other reaction conditions for this reaction (2)

4.3.3 IUPAC name of the major product **Y** (2)

4.4 Use the structural formulae to write a balance equation for reaction **B**, showing the formation of alcohol **Y**. (3)

4.5 Reaction **E** is a reaction between minor product, alcohol **Z** and a carboxylic acid to form an ester.

Write down the:

4.5.1 Name of this type of reaction (1)

4.5.2 Name of the inorganic compound formed during this reaction (1)

4.5.3 Name of the catalyst needed for this reaction (1)

4.5.4 IUPAC name for the functional isomer of the ester formed (2)

4.6 Draw the STRUCTURAL FORMULA of the functional group of the carboxylic acid. (1)

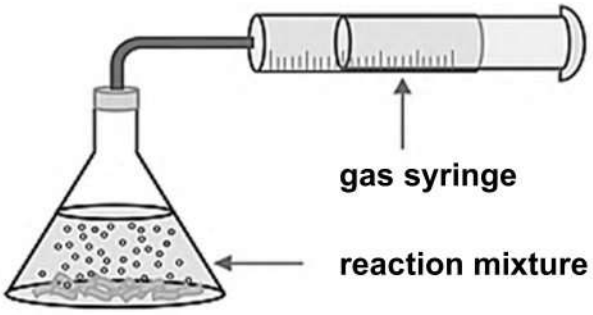
[17]

QUESTION 5 (Start on a new page.)

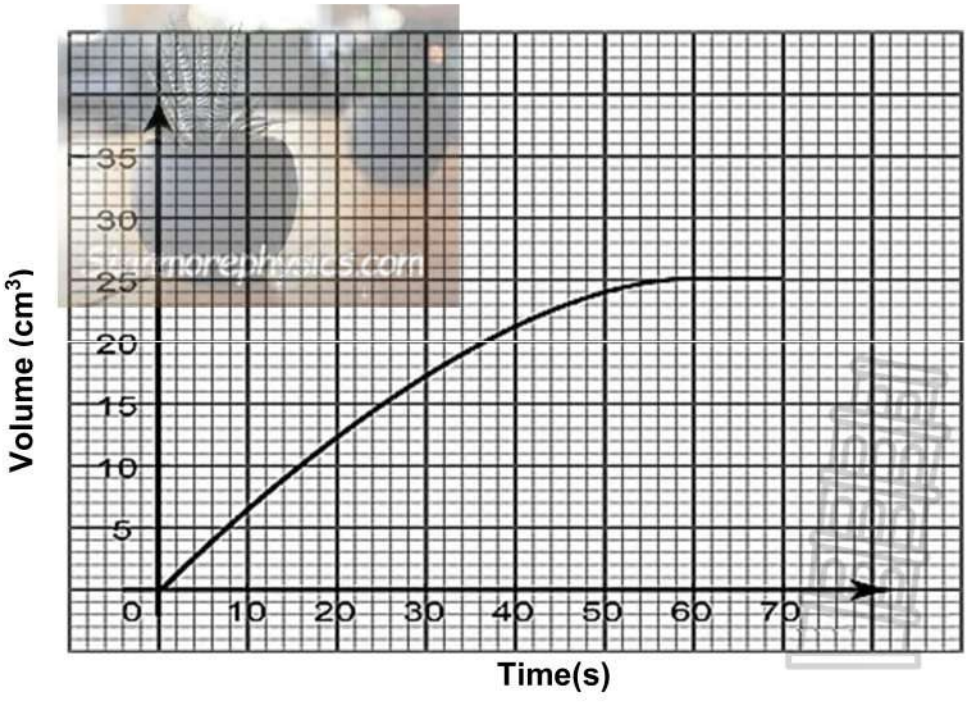
Learners are asked to investigate the rate at which 0,3 g of impure calcium carbonate will react with an excess of 1 mol·dm^{-3} hydrochloric acid at room temperature to produce CO_2 gas.

The equation for the reaction is:

$$CaCO_3\,(s) + 2HC\ell\,(aq) \rightarrow CaC\ell_2(aq) + H_2O(\ell) + CO_2(g)$$



The graph below represents the volume of $CO_2(g)$ produced at regular time intervals.



5.1 Write down:

5.1.1 An investigative question for this experiment (2)

5.1.2 A controlled variable (1)

5.1.3 The dependent variable for this investigation (1)

5.2 With reference to the graph, how will the rate of reaction between the time 0 s to 20 s compare with the reaction rate between time 30 s to 50 s? (1)

5.3 What conclusion can be drawn from the graph between the time 60 s and 70 s? (1)

5.4 Use the graph to calculate the mass of calcium carbonate that reacted. The molar volume is 24 dm^3 at room temperature. (5)

5.5 Calculate the percentage purity of the calcium carbonate which reacted in the above reaction. (2)

5.6 The learners repeat their investigation by using 0,3 g of the same impure calcium carbonate but increased the concentration of hydrochloric acid to 2 $mol \cdot dm^{-3}$.

5.6.1 How will the gradient of the graph change when the concentration of the acid is increased? (1)

5.6.2 Use the *Collision Theory* to explain how an increase in concentration affects the rate of reaction. (3)

[17]

QUESTION 6 (Start on a new page.)

Potassium dichromate is formed when nitric acid is slowly added to a potassium chromate solution. The chromate ions (CrO_4^{2-}) in the solution reach equilibrium with the dichromate ions $(Cr_2O_7^{2-})$ according to the following balanced ionic equation:

$$2CrO_4^{2-}(aq) + 2H^+(aq) \quad \rightleftharpoons \quad Cr_2O_7^{2-}(aq) + H_2O(\ell)$$

Yellow Orange

6.1 Define the term *chemical equilibrium*. (2)

6.2 A concentrated nitric acid solution is now added to this reaction mixture.

6.2.1 What colour change will be observed in the mixture? Choose from MORE YELLOW or MORE ORANGE. (1)

6.2.2 Explain the answer to QUESTION 6.2.1 in terms of Le Chatelier's principle. (3)

6.3 When the temperature of the original reaction mixture is increased, it is observed that the colour of the mixture changes to yellow.

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

6.3.2 Explain the answer to QUESTION 6.3.1 in terms of Le Chatelier's principle. (3)

6.4 11 mol CrO_4^{2-}(aq) and **x** mol H^+(aq) are initially added together to make a 0,5 dm^3 solution and allowed to react.

When the reaction reaches equilibrium, the solution contains 9 mol·dm^{-3} $Cr_2O_7^{2-}$ (aq).

Calculate the initial mole of H^+(aq) placed in the container if the equilibrium constant is 0,09. (8)

[18]

QUESTION 7 (Start on a new page.)

7.1 A solution of carbonic acid has a pH of 4,2 and the following Ka value:

$$K_a = 4{,}30 \times 10^{-7}$$

A solution of sulphuric acid has the following Ka value:

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$$K_a = 1{,}0 \times 10^{3}$$

7.1.1 Calculate the concentration of the hydronium ions in the carbonic acid solution. (3)

7.1.2 How will the strength of the carbonic acid compare to that of sulphuric acid if both acids have a concentration of 0,02 mol·dm^{-3}?

Write only that the carbonic acid is STRONGER THAN, WEAKER THAN or THE SAME AS sulphuric acid. Give a reason for the answer. (2)

7.2 A solution of vinegar can be neutralised with a solution of sodium hydroxide. The reaction takes place according to the following balanced equation:

$$CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa(aq) + H_2O(\ell)$$

The sodium acetate produced during this reaction can undergo hydrolysis.

7.2.1 Define the term *hydrolysis*. (1)

7.2.2 Will the pH of the sodium acetate solution be GREATER THAN or LESS THAN 7? (1)

7.2.3 Explain the answer to QUESTION 7.2.2 by referring to a balanced equation. (3)

7.3 An unknown carbonate has a chemical formula of Y_2CO_3. A learner is asked to identify element **Y**.

The learner adds 0,5865 g of the carbonate in a conical flask containing 25 cm^3 hydrochloric acid solution with a concentration of 0,3 $mol \cdot dm^{-3}$. The balanced equation for the reaction that takes place is:

$$2HC\ell(aq) + Y_2CO_3(aq) \rightarrow 2YC\ell(aq) + CO_2(g) + H_2O(\ell)$$

The hydrochloric acid is in EXCESS.

7.3.1 Calculate the initial mole of hydrochloric acid in the conical flask. (3)

Once the mixture has stopped fizzing, 15 cm^3 of a 0,1 $mol \cdot dm^{-3}$ NaOH(aq) is added to the mixture to neutralise any remaining hydrochloric acid.

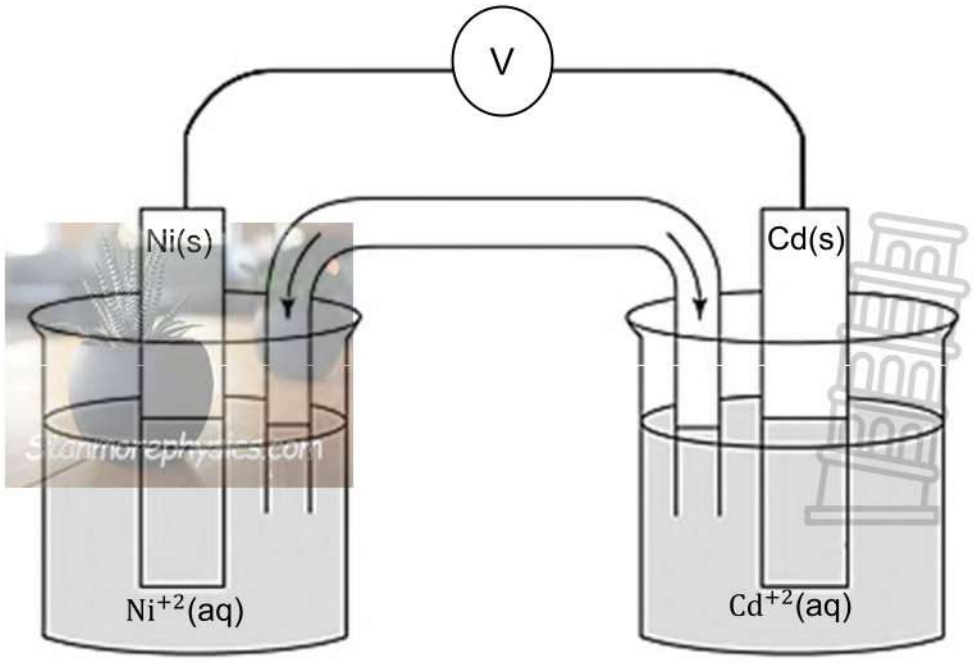
7.3.2 Calculate the amount of hydrochloric acid (in mole) that reacted with the unknown carbonate. (4)

7.3.3 Identify element **Y**. Show ALL calculations. (5)

[22]

QUESTION 8 (Start on a new page.)

8.1 A galvanic cell is constructed as shown in the diagram below.



8.1.1 Which electrode is cathode? Write only NICKEL or CADMIUM. (1)

8.1.2 Write down the equation for the oxidation half-reaction of this cell. (2)

8.1.3 How will the reading on the voltmeter be affected if the concentration of the nickel ions is increased after the cell has reached equilibrium?

Choose from INCREASE, DECREASE or REMAIN THE SAME.

Give a reason for the answer. (2)

8.2 Consider the following standard electrochemical cell:

$$Cu(s)|Cu^{2+}(aq)(1mol \cdot dm^{-3}) \parallel Ag^{1+}(aq)(1mol \cdot dm^{-3})|Ag(s)$$

Initially each half cell contains 200 cm^3 electrolyte.

The cell is connected to a circuit and allowed to produce current until the concentration of the electrolyte in the cathode half-cell is reduced to 0,5 $mol \cdot dm^{-3}$.

The cell is then disconnected.

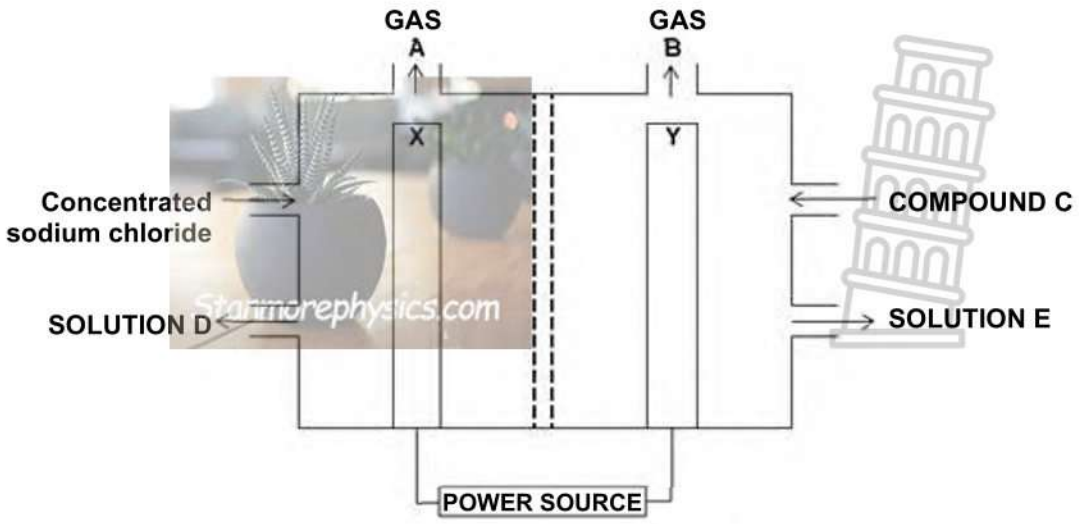
8.2.1 Write a balanced equation for the net ionic cell reaction. (3)

8.2.2 Calculate the concentration of the electrolyte in the anode half-cell when the cell is disconnected. (7)

[15]

QUESTION 9 (Start on a new page.)

Electrolysis is generally used in industry to produce chemicals through the decomposition of compounds.The simplified diagram below represents an electrolytic cell used in the electrolysis of a concentrated sodium chloride solution.



9.1 Define the term *anode* in terms of oxidation or reduction. (1)

9.2 Which electrode, **X** or **Y**, is connected to the positive terminal of the power source? Give a reason for the answer. (2)

9.3 Write down the NAME or CHEMICAL FORMULA of:

9.3.1 Gas **A** (1)

9.3.2 Compound **C** (1)

9.4 Write down the equation for the half-reaction that takes place at the cathode of the cell. (2)

9.5 Refer to the relative strength of the oxidising agents to explain the answer to QUESTION 9.4. (3)
[10]

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	$6{,}02 \times 10^{23}$

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^+]
$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ / $E^{\theta}_{sel} = E^{\theta}_{katode} - E^{\theta}_{anode}$ $E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ / $E^{\theta}_{sel} = E^{\theta}_{reduksie} - E^{\theta}_{oksidasie}$ $E^{\theta}_{cell} = E^{\theta}_{oxidising\ agent} - E^{\theta}_{reducing\ agent}$ / $E^{\theta}_{sel} = E^{\theta}_{oksideermiddel} - E^{\theta}_{reduseermiddel}$	

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

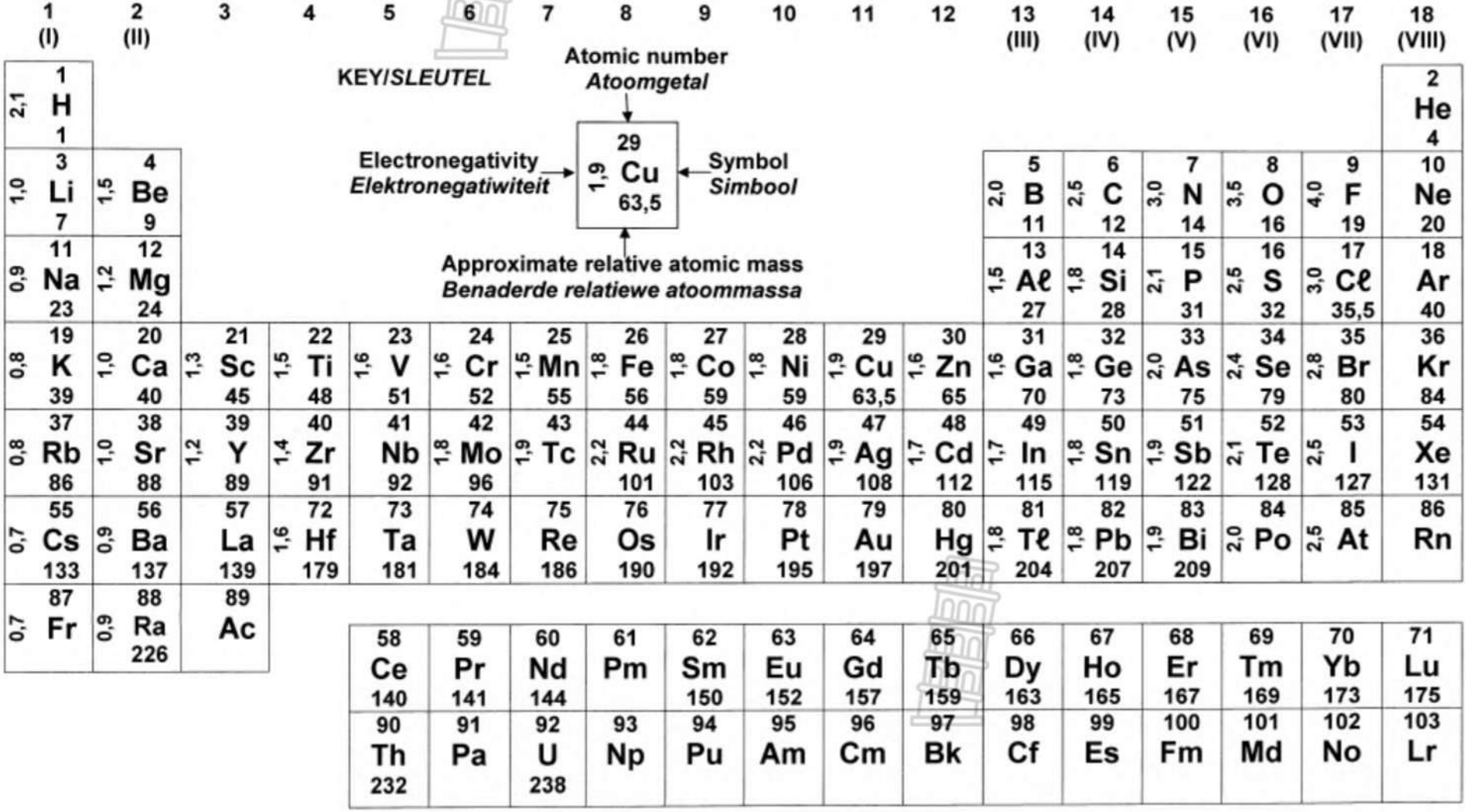


TABLE 4A: STANDARD REDUCTION POTENTIALS
TABEL 4A: STANDAARD REDUKSIEPOTENSIALE

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

Increasing oxidising ability/*Toenemende oksiderende 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

Increasing reducing ability/*Toenemende reduserende vermoë* ↑