GAUTENG PROVINCE

EDUCATION

REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION
PREPARATORY EXAMINATION
2019

10842

PHYSICAL SCIENCES: CHEMISTRY

PAPER 2

TIME: 3 hours

MARKS: 150

16 pages + 4 data sheets and 1 answer sheet

PHYSICAL SCIENCES: Paper 2

10842E

X10

GAUTENG DEPARTMENT OF EDUCATION

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PHYSICAL SCIENCES: CHEMISTRY
(Paper 2)

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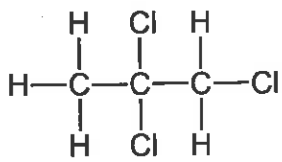
INSTRUCTIONS AND INFORMATION

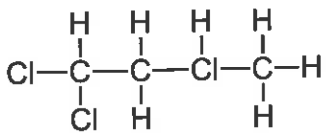
1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of 10 questions. Answer ALL the questions in the ANSWER BOOK.
3. Start the answer to each question on a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line open between sub-questions, 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. 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 discussions, et cetera where required.
12. Write neatly and legibly.

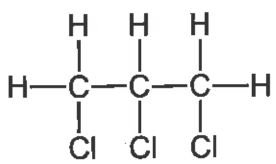
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

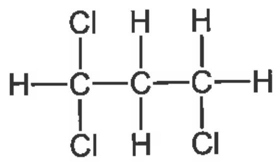
Four options are given as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question number (1.1 – 1.10) in the ANSWER BOOK.

1.1 Which ONE of the following is the correct structural formula for 1,2,2-trichloropropane?

A


B


C


D


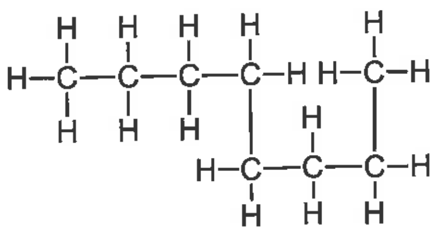
(2)

1.2 Which ONE of the following pairs of compounds contains members of the same homologous series?

A C_2H_4 and C_3H_8
B C_3H_6 and C_4H_6
C CH_4O and $C_2H_4O_2$
D C_2H_4O and C_3H_6O

(2)

1.3 Consider the following structural formula of an organic compound and the statements referring to it.



I. The compound belongs to the same homologous series as methane.
II. The compound is a hydrocarbon.
III. The compound has a higher boiling point than methane.

Which of the above statements are correct?

A Only I
B I and II
C II and III
D I, II and III

(2)

1.4 The following equation represents the chemical reaction of the dissociation of pure distilled water:

$$H_2O \rightleftharpoons H^+(aq) + OH^-(aq) \qquad \Delta H > 0$$

How will the pH and the acid-base properties of distilled water be affected if the temperature of the water is increased?

	pH	Acid-base properties
A	Decreases	Becomes acid
B	Decreases	Remains neutral
C	Remains the same	Remains neutral
D	Increases	Becomes alkaline

(2)

1.5 A standard zinc / copper cell is set up with a salt bridge containing a concentrated potassium nitrate (KNO_3) solution. The electrolytes are zinc sulphate ($ZnSO_4$) and copper sulphate ($CuSO_4$). After the reaction has been allowed to continue for an extended period of time, the salt bridge was found to contain ...

A K^+ and NO_3^- ions.

B K^+, NO_3^- and SO_4^{2-} ions.

C K^+, NO_3^- and Zn^{2+} ions.

D K^+, NO_3^-, SO_4^{2-} and Zn^{2+} ions. (2)

1.6 The following reaction is given.

$$HC_2O_4^-(aq) + H_2O(\ell) \rightarrow H_3O^+(aq) + C_2O_4^{2-}(aq)$$

The correct conjugate acid-base pair is given as:

A $HC_2O_4^-(aq)$ and $H_2O(\ell)$

B $HC_2O_4^-(aq)$ and $H_3O^+(aq)$

C $HC_2O_4^-(aq)$ and $C_2O_4^{2-}(aq)$

D $H_2O(\ell)$ and $C_2O_4^{2-}(aq)$ (2)

1.7 The equilibrium constant for the gas phase reaction given below is 230 at 300°C.

$$2NH_3(g) \rightleftharpoons 3H_2(g) + N_2(g)$$

Which one of the following statements is true for this reaction at equilibrium?

A Only reactants are present.

B Only products are present.

C The concentration of reactants is high.

D The yield of products is high. (2)

1.8 Consider the following chemical reaction:

$$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$$

In this reaction copper(II)oxide (CuO) acts as ...

A a base.

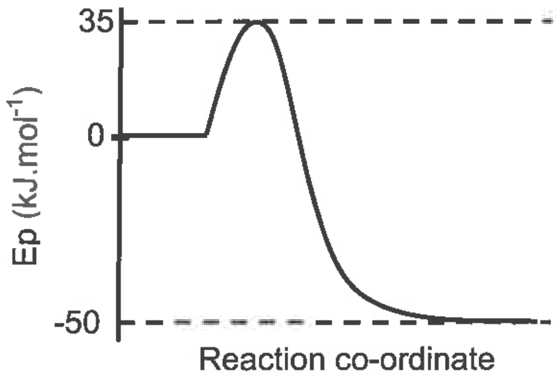
B an acid.

C a reducing agent.

D an oxidising agent. (2)

1.9 The graph below shows the change in potential energy for the reaction:

$$CO_2 + NO \rightleftharpoons CO + NO_2$$



The activation energy in $kJ \cdot mol^{-1}$ for the reverse reaction is ...

A 35.

B 50.

C 85.

D 15. (2)

1.10 Which ONE of the following statements about the extraction process of aluminium is TRUE?

A The aluminium ion is oxidised.

B Aluminium forms at the anode.

C The aluminium oxide ore is called bauxite.

D Carbon dioxide gas forms at the cathode. (2)

[20]

QUESTION 2 (Start on a new page.)

2.1 Consider the condensed structural formulae of the organic compounds below.

A	$H_3C-CH=CH_2$	B	H_3C-CH_2-OH
C	$H_3C-C(=O)-OH$	D	$H_3C-C(=O)-O-CH_3$
E	$H_3C-CH(OH)-CH_3$	F	$H_3C-C(CH_3)(OH)-CH_3$

Write down the letter that represents a substance that ...

2.1.1 is an unsaturated compound. (1)

2.1.2 will react with a halogen by means of an addition reaction. (1)

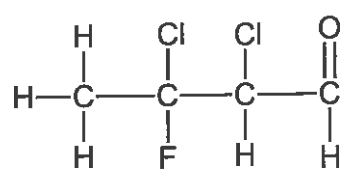
2.1.3 can be used for the preparation of methyl ethanoate. (1)

2.1.4 is a primary alcohol. (1)

2.1.5 when produced, needs sulphuric acid as a catalyst. (1)

2.2 Draw the structural formula of 2,4-dimethylhexan-3-one. (3)

2.3 Write down the correct IUPAC name of the following compound:



(3)
[11]

QUESTION 3 (Start on a new page.)

3.1 Write down the name of the homologous series to which each of the following compounds belong.

3.1.1 $C_5H_{10}O_2$ (1)

3.1.2 CH_3COCH_3 (1)

3.2 3.2.1 Define the term *chain isomer*. (2)

3.2.2 Write down the structural formula and IUPAC names of the 3 isomers of C_4H_8. (6)

3.3 The compound responsible for the fruity scent in pineapples, butyl pentanoate, is prepared in a laboratory.

Write down the ...

3.3.1 IUPAC names of TWO compounds needed for this preparation. (2)

3.3.2 type of reaction that takes place. (1)

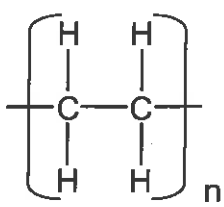
3.4 The boiling points of two compounds are given below.

Compound	Boiling point, °C
butyl pentanoate	185,8
butyl butanoate	166,0

Explain why the boiling point of butyl pentanoate is higher than that of butyl butanoate. Refer to relative strengths of intermolecular forces and energy. (3)

3.5 Explain the difference between *addition polymerisation* and *condensation polymerisation.* (4)

3.6 Consider the structural formula of a part of a polymer as shown below.



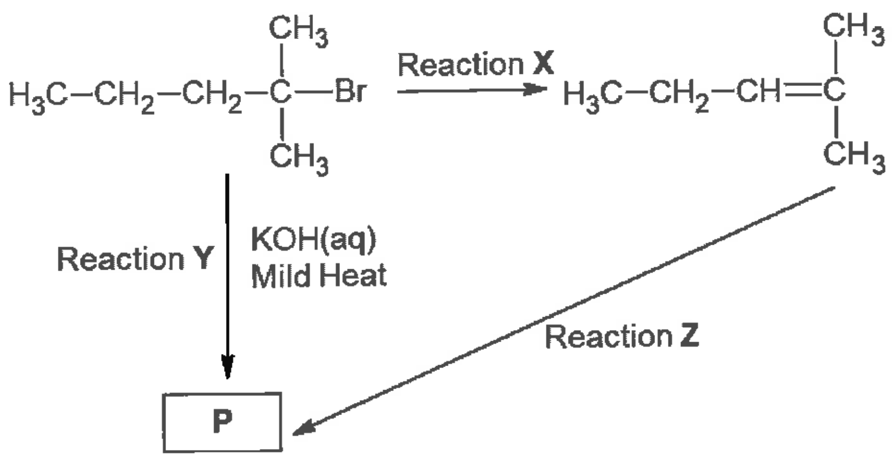
Write down the IUPAC name of ...

3.6.1 this polymer. (1)

3.6.2 the monomer used to prepare this polymer. (1)
[22]

QUESTION 4 (Start on a new page.)

In the flow diagram below, **X**, **Y** and **Z** represent three different types of organic reactions. **P** represents an organic compound.



4.1 Name the type of reaction represented by **X**. (1)

4.2 State TWO reaction conditions needed for reaction **X**. (2)

4.3 Reaction **Y** represents a substitution reaction. Write down the structural formula of the organic compound **P**, formed in this reaction. (3)

4.4 Apart from the organic reactant, write down the NAME or FORMULA of the other reactant needed in reaction **Z**. (1)

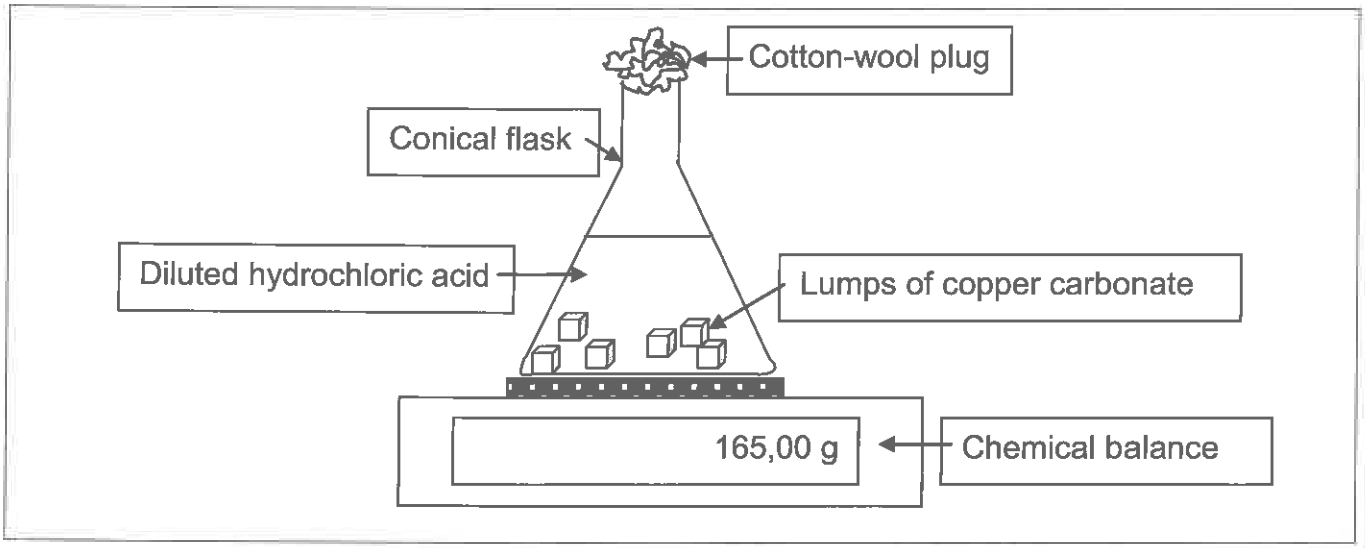
4.5 Name the type of reaction represented by **Z**. (1)
[8]

QUESTION 5 (Start on a new page.)

Copper(II)carbonate reacts with diluted hydrochloric acid as given in the reaction below.

$$CuCO_3(s) + 2HC\ell(aq) \rightarrow CuC\ell_2(aq) + H_2O(\ell) + CO_2(g)$$

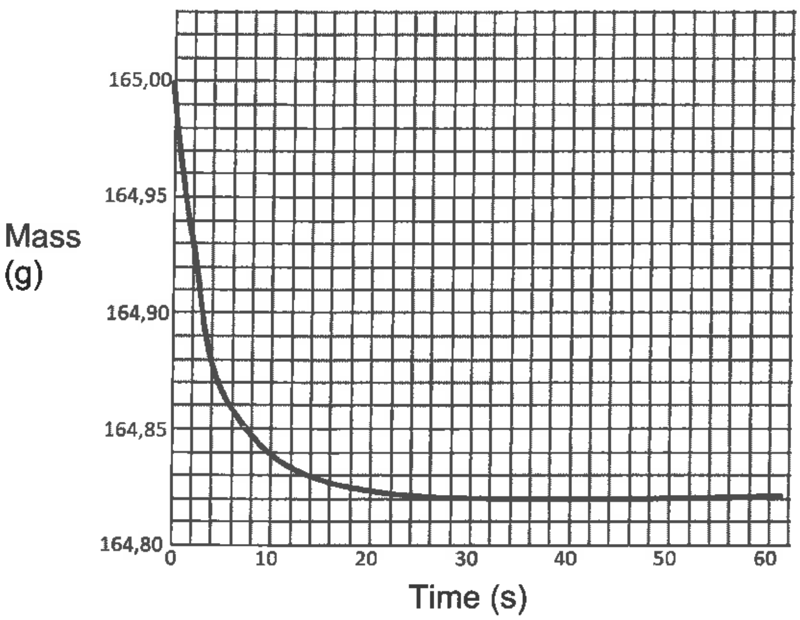
A learner used the apparatus shown below.



5.1 Supply a reason why a cotton-wool plug is placed in the mouth of the conical flask. (1)

The experiment was carried out using a 0,50 g sample of pure copper(II)carbonate.
The graph below shows the results obtained:

Graph of mass versus time



5.2 For this sample of pure copper(II)carbonate, calculate the average reaction rate, in $g \cdot s^{-1}$, for the first 10 seconds. (3)

5.3 The experiment is repeated under the same conditions using a sample of 0,5 g of impure copper(II)carbonate. The data obtained is given below.

Time (s)	0	4	6	8	12	20	40	60
Decrease in mass (g)	165,00	164,90	164,88	164,87	164,86	164,85	164,85	164,85

5.3.1 Draw a line graph showing the change in mass of the impure copper(II)carbonate versus the time.

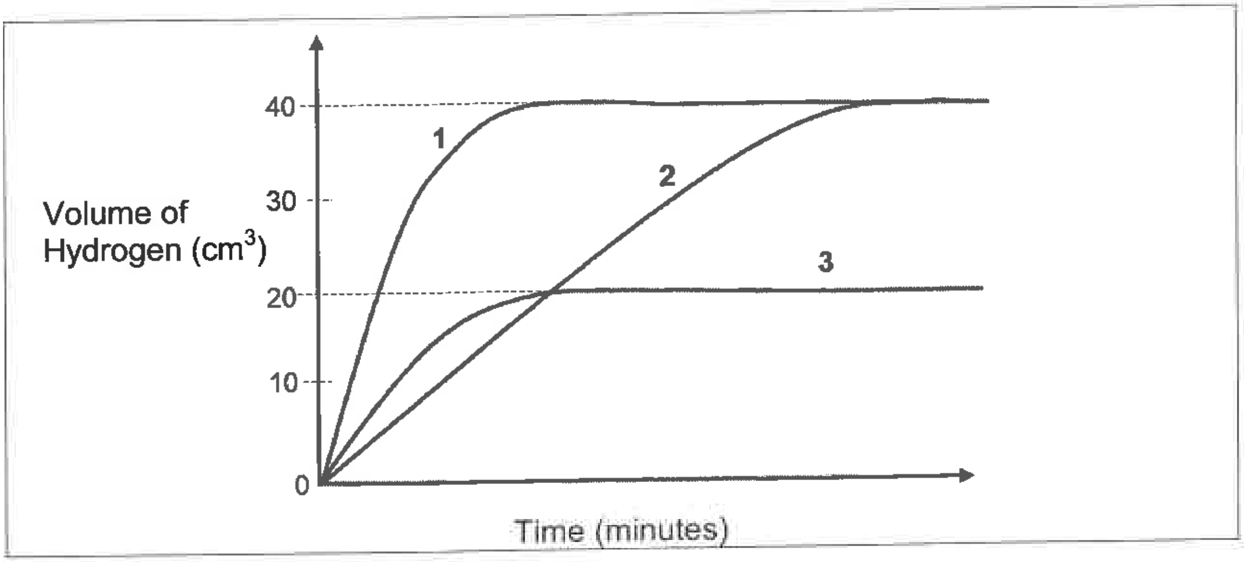
Use the attached ANSWER SHEET to answer this question. (3)

5.3.2 This experiment is repeated with hydrochloric acid that has been heated. Explain in terms of the collision theory how the rate of this reaction will be affected. (4)

5.4 A learner performed three experiments in which zinc reacted with an excess of a 1 mol·dm^{-3} hydrochloric acid solution.

In ALL three experiments, the learner kept the initial temperature the same and used the same volume of a 1 mol·dm^{-3} hydrochloric acid solution.

The graph below shows the results for each of the experiments **1**, **2** and **3**.



5.4.1 In which experiment did the reaction take the longest to complete? Choose from **1, 2** or **3**. (1)

5.4.2 Suggest ONE factor that could have been changed from experiment **1** to produce the results in experiment **2**. (1)

5.4.3 1 g of zinc was used in experiment **1**. What mass of zinc was used in experiment **3**? (No calculation required.) (1)
[14]

QUESTION 6 (Start on a new page.)

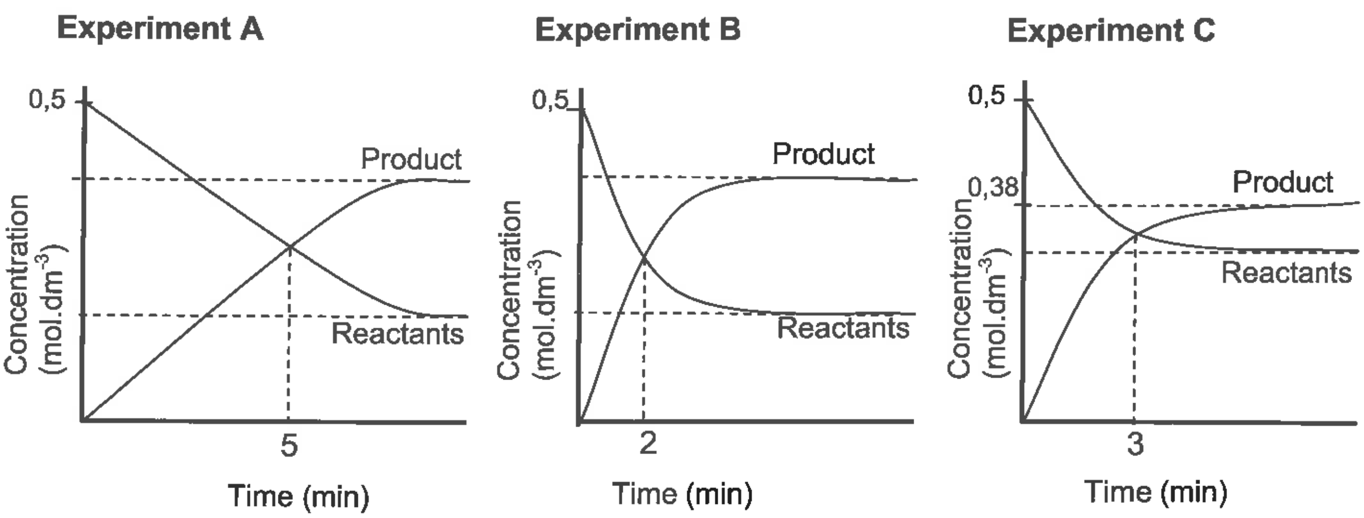
Consider the following reversible reaction represented below in a closed container.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

Three experiments were done under different conditions as shown in the table below. In **each** case 0,5 mol H_2 and 0,5 mol I_2 reacted in a 1 dm^3 container.

GRAPH	CONDITIONS
A	500°C
B	500°C; different condition from A
C	600°C; same conditions as A

The sketch graphs of the concentration versus time for the three experiments are shown below.



6.1 What condition changed in experiment **B**? (1)

6.2 Explain your answer to Question 6.1. (2)

6.3 Refer to the graphs of experiment **A** and **C**.
Is the forward reaction ENDOTHERMIC or EXOTHERMIC? (1)

6.4 Use Le Chatelier's principle and explain your answer to Question 6.3. (3)

6.5 At equilibrium, 0,3 mol-dm^{-3} H_2 is present in the container at a temperature of 500°C.
Use the data given to calculate the equilibrium constant at 500°C. (6)

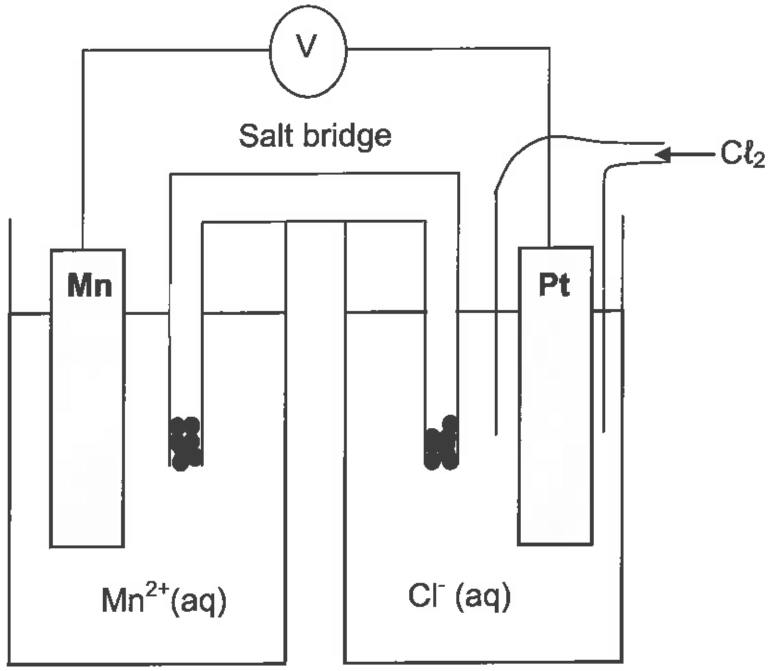
6.6 Will the K_c value be HIGHER THAN, LOWER THAN or REMAIN THE SAME at a temperature of 600°C? (1)

6.7 Explain your answer to Question 6.6. (2)
[16]

P.T.O.

QUESTION 7 (Start on a new page.)

An electrochemical cell is set up as shown in the diagram below.



7.1 Write down the values of the standard conditions that apply to the $C\ell_2/C\ell^-$ half-cell. (3)

7.2 For this cell, write down the equation for the ...

7.2.1 oxidation half reaction. (2)

7.2.2 net reaction of the cell. (3)

7.3 Write down the cell notation for this cell. (3)

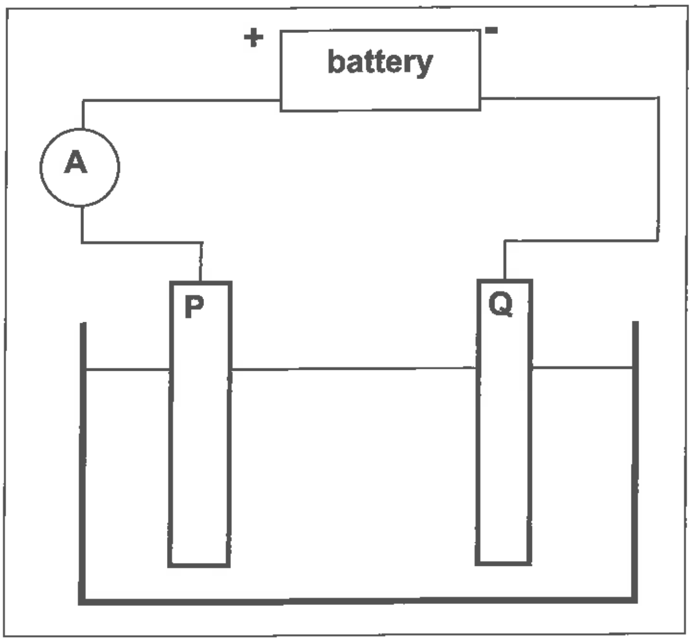
7.4 Write down the FORMULA of a possible electrolyte that can be used in the Mn/Mn^{2+} half-cell. (1)

7.5 Write down the NAME or FORMULA of the oxidising agent in this cell. (1)

7.6 Calculate the initial reading on the voltmeter when this cell functions under standard conditions. (3)
[16]

QUESTION 8 (Start on a new page.)

The diagram below represents an electrochemical cell. The electrodes of the cell are labeled **P** and **Q**.



8.1 8.1.1 Which electrode, **P** or **Q**, is the anode in this cell? (1)

8.1.2 Give a reason for your answer to Question 8.1.1. (1)

8.2 This cell is used to plate an iron coin with nickel. The iron coin is connected to a steel electrode while the other electrode is a nickel electrode.

8.2.1 Write down the FORMULA of the ION that can be used as an oxidising agent in this cell. (1)

8.2.2 To which electrode, **P** or **Q**, is the iron coin attached? (1)

8.2.3 At which electrode does reduction occur? Choose from **P** or **Q**. (1)

8.2.4 Write down the half-reaction that will occur at the electrode mentioned in Question 8.2.3. (2)

8.2.5 The anode of this cell is a nickel electrode. How does the concentration of the electrolyte change during the functioning of the cell? Write only INCREASES, DECREASES or REMAINS THE SAME. (1)

8.2.6 Explain your answer to Question 8.2.5. (2)
[10]

QUESTION 9 (Start on a new page.)

9.1 Washing soda contains sodium carbonate (Na_2CO_3) as its most important constituent.

Learners used 5,13 g of the washing soda crystals to prepare a 250 cm^3 solution in distilled water. They titrated 25 cm^3 of the sodium carbonate solution with 36 cm^3 of a 0,05 $mol{\cdot}dm^{-3}$ H_2SO_4 solution to neutralise the solution.

The balanced equation for the reaction is:

$$Na_2CO_3(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + CO_2(g) + H_2O(\ell)$$

9.1.1 Define an *ampholyte*. (2)

9.1.2 Identify which ONE of the compounds in the equation above CAN act as an ampholyte. (1)

9.1.3 Calculate the number of moles of sulphuric acid that reacted with the sodium carbonate. (3)

9.1.4 Calculate the mass of the sodium carbonate in the washing soda that was used and neutralised during the titration. (4)

9.1.5 Calculate the percentage purity of the washing soda sample. (3)

9.2 When CO_3^{2-} ions are added to water, the concentration of the hydroxide ions present in the water increases.

Write down a balanced equation for this reaction between CO_3^{2-} and H_2O. (2)

[15]

QUESTION 10 (Start on a new page.)

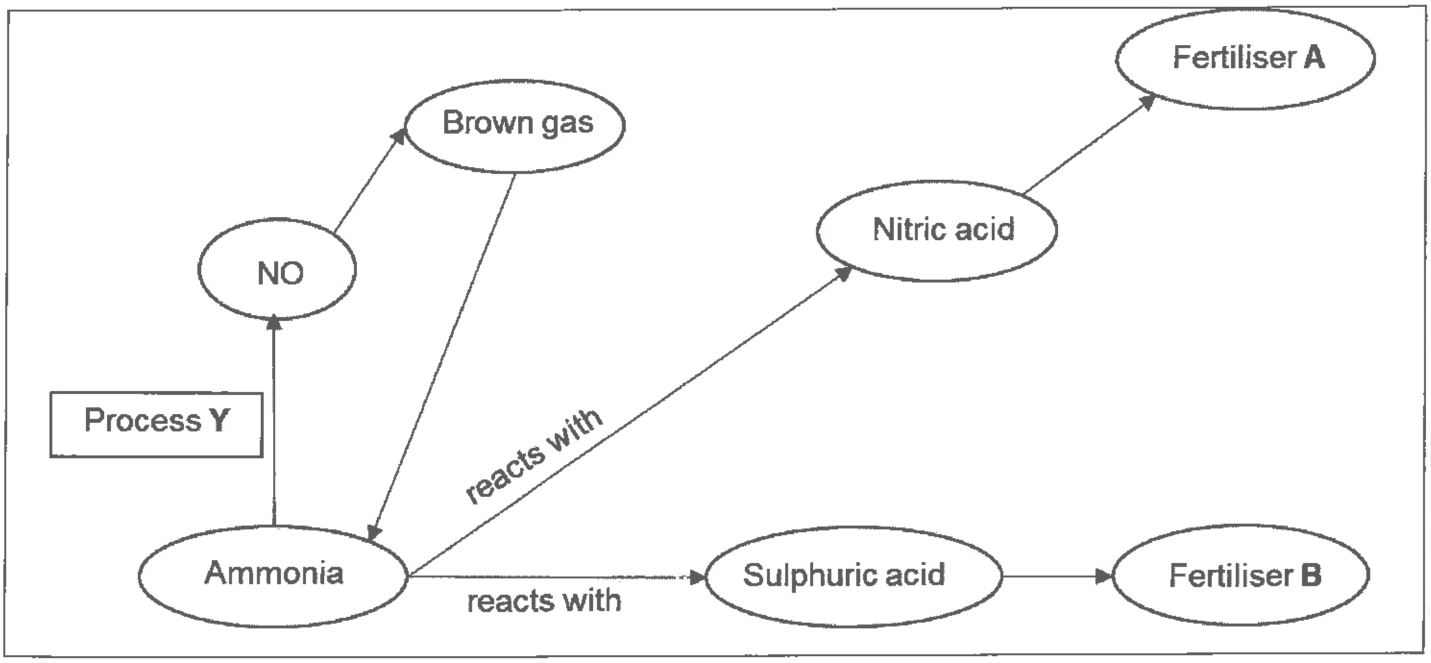
10.1 A fertilizer bag is labelled 2:6:3 (40).

10.1.1 Explain the meaning of the value in brackets (40). (1)

10.1.2 Name any TWO primary nutrients that are contained in this fertiliser bag. (2)

10.1.3 Calculate the percentage mass of nitrogen in this fertiliser bag. (3)

10.2 Part of the flow diagram below shows the industrial process used in the production of nitric acid.



10.2.1 Write down the NAME or FORMULA of Fertiliser **A**. (1)

10.2.2 Name the process used to make ammonia. (1)

10.2.3 Write down the FORMULA of Fertiliser **B**. (1)

10.2.4 Write down the NAME of process **Y**. (1)

10.2.5 Why is it important for fertilisers to be soluble in water? (1)

10.2.6 If too much fertiliser is used and it leaches into rivers, what negative effect could this have on rivers and dams? (1)

10.2.7 Name TWO reactants needed to produce ammonia. (2)

10.2.8 During the manufacturing of H_2SO_4 sulphur is burned in air. NAME the product of this combustion reaction. (1)

10.2.9 Write down THREE positive impacts of fertilisers on humans. (3)
[18]

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***	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 $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ / $E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$ $E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ / $E^\theta_{sel} = E^\theta_{reduksie} - E^\theta_{oksidasie}$ $E^\theta_{cell} = E^\theta_{oxidising\ agent} - E^\theta_{reducing\ agent}$ / $E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$	

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

KEY/*SLEUTEL*

Electronegativity / *Elektronegatiwiteit*	Atomic number / *Atoomgetal*	Symbol / *Simbool*	Approximate relative atomic mass / *Benaderde relatiewe atoommassa*
1,9	29	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)
(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: STANDAARD REDUKSIEPOTENSIALE

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
$\mathbf{2H^+ + 2e^-}$	⇌	$\mathbf{H_2(g)}$	**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 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* (↓)

Increasing reducing ability / *Toenemende reduserende vermoë* (↑)

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

ANSWER SHEET

Name: ______________________________

Attach this page to your answer book.

Question 5.3.1