Confidential

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

PHYSICAL SCIENCES: CHEMISTRY (P2)

MAY/JUNE 2025

MARKS: 150

TIME: 3 hours

This question paper consists of 16 pages and 4 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your centre number and examination number in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of NINE questions. Answer ALL the questions in the ANSWER BOOK.

3. Start EACH question on a NEW page in the ANSWER BOOK.

4. Number the answers correctly according to the numbering system used in this question paper.

5. Leave ONE line between two subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.

6. You may use a non-programmable calculator.

7. Show ALL formulae and substitutions in ALL calculations.

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

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

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

11. Write neatly and legibly. 2025

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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

1.1 How many types of Van der Waals forces are present between the molecules of CH_3CH_2Br?

A 1

B 2

C 3

D 4 (2)

1.2 Which ONE of the following is the CORRECT formula of methylbutanone?

A $CH_3CH(OH)CH(CH_3)CH_3$

B $HCOOCH(CH_3)CH_2CH_3$

C $CH_3CH_2CH(CH_3)CHO$

D $CH_3COCH(CH_3)CH_3$ (2)

1.3 A compound $CH_3(CH_2)_5CH_3$ undergoes the following reaction:

$$CH_3(CH_2)_5CH_3 \longrightarrow \mathbf{R} + CH_3(CH_2)_2CH_3$$

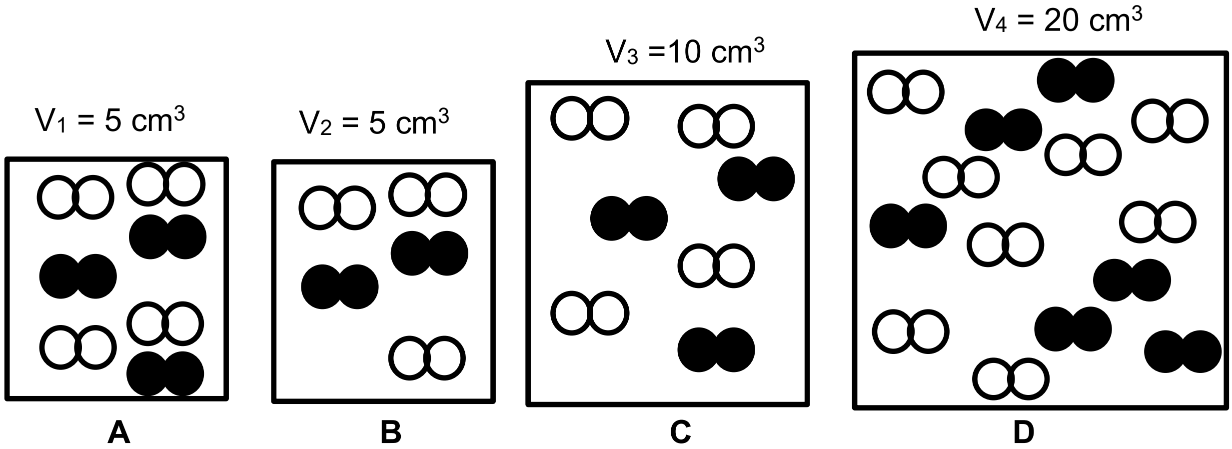
Which ONE of the following combinations CORRECTLY describes the type of reaction and the IUPAC name of compound **R**?

	TYPE OF REACTION	IUPAC NAME
A	Elimination	Propane
B	Addition	Propene
C	Cracking	Propane
D	Cracking	Propene

(2)

1.4 Two gases are added into each of four empty containers at the same temperature. The diagrams below show the molecules of the gases and the volumes of the containers at the start of the reaction.

In which ONE of the following containers is the initial reaction rate the highest?



(2)

1.5 Which ONE of the following statements is TRUE for the effect of a catalyst on a reaction at equilibrium?

A The equilibrium constant increases.

B The rate of the reverse reaction increases.

C The activation energy for the reverse reaction increases.

D The enthalpy change, ΔH, for the forward reaction decreases. (2)

1.6 Carbonyl chloride gas, $COC\ell_2(g)$, decomposes in a closed container and reaches equilibrium according to the following equation:

$$COC\ell_2(g) \rightleftharpoons CO(g) + C\ell_2(g) \qquad \Delta H > 0$$

Consider the following statements.

An increase in temperature will:

(i) Favour the reverse reaction
(ii) Increase the concentration of the products
(iii) Increase the equilibrium constant

Which of the statements above are TRUE?

A (i) and (ii) only

B (i) and (iii) only

C (ii) and (iii) only

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

1.7 Consider the equation for the acid-base reaction below.

$$HSO_4^-(aq) + NH_3(aq) \rightleftharpoons SO_4^{2-}(aq) + NH_4^+(aq)$$

The two acids in this reaction are …

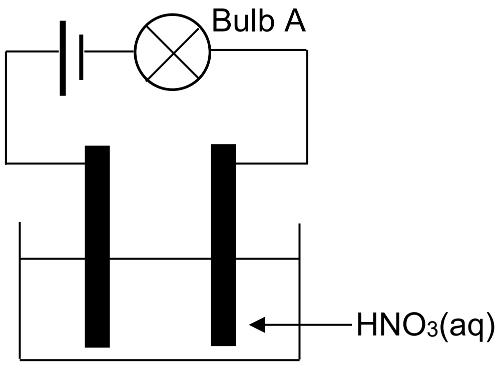
A $NH_3(aq)$ and $NH_4^+(aq)$

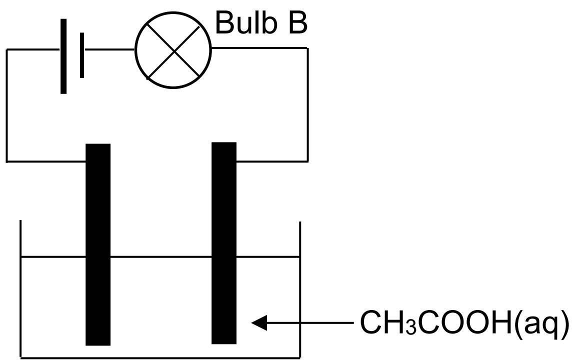
B $HSO_4^-(aq)$ and $SO_4^{2-}(aq)$

C $HSO_4^-(aq)$ and $NH_3(aq)$

D $HSO_4^-(aq)$ and $NH_4^+(aq)$ (2)

1.8 The conductivity of two acids, HNO_3(aq) and CH_3COOH(aq), each with a concentration of 1 mol·dm^{-3}, is compared at 25 °C. The simplified diagrams below show the apparatus used. The electrodes are made of carbon.





Which ONE of the following combinations CORRECTLY describes the brightness of bulb A and bulb B, and provides the reason for this?

	BRIGHTNESS OF BULBS	REASON
A	A is brighter than B	CH_3COOH is the stronger acid
B	A is brighter than B	HNO_3 is the stronger acid
C	B is brighter than A	CH_3COOH is the weaker acid
D	A and B have equal brightness	Acids are of equal concentration

(2)

1.9 Which ONE of the following combinations of temperature and pressure is CORRECT for the standard hydrogen half-cell?

	TEMPERATURE (°C)	PRESSURE (kPa)
A	0	273
B	25	273
C	25	101,3
D	0	101,3

(2)

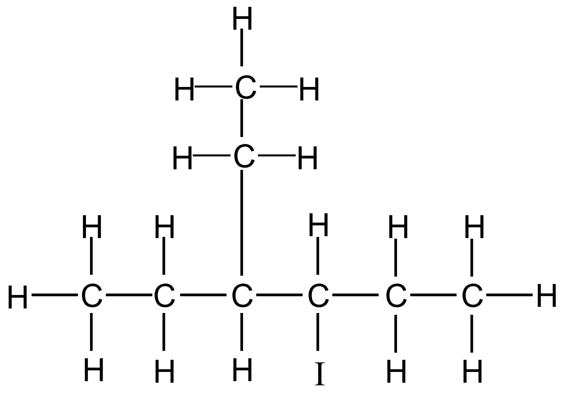
1.10 Impure copper is refined in an electrolytic cell. Which ONE of the following combinations CORRECTLY identifies the anode and the electrolyte for this cell?

	ANODE	ELECTROLYTE
A	Pure copper	$Cu(NO_3)_2$(aq)
B	Pure copper	$AgNO_3$(aq)
C	Impure copper	$Cu(NO_3)_2$(aq)
D	Impure copper	$AgNO_3$(aq)

(2)
[20]

QUESTION 2 (Start on a new page.)

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

A	$C_5H_{10}O$	**B**	
C	Butanoic acid	**D**	$(CH_3)_3COH$
E	$CH_2C(CH_3)_2$	**F**	$HCOOCH_2CH_2CH_3$

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

2.2 Write down the LETTER that represents EACH of the following:

2.2.1 An unsaturated compound (1)

2.2.2 A functional isomer of compound **C** (1)

2.3 Name the TWO homologous series to which **A** belongs. (2)

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

2.5 Write down the IUPAC name of:

2.5.1 Compound **B** (3)

2.5.2 The POSITIONAL isomer of compound **D** (2)

2.6 Ethanol reacts with compound **C** to form an organic compound **Z**.

Write down the:

2.6.1 Type of reaction (1)

2.6.2 STRUCTURAL FORMULA of compound **Z** (2)

2.7 Write down the:

2.7.1 Empirical formula of compound **F** (1)

2.7.2 STRUCTURAL FORMULA of the CHAIN ISOMER of compound **E** (2)

[19]

QUESTION 3 (Start on a new page.)

3.1 The boiling points of straight chain aldehydes and straight chain carboxylic acids are compared. The table below shows the results obtained.

	INVESTIGATION 1	**INVESTIGATION 2**
Number of carbon atoms in the compound	**Boiling point of aldehydes (°C)**	**Boiling point of carboxylic acids (°C)**
1	-19	101
2	20	118
3	49	141
4	75	164

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

3.1.2 Write down the:

(a) NAME of the FUNCTIONAL GROUP of the aldehydes (1)

(b) IUPAC NAME of the compound with the highest vapour pressure in this comparison (2)

3.1.3 For INVESTIGATION **2**:

(a) Write down the controlled variable. (1)

(b) Describe the trend in the boiling points. (1)

(c) Fully explain the answer to QUESTION 3.1.3(b). (2)

3.1.4 Write down the boiling point of butanal. (1)

3.2 The vapour pressures of compounds **A** and **B** are compared.

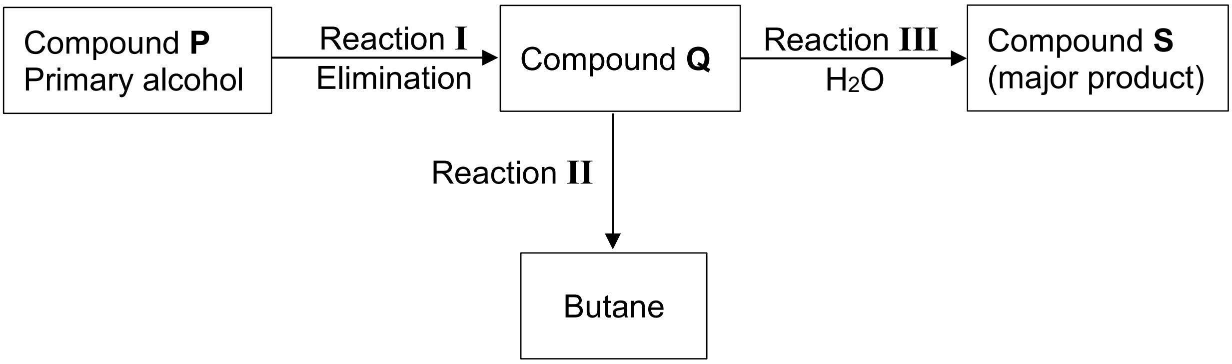
A	$CH_3CH_2CH_2CH_2CH_2OH$
B	$CH_3CH_2CH_2COOH$

How does the vapour pressure of compound **A** compare to that of compound **B**? Choose from HIGHER THAN, LOWER THAN or EQUAL TO.

Fully explain the answer. (4)
[14]

QUESTION 4 (Start on a new page.)

In the flow diagram below, a primary alcohol **P** is used as a starting reactant to form different organic compounds under different reaction conditions.



4.1 Write down the TYPE of:

4.1.1 Addition reaction represented by reaction **II** (1)

4.1.2 Elimination reaction represented by reaction **I** (1)

4.2 Write down the IUPAC name of compound **P**. (2)

4.3 Consider reaction **III**.

Write down:

4.3.1 The balanced equation using CONDENSED structural formulae (4)

4.3.2 The NAME or FORMULA of a suitable catalyst (1)

4.4 Butane can be converted to compound **P** in a TWO-STEP reaction. Use STRUCTURAL FORMULAE and write down the balanced equations for these TWO reactions. (5)

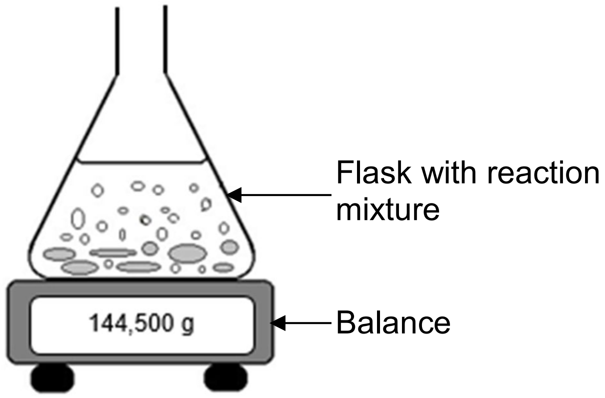
4.5 Write down a balanced equation using MOLECULAR FORMULAE for the complete combustion of butane. (3)
[17]

QUESTION 5 (Start on a new page.)

The reaction between magnesium carbonate pellets, $MgCO_3(s)$, and EXCESS dilute hydrochloric acid, $HC\ell(aq)$, is used to investigate the effect of concentration on the rate of a reaction.

$$MgCO_3(s) + 2HC\ell(aq) \rightarrow MgC\ell_2(aq) + H_2O(\ell) + CO_2(g)$$

The apparatus used for this investigation is shown below.



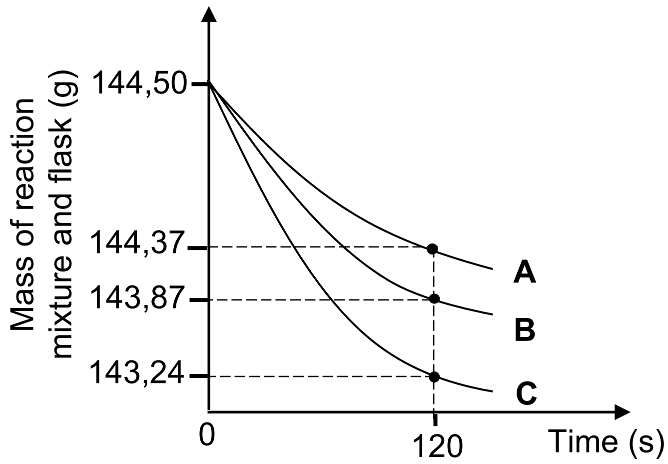
5.1 Define the term *rate of reaction*. (2)

5.2 Write down ONE controlled variable for this investigation. (1)

Three experiments using different concentrations of HCℓ(aq) are carried out. The concentration of the HCℓ(aq) during each experiment does not change.

EXPERIMENT	**CONCENTRATION OF HCℓ(aq) ($mol \cdot dm^{-3}$)**
1	0,1
2	0,5
3	1,0

The INCOMPLETE graph of the results of the experiments is shown below.



5.3 Give a reason why the mass of the reaction mixture and flask decreases. (1)

5.4 For curve **B**, calculate the average rate at which $CO_2(g)$ is produced for the first 120 s in $dm^3 \cdot s^{-1}$. The molar gas volume is 24,5 $dm^3 \cdot mol^{-1}$. (6)

5.5 Which curve represents EXPERIMENT **1**? Choose from **A**, **B** or **C**.

Use the collision theory to explain the answer. (5)

5.6 How will the final mass of $CO_2(g)$ produced in EXPERIMENT **2** compare to that of EXPERIMENT **3**? Choose from MORE THAN, LESS THAN or THE SAME.

Give a reason for the answer. (2)
[17]

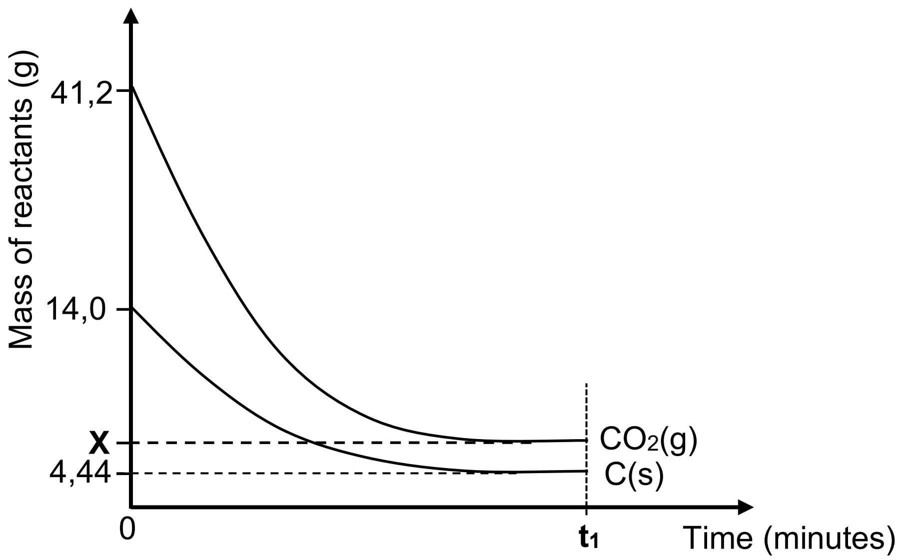
QUESTION 6 (Start on a new page.)

The reaction between powdered carbon, C(s), and carbon dioxide gas, $CO_2(g)$, takes place in a closed 3 dm^3 container according to the balanced equation below.

$$C(s) + CO_2(g) \rightleftharpoons 2CO(g) \qquad \Delta H < 0$$

Equilibrium is reached at temperature T °C.

The graph below, not drawn to scale, shows the curves for the mass of the reactants in the container against time.



6.1 How will EACH of the following changes affect the number of moles of $CO_2(g)$ at equilibrium?

Choose from INCREASES, DECREASES or REMAINS THE SAME.

6.1.1 A catalyst is added. (1)

6.1.2 The volume of the container is increased at a constant temperature. (1)

6.1.3 More powdered carbon is added. (1)

6.2 Explain the answer to QUESTION 6.1.2 by referring to Le Chatelier's principle. (2)

6.3 Calculate the value of **X** shown on the graph. (6)

6.4 Calculate the equilibrium constant, K_c, at T °C. (5)

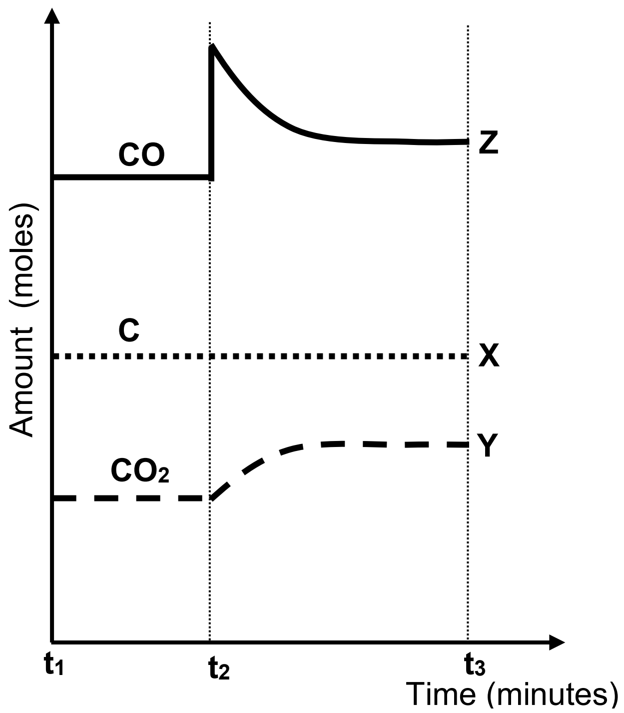
The balanced equation for this reaction is rewritten below for easy reference.

$$C(s) + CO_2(g) \rightleftharpoons 2CO(g) \qquad \Delta H < 0$$

6.5 The graph below shows the equilibrium number of moles of CO(g), C(s) and CO_2(g) in the flask at time $\mathbf{t_1}$.

At $\mathbf{t_2}$, some CO(g) is added to the flask and the reaction is allowed to reach equilibrium. Curve **Z** correctly shows the change in the amount of CO(g) between $\mathbf{t_2}$ and $\mathbf{t_3}$.

A learner draws corresponding curves, labelled **X** and **Y**, for C(s) and CO_2(g) respectively.



Which of these curves is the CORRECT representation for these changes?

Choose from: **X** or
Y or
X and **Y** (2)

6.6 What effect will the addition of CO(g) have on the equilibrium constant, K_c? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

[19]

QUESTION 7 (Start on a new page.)

7.1 Define an *acid* according to the Arrhenius theory. (2)

7.2 The table below shows aqueous solutions of different substances, each of concentration 1 mol·dm^{-3} at room temperature.

HNO_3(aq)	H_2SO_4(aq)	NaCℓ(aq)	NaOH(aq)	
$(COOH)_2$(aq)	HCO_3^-(aq)	$Mg(OH)_2$(aq)	NH_3(aq)	CH_3COOH(aq)

Identify from the table and write down the FORMULA for:

7.2.1 A weak diprotic acid (1)

7.2.2 A solution with a pH of 7 (1)

7.2.3 An ampholyte (1)

7.2.4 The solution, which when neutralised with $(COOH)_2$(aq), will have a pH greater than 7 (2)

7.3 An unknown acid H_xY is investigated.

During a titration, 23,64 cm^3 of a 0,11 mol·dm^{-3} H_xY solution neutralises 20 cm^3 of a 0,26 mol·dm^{-3} NaOH solution.

Calculate the value of x. Hence, write down the balanced equation for this reaction. (6)

7.4 In an experiment, 1,5 g of a powdered IMPURE calcium carbonate sample, $CaCO_3$(s), is reacted with 200 cm^3 of a 0,15 mol·dm^{-3} hydrochloric acid solution, HCℓ(aq). The balanced equation for the reaction is:

$$CaCO_3(s) + 2HCℓ(aq) \rightarrow CaCℓ_2(aq) + CO_2(g) + H_2O(ℓ)$$

All the CO_2(g) formed escapes from the solution.

The resulting solution has a pH of 1,61 and a volume of 200 cm^3.

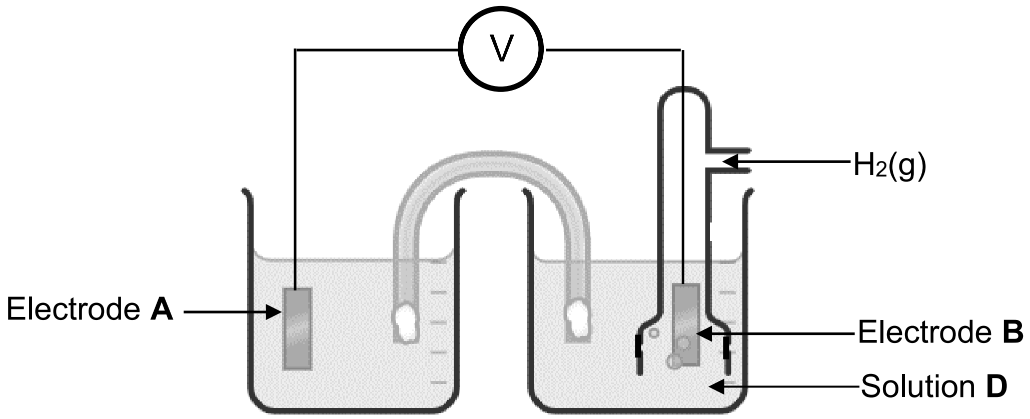
Assume that ALL the $CaCO_3$(s) in the impure sample reacted with the HCℓ(aq) and none of the impurities reacted.

Calculate the mass of the impurities present in the 1,5 g sample of impure $CaCO_3$(s). (9)
[22]

QUESTION 8 (Start on a new page.)

The simplified diagram below shows a cell that can be used to measure the standard electrode potential of the half-reaction represented by the equation below.

$$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq)$$



8.1 For solution **D**, write down the NAME or FORMULA of the ions needed. (1)

8.2 Write down the initial reading on the voltmeter. (1)

8.3 Which electrode, **A** or **B**, is the cathode? (1)

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

8.5 Write down the:

8.5.1 NAME or FORMULA of the metal used as electrode **A** (1)

8.5.2 Half-reaction that occurs at electrode **B** (2)

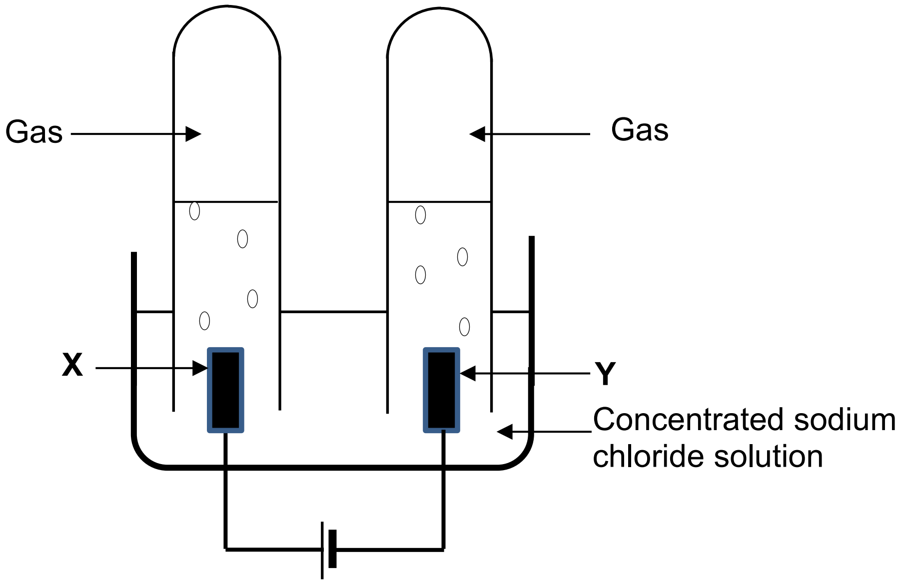
8.5.3 Cell notation for this cell (3)

8.6 Give a reason why the voltmeter reading drops to zero after the cell has operated for some time. (1)
[13]

QUESTION 9 (Start on a new page.)

The simplified diagram below represents an electrolytic cell used to demonstrate the electrolysis of a concentrated sodium chloride solution, NaCℓ(aq).

X and **Y** are carbon electrodes.



9.1 Define the term *electrolysis.* (2)

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

9.3 What is the direction of the electron flow in the external circuit? Choose from **X** to **Y** or **Y** to **X**. (1)

9.4 Calculate the number of electrons transferred through the external circuit when 300 cm^3 gas is collected at electrode **X**.

Take the molar gas volume as 24 $dm^3 \cdot mol^{-1}$. (4)
[9]

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

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

KEY/*SLEUTEL*

Atomic number / *Atoomgetal*	Electronegativity / *Elektronegatiwiteit*	Symbol / *Simbool*	Approximate relative atomic mass / *Benaderde relatiewe atoommassa*
29	1,9	Cu	63,5

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1 2,1 H 1																	2 He 4
3 1,0 Li 7	4 1,5 Be 9											5 2,0 B 11	6 2,5 C 12	7 3,0 N 14	8 3,5 O 16	9 4,0 F 19	10 Ne 20
11 0,9 Na 23	12 1,2 Mg 24											13 1,5 Aℓ 27	14 1,8 Si 28	15 2,1 P 31	16 2,5 S 32	17 3,0 Cℓ 35,5	18 Ar 40
19 0,8 K 39	20 1,0 Ca 40	21 1,3 Sc 45	22 1,5 Ti 48	23 1,6 V 51	24 1,6 Cr 52	25 1,5 Mn 55	26 1,8 Fe 56	27 1,8 Co 59	28 1,8 Ni 59	29 1,9 Cu 63,5	30 1,6 Zn 65	31 1,6 Ga 70	32 1,8 Ge 73	33 2,0 As 75	34 2,4 Se 79	35 2,8 Br 80	36 Kr 84
37 0,8 Rb 86	38 1,0 Sr 88	39 1,2 Y 89	40 1,4 Zr 91	41 Nb 92	42 1,8 Mo 96	43 1,9 Tc	44 2,2 Ru 101	45 2,2 Rh 103	46 2,2 Pd 106	47 1,9 Ag 108	48 1,7 Cd 112	49 1,7 In 115	50 1,8 Sn 119	51 1,9 Sb 122	52 2,1 Te 128	53 2,5 I 127	54 Xe 131
55 0,7 Cs 133	56 0,9 Ba 137	57 La 139	72 1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 1,8 Tℓ 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po	85 2,5 At	86 Rn
87 0,7 Fr	88 0,9 Ra 226	89 Ac															
				58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
				90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

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

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

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

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
$Cℓ_2(g) + 2e^-$	⇌	$2Cℓ^-$	+ 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
$Br_2(ℓ) + 2e^-$	⇌	$2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^-$	⇌	$NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^-$	⇌	$Hg(ℓ)$	+ 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
$Aℓ^{3+} + 3e^-$	⇌	$Aℓ$	− 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

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

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