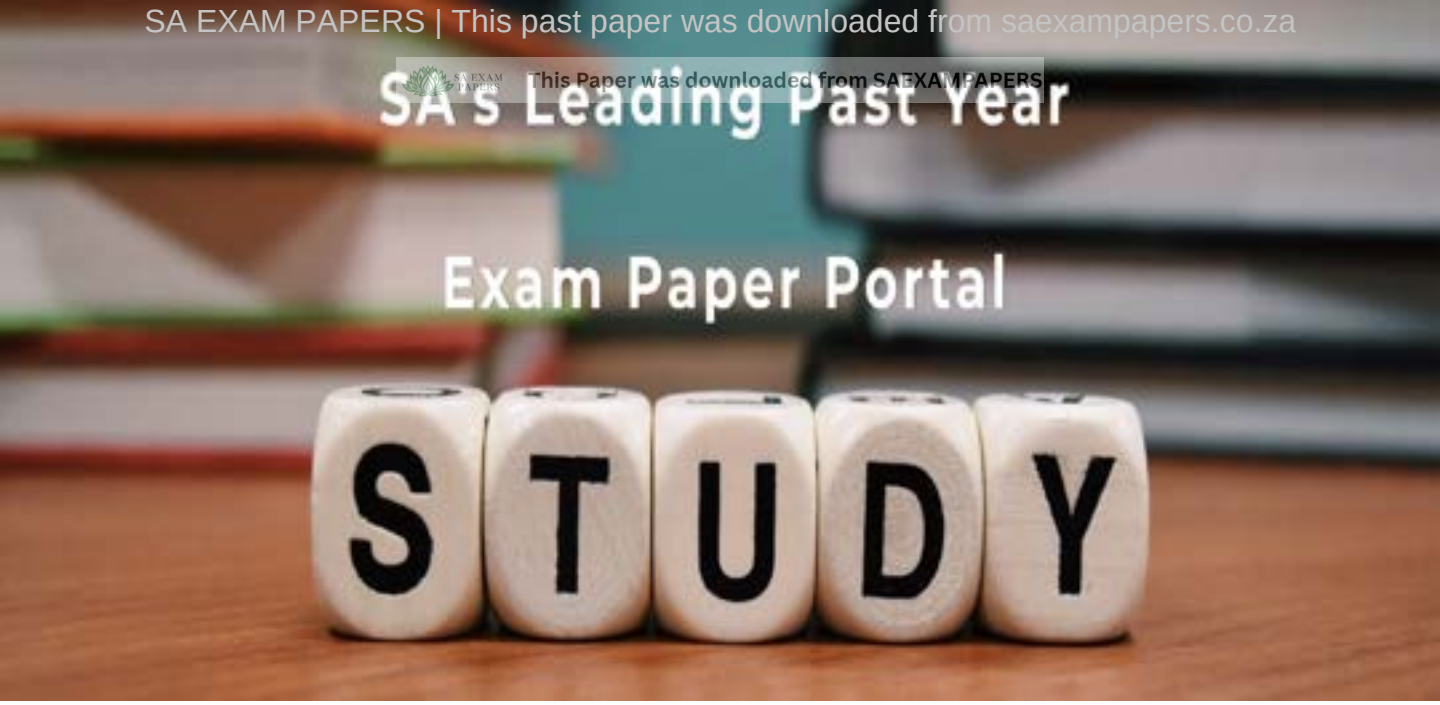


education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY (P2)

JUNE 2026

MARKS: 150

TIME: 3 hours

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

INSTRUCTIONS AND INFORMATION

1. This question paper consists of EIGHT questions. Answer ALL the questions in the ANSWER SHEET.
2. Start EACH question on a NEW page in the ANSWER SHEET.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. Show ALL formulae and substitutions in ALL calculations.
7. Round off your FINAL numerical answers to a minimum of TWO decimal places.
8. Give brief motivations, discussions, etc. where required.
9. You are advised to use the attached DATA SHEETS.
10. Write neatly and legibly.

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 (1.1–1.10) in the ANSWER SHEET, e.g. 1.11 E.

1.1 The name of the CHAIN isomer of the compound but-2-ene is:

A But-1-ene

B 2-methylbut-2-ene

C 2-methylpropan-2-ene

D Methylpropene (2)

1.2 Which ONE of the following organic compounds is a tertiary haloalkane?

A 1-bromobutane

B 2-chloro-2-methylpentane

C 2-bromohexane

D 1,2,3-trichloropentane (2)

1.3 Which ONE of the following compounds forms hydrogen bonds between its molecules?

A CH_3CH_2CHO

B CH_3COOCH_3

C $CH_3CH_2CH_2OH$

D CH_3COCH_3 (2)

1.4 Magnesium ribbon of mass 2 g reacts with excess hydrochloric acid of concentration 0,1 mol·dm^{-3} at 20 °C below:

$$Mg(s) + 2HC\ell(aq) \rightarrow MgC\ell_2(aq) + H_2(aq)$$

Which ONE of the following changes will NOT increase the initial rate of the reaction?

A Using 2 g of powdered magnesium

B Increasing the temperature of HCl to 30 °C

C Using a longer piece of the magnesium ribbon

D Doubling the volume of the hydrochloric acid used (2)

1.5 Which ONE of the following combinations of values for activation energy (E_a) and heat of reaction (ΔH) is possible for a reaction?

	ACTIVATION ENERGY (E_a)	HEAT OF REACTION (ΔH)
A	100	-50
B	100	+100
C	50	+50
D	50	+100

(2)

1.6 According to Collision Theory, the reaction rate increases when the … decreases.

A temperature

B concentration

C activation energy

D kinetic energy of particles (2)

1.7 Consider the following reaction that reaches equilibrium in a closed container:

$$3H_2(g) + N_2(g) \leftrightarrows 2NH_3 \qquad \Delta H < 0$$

Which ONE of the following changes will increase the yield of NH_3?

A The addition of a catalyst

B An increase in temperature

C A decrease in the volume of the container

D A decrease in the concentration of N_2 (2)

1.8 Initially certain moles of NH_3 and H_2S are placed in a sealed 2 dm^3 at 300 °C. The reaction is allowed to reach equilibrium according to the following balanced equation:

$$NH_3(g) + H_2S(g) \leftrightarrows NH_4HS(s)$$

The Kc values for the formation of $NH_4HS(s)$ at different temperatures are given in the table below.

TEMPERATURE (°C)	Kc VALUE
300	40×10^{-2}
250	18×10^{-2}
200	$7{,}5 \times 10^{-2}$

According to Le Chatelier's principle, when temperature is decreased the …

A forward reaction is endothermic and is favoured.

B reverse reaction is endothermic and is favoured.

C forward reaction is exothermic and concentration of reactants increases.

D reverse reaction is favoured and the mass of the product decreases. (2)

1.9 Which ONE of the following acids would ionise completely in water and form a high concentration of hydronium ions?

A Carbonic acid

B Phosphoric acid

C Nitric acid

D Ethanoic acid (2)

1.10 Which ONE of the following indicators is most suitable for the titration of ethanoic acid with sodium hydroxide?

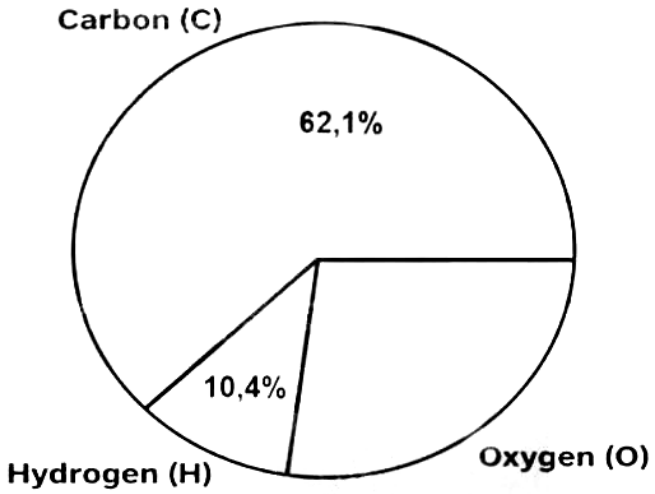
INDICATOR	pH
A	0,2 – 1,8
B	2,9 – 4,0
C	6,0 – 7,6
D	11,6 – 14,0

(2)
[20]

QUESTION 2 (Start on a new page.)

2.1 Define the term *organic molecules.* (2)

2.2 The pie chart below shows percentage composition of a certain compound with a molar mass of 116 $g \cdot mol^{-1}$.



2.2.1 Write down the percentage of oxygen in the above compound. (1)

2.2.2 Determine by means of a calculation, the molecular formula of the compound. (5)

The compound with the molecular formula in QUESTION 2.2.2 is prepared using propanoic acid as one of the reactants.

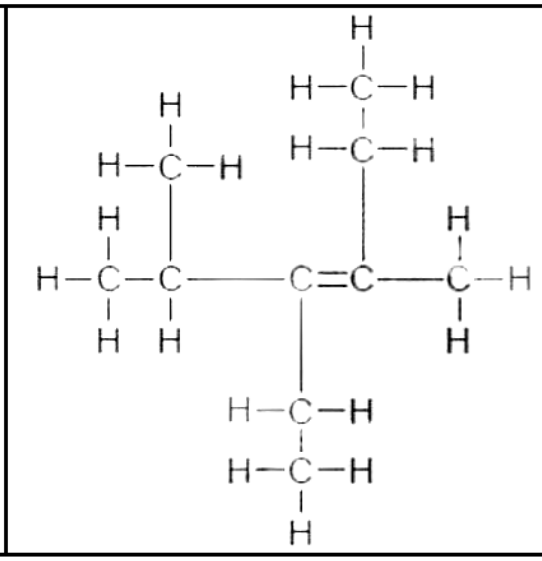
2.2.3 Draw the STRUCTURAL FORMULA of the FUNCTIONAL GROUP of the homologous series to which this compound belongs. (2)

2.2.4 Write down the IUPAC NAME of the compound. (2)

2.2.5 Write down the MOLECULAR FORMULA of the inorganic product formed when the compound named in QUESTION 2.2.4 was prepared. (1)

2.2.6 Draw the STRUCTURAL FORMULA of the other organic compound used to prepare the compound named in QUESTION 2.2.4. (2)

2.3 Consider compounds **A** and **B** below.

A		**B**	4-methylpentan-2-one

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

2.3.2 Which compound, **A** or **B** is unsaturated? Give a reason for the answer. (3)

Write down the:

2.3.3 IUPAC NAME of compound **A** (3)

2.3.4 GENERAL FORMULA of the homologous series to which compound **A** belongs (1)

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

2.3.6 STRUCTURAL FORMULA of compound **B** (3)
[28]

QUESTION 3 (Start on a new page.)

Compounds **A**, **B**, **C** and **D** are used to investigate one of the factors that influences the VAPOUR PRESSURE of organic compounds.

A	$CH_3CH_2CH_2CH_2OH$
B	$CH_3CH_2CH_2CH_3$
C	$CH_3CH_2COCH_3$
D	$CH_3CH_2CH_2COOH$

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

3.2 Which compound, **B** or **C**, has a higher vapour pressure? Give a reason for the answer by referring to the strength of intermolecular forces. (3)

3.3 Refer to the table above, which ONE of compounds has a FUNCTIONAL isomer? Write down only the letter. (1)

3.4 Write down the IUPAC NAME of the functional isomer of the compound mentioned in QUESTION 3.3. (2)

3.5 Explain what is *hydrogen bonding?* (2)

3.6 Which compound, **A** or **D**, has a lower boiling point? Fully explain the answer. (4)

3.7 The boiling point of compound **A** is measured again on another day when the atmospheric pressure is much lower.

How will the boiling point of this compound be affected? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

[15]

QUESTION 4 (Start on a new page.)

4.1 Explain the term *dehydrohalogenation.* (2)

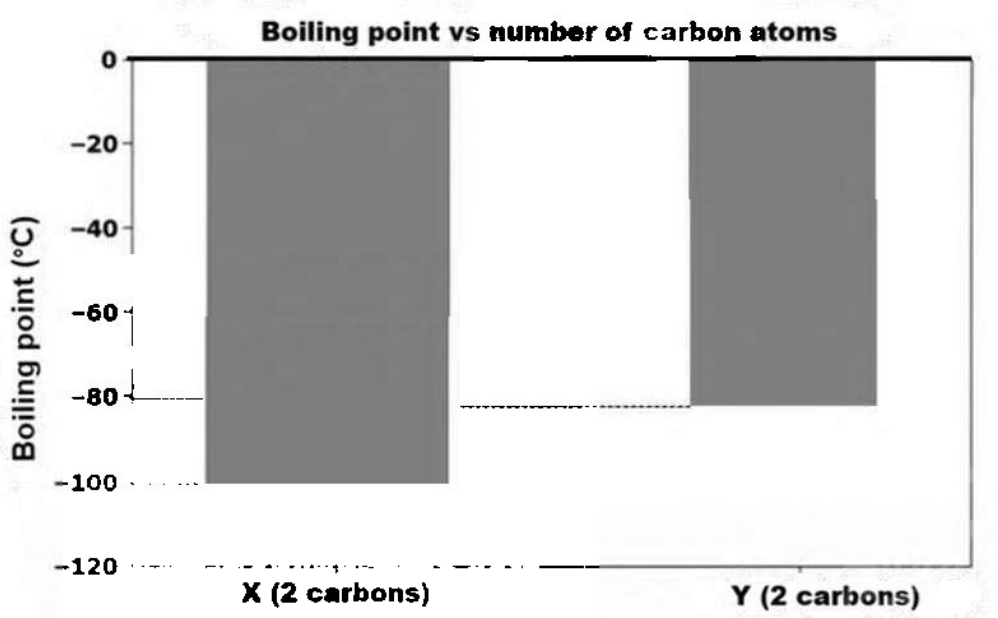
4.2 Hexane can be prepared from 2-bromohexane ($CH_3CH_2CH_2CH_2CHBrCH_3$) by a TWO STEP process. You are supplied with the following chemicals:

HCl	Concentrated NaOH	H_2	Pt	Concentrated H_2SO_4

Select appropriate chemicals from the table above to write down balanced equations for the TWO steps. Use CONDENSED STRUCTURAL FORMULAE and indicate the reaction conditions for each step. (8)

4.3 Write down the STRUCTURAL formula of the MINOR PRODUCT formed during step 1 in QUESTION 4.2. (2)

4.4 Hexane undergoes a cracking reaction, and the products (compounds **X** and **Y**) are shown in the graph below:



Write down the:

4.4.1 IUPAC NAME of compound **X** (2)

4.4.2 Homologous series to which compound **Y** belongs (1)

4.4.3 Balanced chemical equation for the cracking of hexane using MOLECULAR FORMULAE (3)

4.4.4 Write down the NAMES of the TWO products formed during the complete combustion of compound Y (2)
[20]

QUESTION 5 (Start on a new page.)

A learner investigates the reaction between zinc granules and excess dilute hydrochloric acid in a sealed 2,0 dm^3 container. The balanced equation is:

$$Zn(s) + 2HC\ell(aq) \rightarrow ZnC\ell_2(aq) + \mathbf{X_2}(g)$$

The volume of **X** gas produced is measured at regular time intervals at constant temperature. The results are recorded below:

TIME (s)	VOLUME OF X_2 (cm^3)
0	0
10	22
20	40
30	54
40	64
50	70
60	70

5.1 Write down the chemical NAME of gas $\mathbf{X_2}$. (1)

5.2 At what time does the reaction reach completion? Give a reason for the answer using data from the table. (3)

5.3 Explain what is meant by *dilute hydrochloric acid.* (2)

5.4 Which reactant is completely consumed during the reaction of zinc granules with the dilute hydrochloric acid, Zn or HCℓ? (1)

5.5 Define the term *reaction rate.* (2)

5.6 Calculate the average reaction rate between 30 s and 50 s. (3)

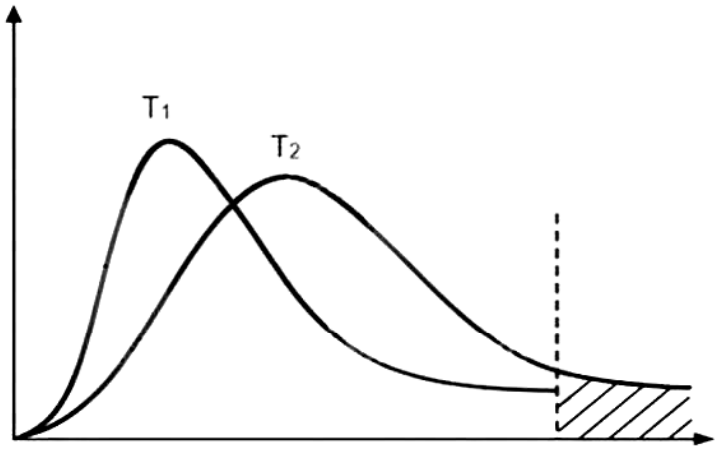
5.7 Using collision theory, explain the effect of a decreased surface area or state of division on the reaction rate. (4)

5.8 Define the term *catalyst.* (2)

5.9 The learner repeats the experiment using a suitable catalyst. Will the final volume of $\mathbf{X_2}$ gas INCREASE, DECREASE or REMAIN THE SAME? Explain the answer. (3)
[21]

QUESTION 6 (Start on a new page.)

The graph below represents the Maxwell-Boltzmann distribution of molecular energies for a gas at two different temperatures, T_1 and T_2.



6.1 Label the following:

6.1.1 y-axis (1)

6.1.2 shaded area (1)

6.1.3 dotted vertical line (1)

6.2 Which curve, T_1 or T_2, represents the gas at a higher temperature? Give a reason for the answer. (2)

6.3 A catalyst is added to the reaction.

How will the position of the dotted vertical line change? Choose from SHIFT TO THE LEFT or SHIFT TO THE RIGHT? Give a reason for the answer. (2)

6.4 Explain why the total area under the curves remains the same even when the temperature is increased and a catalyst is added. (3)

[10]

QUESTION 7 (Start on a new page.)

7.1 Give TWO conditions under which a dynamic equilibrium can be reached. (2)

7.2 State Le Chatelier's principle. (2)

7.3 A solid ammonium chloride decomposes in a sealed container according to the following equilibrium reaction:

$$NH_4C\ell\,(s) \rightleftharpoons NH_3(g) + HC\ell\,(g) \qquad \Delta H > 0$$

A mass of 64,2 g of $NH_4C\ell$ (s) is placed into a sealed container and heated to 480K. The system reaches equilibrium.

At equilibrium, it is found that 0,80 mol $NH_3(g)$ is present.
The equilibrium constant (Kc) at 480K is 1,0.

7.3.1 Is the forward reaction ENDOTHERMIC or EXOTHERMIC? Give a reason for the answer. (2)

7.3.2 Calculate the volume of the container in dm^3. (8)

7.3.3 The temperature now is changed from 480K to 300K, how will this change in temperature affect the Kc value? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

7.3.4 Explain the answer to QUESTION 7.3.3 by using Le Chatelier's principle. (3)

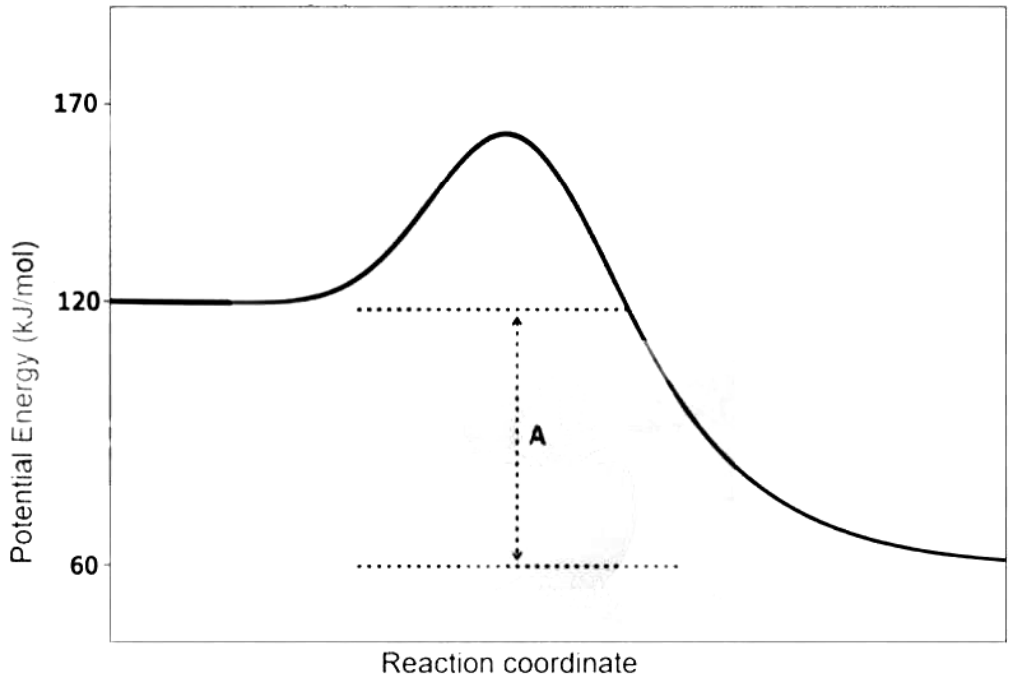
[18]

QUESTION 8 (Start on a new page.)

8.1 Equilibrium is established at 25 °C in an ionisation of hydrochloric acid according to the reaction:

$$HC\ell(g) + H_2O(l) \rightleftharpoons C\ell^-(aq) + H_3O^+(aq)$$

The graph below shows the energy profile for the ionisation of hydrochloric acid above.



8.1.1 Is the ionisation of hydrochloric acid an EXOTHERMIC or ENDOTHERMIC reaction? (1)

8.1.2 Define the term chosen in QUESTION 8.1.1. (1)

8.1.3 LABEL and write down the MAGNITUDE of section **A** in the graph. (2)

8.1.4 Define a *base* in terms of Arrhenius theory. (2)

8.1.5 Write down ONE conjugate acid-base pair from the ionisation of hydrochloric acid above. (2)

8.1.6 A few drops of concentrated nitric acid, HNO_3(conc.), are added to the equilibrium mixture. What effect does this addition have on the amount of $HC\ell$ (g)? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

8.1.7 Explain the answer to QUESTION 8.1.6 by using Le Chatelier's principle. (2)

8.2 A certain volume of a hydrochloric acid solution of concentration 0,5 mol·dm^{-3} is added to a sample of seashells of mass 8 g in a container. The seashell contains 95 % $CaCO_3$.

The hydrochloric acid solution ($HC\ell$) COMPLETELY reacts with the calcium carbonate ($CaCO_3$) in the sample according to the balanced equation:

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

Calculate the volume, in cm^3, of the hydrochloric acid ($HC\ell$) that was added to the sample inside the container. (7)

[18]

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*	$p^{\ominus}$	$1,013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	22,4 $dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	$T^{\ominus}$	273 K
Charge on electron *Lading op elektron*	e	-1.6×10^{-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* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ 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* $E^{\theta}_{cell} = E^{\theta}_{oxidising\ agent} - E^{\theta}_{reducing\ agent}$ / $E^{\theta}_{sel} = E^{\theta}_{oksideermiddel} - E^{\theta}_{reduseermiddel}$	
$I = \frac{Q}{\Delta t}$	$n = \frac{Q}{q_e}$ 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

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**

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29
1,9 **Cu** 63,5

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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*	$E^\ominus$ (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

Increasing strength of oxidising agents / *Toenemende sterkte van oksideermiddels* ↓

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

Half-reactions/*Halfreaksies*	$E^{\ominus}$(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