education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION

GRADE 12

PHYSICAL SCIENCES P2
(CHEMISTRY)

SEPTEMBER 2026

PHYSICAL SCIENCES P2

12842B

MARKS: 150

TIME: 3 HOURS

X05 **This question paper consists of 15 pages and 4 data sheets.**

N1

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INSTRUCTIONS AND INFORMATION

1. Write your name and other applicable information in the appropriate spaces on the ANSWER BOOK.
2. The 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 pocket calculator.
7. You may use appropriate mathematical instruments.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your FINAL numerical answers to a minimum of TWO decimal places where necessary.
10. Give brief motivations, discussions, etc., where required.
11. You are advised to use the attached DATA SHEETS.
12. Write neatly and legibly.

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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 your ANSWER BOOK, for example, 1.11 E.

1.1 The EMPIRICAL formula of but-2-ene is …

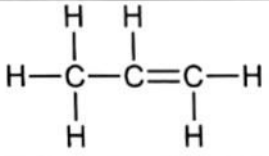
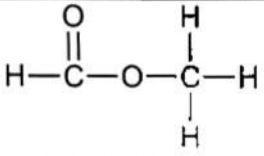
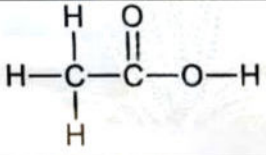
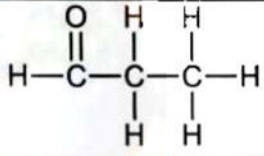
A C_2H.

B CH_2.

C C_4H_8.

D C_4H_{10}. (2)

1.2 Consider the organic compounds below.

COMPOUND 1	COMPOUND 2
	
COMPOUND 3	**COMPOUND 4**
	

The compound that is a functional isomer of a ketone is …

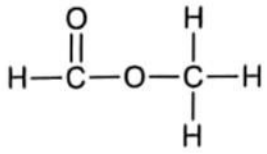
A compound 1.

B compound 2.

C compound 3.

D compound 4. (2)

1.3 Consider the STRUCTURAL FORMULA of an organic compound below.



The correct IUPAC name is ...

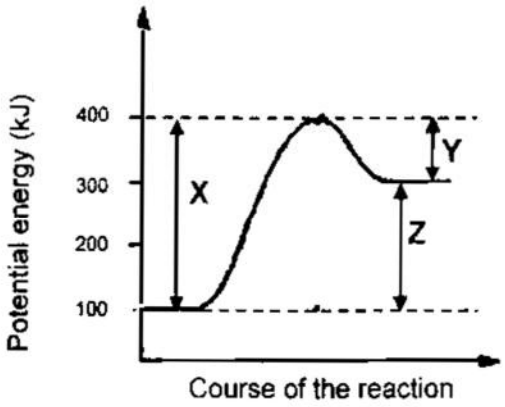
A ethanol.

B methanal.

C ethanoic acid.

D methyl methanoate. (2)

1.4 Study the graph below.



The activation energy for the reverse reaction is ...

A X.

B Y.

C Z.

D Y – Z. (2)

1.5 Carbon dioxide gas (CO_2) is prepared by adding pieces of calcium carbonate, mass 100 g, to dilute hydrochloric acid ($HC\ell$) in a conical flask.

Which statement below is correct regarding the reaction and changes in the reaction conditions?

A Increasing the volume of the dilute $HC\ell$ increases the rate of reaction.

B Using 100 g of bigger pieces of calcium carbonate increases the rate of reaction.

C Increasing the temperature increases the rate of reaction.

D The mass of the conical flask and its contents increases as the carbon dioxide is formed. (2)

1.6 Catalysts are extensively used in industries. The most probable reason for this is that a catalyst ...

A increases the rates of both the forward and reverse reactions.

B decreases the rate of the reverse reaction only.

C increases the rate of the reverse reaction only.

D can shift the equilibrium position to the preferred side. (2)

1.7 Consider the following hypothetical reaction.

$$A_2(g) + B(g) \rightleftharpoons A_2B(g) \qquad \Delta H < 0$$

The reaction reaches equilibrium at temperature **T**. Which ONE of the following changes to the equilibrium conditions will result in an INCREASE in the equilibrium constant, K_c?

A Increase in temperature

B Decrease in temperature

C Increasing both pressure and temperature

D Increase in pressure by decreasing volume (2)

1.8 Which ONE of the following substances CANNOT act as an ampholyte?

A H_2O

B HCO_3^-

C HNO_3

D HSO_4^- (2)

1.9 Sulphuric acid, $H_2SO_4(aq)$, and hydrochloric acid, $HC\ell(aq)$, solutions of EQUAL CONCENTRATIONS are compared.

How does the concentration of $H_3O^+(aq)$ in a solution of $HC\ell(aq)$ and the pH of $HC\ell(aq)$ compare to those of the $H_2SO_4(aq)$ solution?

	$[H_3O^+]$ OF $HC\ell(aq)$	**pH OF $HC\ell(aq)$**
A	Higher than	Higher than
B	Lower than	Higher than
C	Higher than	Lower than
D	Equal to	Equal to

(2)

1.10 A standard copper-silver electrochemical cell delivers a current. How do the concentrations of the two electrolytes change with time?

A $[Cu^{2+}]$ increases and $[Ag^+]$ decreases with time.

B $[Cu^{2+}]$ and $[Ag^+]$ decrease until both are zero.

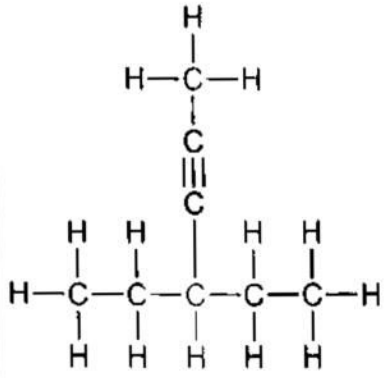
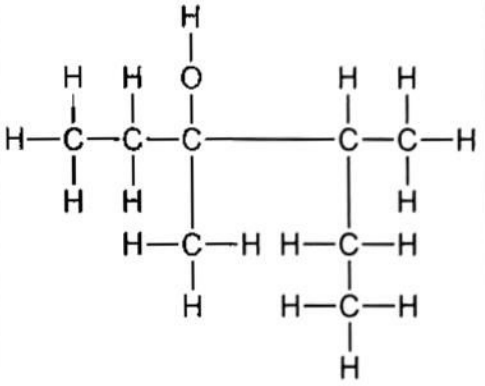
C $[Cu^{2+}]$ decreases and $[Ag^+]$ increases at the same rate.

D $[Cu^{2+}]$ and $[Ag^+]$ are unaffected as the reaction proceeds. (2)

[20]

QUESTION 2 (Start on a new page.)

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

A		**B**	
C	Carboxylic acid	**D**	C_4H_8O
E	C_6H_{12}	**F**	Propyl ethanoate

2.1 Write down the letter(s) that represent(s) the following:

2.1.1 Hydrocarbons (2)

2.1.2 An aldehyde (1)

2.1.3 A compound that can undergo an addition reaction (1)

2.2 For compound **B**, write down the:

2.2.1 General formula of the homologous series to which it belongs (1)

2.2.2 Type of alcohol (1)

2.2.3 IUPAC name (3)

2.3 Compound **C** is a straight-chain functional isomer of compound **F**.

2.3.1 Define the term *functional isomer*. (2)

2.3.2 Write down the structural formula of compound **C**. (2)

2.3.3 Using structural formulae, write down the balanced equation for the formation of compound **F**. (7)

2.4 For compound **A**, write down its IUPAC NAME. (3)

2.5 For compound **D**, write down the condensed structural formula of its FUNCTIONAL ISOMER. (2)

[25]

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QUESTION 3 (Start on a new page.)

The boiling points of organic compounds at a specific pressure are compared.

COMPOUND		MOLAR MASS ($g \cdot mol^{-1}$)	BOILING POINT (°C)
A	$CH_3CH_2CH_2CH_3$	58	-0,5
B	CH_3CH_2CHO	58	48
C	CH_3OH	32	65
D	CH_3CH_2OH	46	78

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

3.2 Choose the symbol (**A** to **D**) of the compound with the highest vapour pressure. (1)

3.3 Explain the answer to QUESTION 3.2. (2)

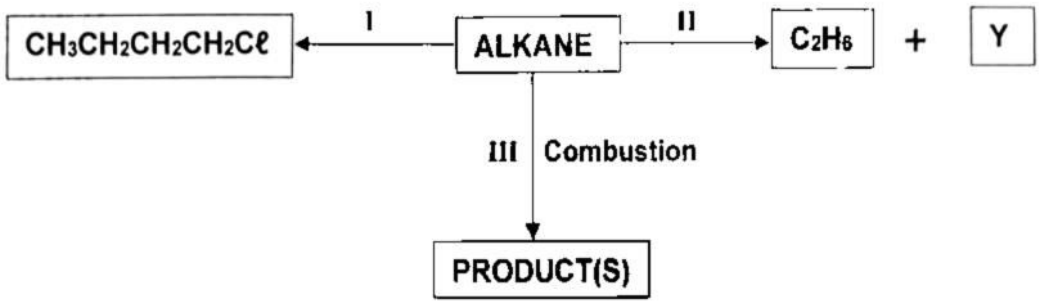
3.4 Compounds **A** to **D** are compared. Fully **explain** the difference in boiling points of compounds:

3.4.1 **A** and **B** (4)

3.4.2 **C** and **D** (3)
[12]

QUESTION 4 (Start on a new page.)

Study the flow diagram below and answer the questions that follow.



4.1 Write down the type of reaction represented by:

4.1.1 Reaction **I** (1)

4.1.2 Reaction **II** (1)

4.2 Consider reaction **III**.

4.2.1 Write down the IUPAC name of the reactant. (2)

4.2.2 Using MOLECULAR FORMULAE, write down the balanced equation for the reaction. (3)

4.3 Write down the structural formula of compound **Y**. (2)

4.4 For reaction **I**, write down the NAME of the inorganic reactant. (2)
[11]

QUESTION 5 (Start on a new page.)

5.1 The reaction rate of ammonia (NH_3) and oxygen (O_2) in a 2 dm^3 container is monitored. The balanced equation for the reaction is as shown below:

$$NH_3(g) + O_2(g) \rightarrow NO(g) + H_2O(g) \qquad \Delta H < 0$$

The rate of formation of NO at time **T** is found to be 0,3 $mol \cdot dm^{-3} \cdot s^{-1}$.

5.1.1 Copy the above chemical equation into your answer book and balance it. (2)

5.1.2 Calculate the rate at which H_2O is being produced at time **T** in $mol \cdot dm^{-3} \cdot s^{-1}$. (2)

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A learner concludes that, to increase the reaction rate, the pressure on the gases should be increased by decreasing the volume of the container to 1 dm^3 at constant temperature.

5.1.3 Is the learner's conclusion correct? Write down YES or NO. (1)

5.1.4 Explain the answer to QUESTION 5.1.3. (3)

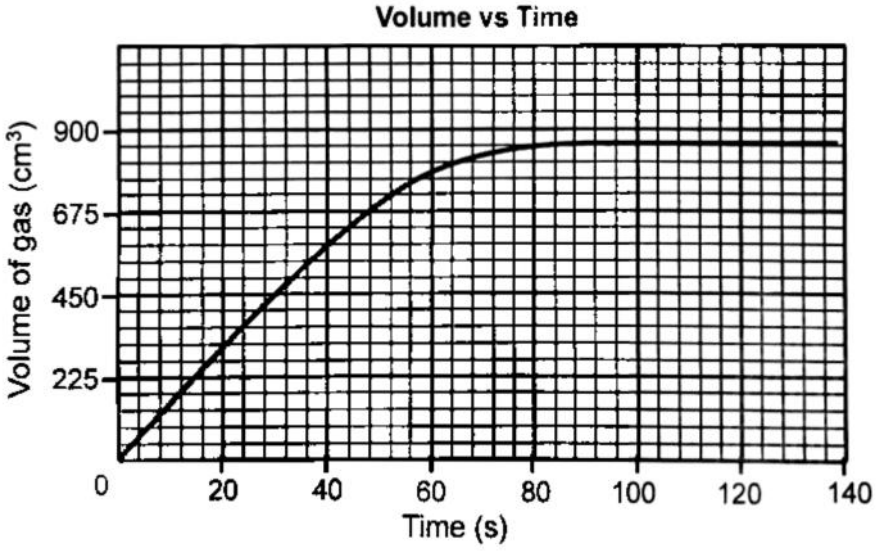
5.2 Two experiments are used to investigate how surface area affects the rate of reaction between excess solid magnesium (Mg) ribbon and dilute nitric acid (HNO_3) at room temperature.

During the reaction, the gas formed is collected in the measuring cylinder. The balanced equation for the reaction is:

$$Mg(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + H_2(g)$$

The summary of the investigation is tabulated below.

EXPERIMENT	MASS OF MAGNESIUM (g)	STATE OF DIVISION
A	2	Ribbon cut into small pieces
B	2	Ribbon as one large piece



5.2.1 Write down the investigative question for this investigation. (2)

5.2.2 The rate of production of hydrogen in the first 50 seconds is 13,8 $cm^3 \cdot s^{-1}$.

A learner predicts that 660 cm^3 of hydrogen will be produced in the first 50 seconds. Prove by calculation whether the learner is correct or not. (3)

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5.2.3 Will the reaction rate between 60 and 80 seconds be GREATER THAN, LESS THAN or EQUAL TO the rate calculated in QUESTION 5.2.2? (1)

5.2.4 Use the graph to give a reason for the answer given in QUESTION 5.2.3. (2)

5.2.5 Draw the above graph (not to scale) in your answer book and label it as **A**.

On the same set of axes, draw a graph for experiment **B** and label it as **B**. (2)

5.2.6 Calculate the remaining mass of magnesium after the reaction has stopped.

Take the molar volume of gas to be 24 $dm^3 \cdot mol^{-1}$ at room temperature. (6)
[24]

QUESTION 6 (Start on a new page.)

Consider a solution of ethanoic acid with the following equilibrium established at room temperature.

$$CH_3COOH(aq) + H_2O(\ell) \rightleftharpoons H_3O^+(aq) + CH_3COO^-(aq) \quad \Delta H < 0$$

At equilibrium, it is found that the pH of the solution is 3,2 and the number of moles of $CH_3COOH(aq)$ is 0,066 mol.

6.1 Explain the term *equilibrium*. (2)

6.2 Calculate the equilibrium constant of an aqueous solution of ethanoic acid at room temperature. (5)

6.3 More CH_3COOH is added to the equilibrium mixture. How will the pH of the solution be affected? Write down only INCREASES, DECREASES or STAYS THE SAME. (1)

6.4 Explain the answer to QUESTION 6.3. (3)

6.5 Draw a graph of potential energy ($kJ \cdot mol^{-1}$) versus the reaction coordinate for the forward reaction.

Indicate the following on the graph:

- Activation energy
- Heat of reaction
- Formulae of reactants and products (4)

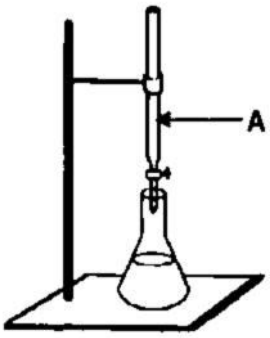
[15]

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QUESTION 7 (Start on a new page.)

7.1 10 g of impure sodium carbonate ($Na_2CO_3 \cdot 10H_2O$) is dissolved in water to make a solution of 500 cm^3. 25 cm^3 of this solution is titrated with a 0,1 $mol \cdot dm^{-3}$ H_2SO_4 solution.

The apparatus below is used for titration.



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

This reaction is known as a neutralisation reaction.

7.1.1 Explain the term *neutralisation reaction*. (2)

7.1.2 Write down the name of the apparatus **labelled A**. (1)

7.1.3 Write down the name of the most suitable indicator for this titration. (1)

7.1.4 Explain the answer to QUESTION 7.1.3. (2)

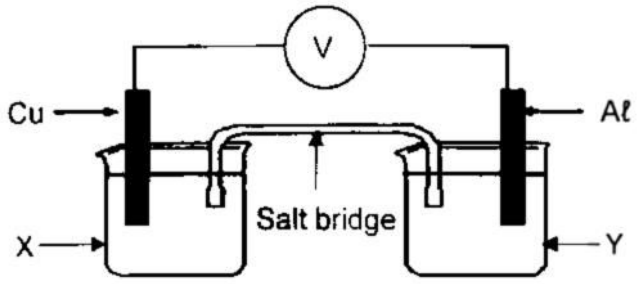
7.2 10 cm^3 of H_2SO_4 is used to neutralise the Na_2CO_3 solution.

7.2.1 Calculate the mass of the impurities in the impure sodium carbonate. (8)

7.2.2 Calculate the percentage purity of the sodium carbonate. (3)
[17]

QUESTION 8 (Start on a new page.)

An electrochemical cell is assembled as shown in the diagram below. The cell functions under standard conditions. The solution in beaker **X** is blue.



8.1 For the above cell, write down the:

8.1.1 Energy conversion (2)

8.1.2 NAME or FORMULA of a substance that can be used in the salt bridge (1)

8.2 In which beaker will the ion concentration decrease? Give a reason for the answer. (2)

8.3 Write down the:

8.3.1 Oxidation half-reaction (2)

8.3.2 Cell notation of the cell (3)

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

8.5 $CuC\ell_2$ crystals (about a spatula-full) are dissolved in the copper half-cell solution.

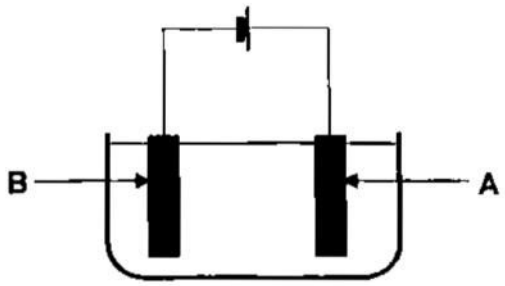
8.5.1 How will this change affect the cell potential? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

8.5.2 Explain the answer to QUESTION 8.5.1. (1)
[16]

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QUESTION 9 (Start on a new page.)

The diagram below represents the purification of copper ore to pure copper. The cell also contains zinc, silver and platinum impurities.



9.1 Besides purification, what other process can this type of cell be used for? (2)

9.2 Which electrode is the anode? Write down **A** or **B**. (1)

9.3 Write down the electrode on which pure copper will be deposited. (1)

9.4 Write down the half-reaction that takes place at the anode. (2)

9.5 When the current flows through the cell for **t** minutes, 16,5 g of pure copper is deposited at one of the electrodes. Calculate the number of moles of electrons that flow through the circuit in **t** minutes. (4)
[10]

TOTAL: 150

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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* ↓

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

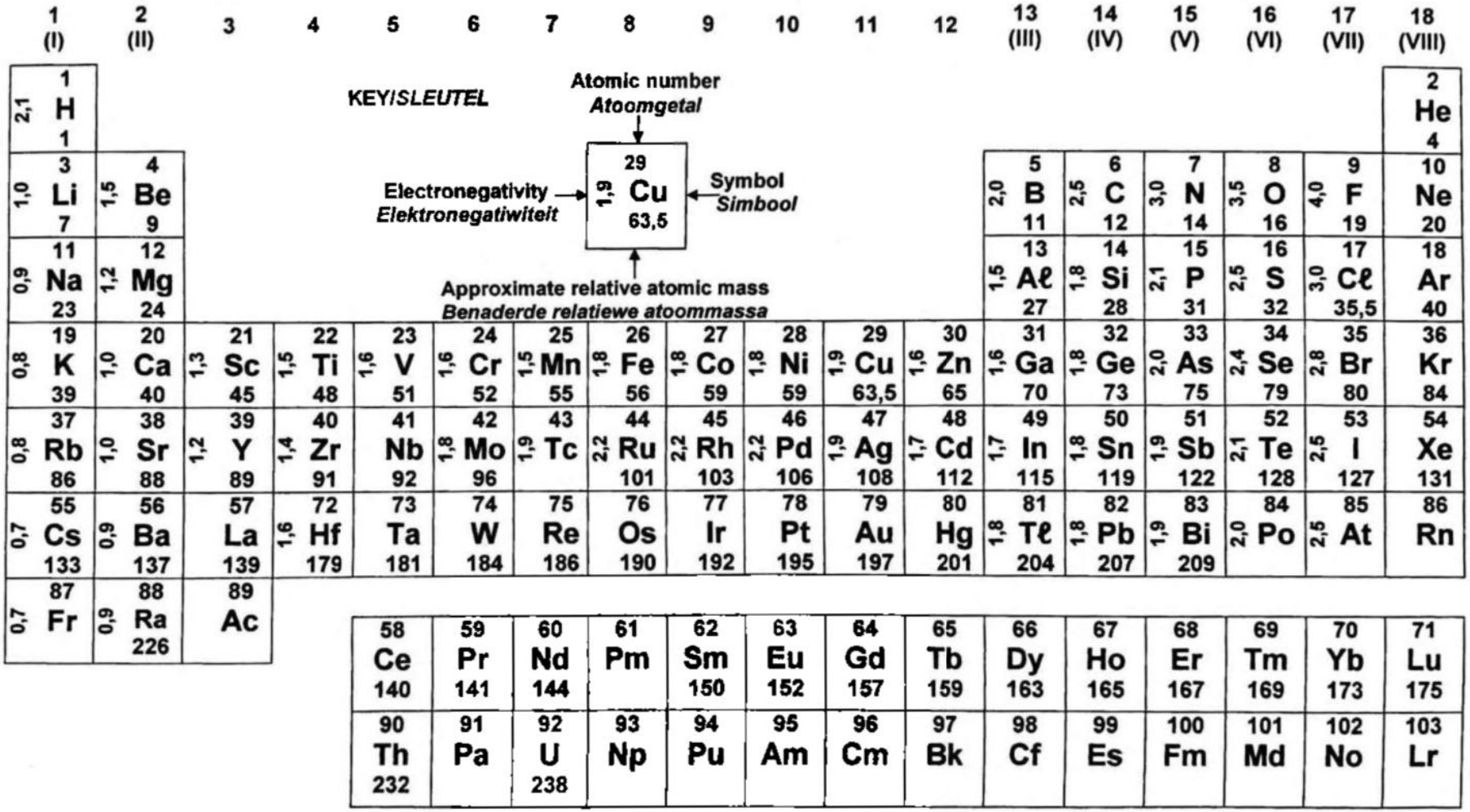
Increasing oxidising ability / *Toenemende oksiderende vermoë* ↓

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
$Al^{3+} + 3e^- \rightleftharpoons Al$	− 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
$Cl_2(g) + 2e^- \rightleftharpoons 2Cl^-$	+ 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* ↑

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TABLE 3: THE PERIODIC OF ELEMENTS



1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 H 1																	2 He 4
1,0 Li 7	1,5 Be 9											2,0 B 11	2,5 C 12	3,0 N 14	3,5 O 16	4,0 F 19	10 Ne 20
0,9 Na 23	1,2 Mg 24											1,5 Aℓ 27	1,8 Si 28	2,1 P 31	2,5 S 32	3,0 Cℓ 35,5	18 Ar 40
0,8 K 39	1,0 Ca 40	1,3 Sc 45	1,5 Ti 48	1,6 V 51	1,6 Cr 52	1,5 Mn 55	1,8 Fe 56	1,8 Co 59	1,8 Ni 59	1,9 Cu 63,5	1,6 Zn 65	1,6 Ga 70	1,8 Ge 73	2,0 As 75	2,4 Se 79	2,8 Br 80	36 Kr 84
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	41 Nb 92	1,8 Mo 96	1,9 Tc	2,2 Ru 101	2,2 Rh 103	2,2 Pd 106	1,9 Ag 108	1,7 Cd 112	1,7 In 115	1,8 Sn 119	1,9 Sb 122	2,1 Te 128	2,5 I 127	54 Xe 131
0,7 Cs 133	0,9 Ba 137	57 La 139	1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	1,8 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	86 Rn
0,7 Fr 87	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

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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	N_A	$6{,}02 \times 10^{23}$ mol^{-1}

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at/*by* 298 K	
$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ / $E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$ or/*of* $E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ / $E^\theta_{sel} = E^\theta_{reduksie} - E^\theta_{oksidasie}$ or/*of* $E^\theta_{cell} = E^\theta_{oxidising\ agent} - E^\theta_{reducing\ agent}$ / $E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$	

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