Province of the
EASTERN CAPE
EDUCATION

NATIONAL
SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY (P2)

COMMON TEST

JUNE 2014

MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages and a 4 Data Sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate spaces on the ANSWER BOOK.

2. Answer ALL the questions in the ANSWER BOOK.

3. This question paper consists of TWO sections:

   SECTION A (14)
   SECTION B (86)

4. You may use a non-programmable calculator.

5. You may use appropriate mathematical instruments.

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

7. Data sheet and periodic table are attached for your use.

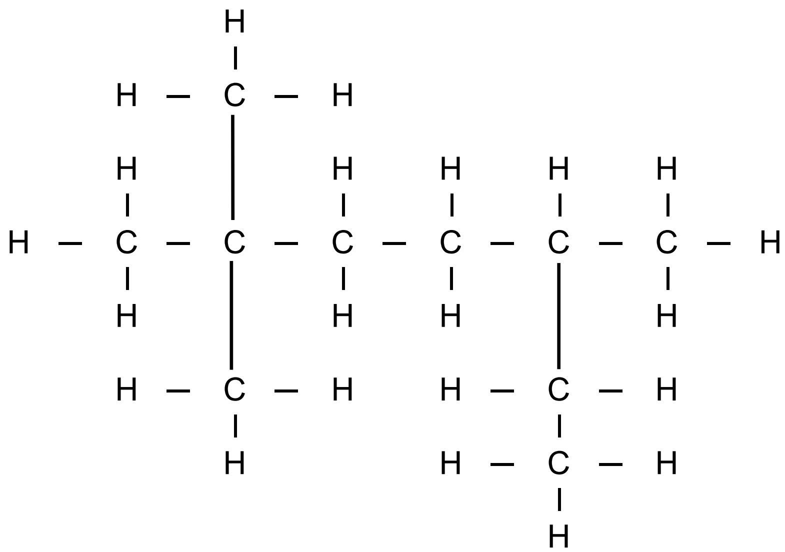
8. Give brief motivations, discussions, et cetera where required.

SECTION A

QUESTION 1: MULTIPLE CHOICE QUESTIONS

Four options are provided 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 – 1.6) in the ANSWER BOOK.

1.1 The IUPAC name for the following compound is …



A 2,2,5-trimethylheptane.
B 3,6,6-trimethylheptane.
C 2-ethyl-5,5-dimethylhexane.
D 5-ethyl-2,2-dimethylhexane. (2)

1.2 Consider the reaction represented below:

$$C_{12}H_{26} \rightarrow 2C_5H_{10} + C_2H_6$$

The term that <u>best</u> describes this reaction is …

A elimination.
B addition.
C cracking.
D polymerisation. (2)

1.3 A change in enthalpy is called …

A activated complex.
B heat of reaction.
C activation energy.
D external energy. (2)

1.4 The following chemical equation represents a reaction that occurs when soft drinks are carbonated:

$$CO_2(g) + H_2O(l) \rightleftharpoons H_2CO_3\ (aq)$$

Which statement is TRUE when this reaction is at equilibrium in a closed system?

A The decomposition of H_2CO_3(aq) begins.
B The formation of H_2CO_3(aq) stops.
C The formation of H_2CO_3(aq) stops, and the decomposition of H_2CO_3(aq) begins.
D The rates of formation and decomposition of H_2CO_3(aq) are equal. (2)

1.5 Refer to the following equation:

$$NH_3(g) + H_2O(\ell) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

The two BrØnsted-Lowry bases in the reaction equation are:

A NH_3 and H_2O
B NH_4^+ and OH^-
C H_2O and NH_4^+
D NH_3 and OH^- (2)

1.6 Which of the following substance(s) is/are amphiprotic?

(i) $H_2PO_4^-$ (ii) H_3PO_4 (iii) HPO_4^{2-}

A (i)
B (iii)
C (ii) and (iii)
D (i) and (iii) (2)

1.7 Which of the following statements regarding a catalyst is TRUE?

A It changes the heat of a reaction.
B It reduces the energy of the activated complex.
C It decreases the energy of the reactants.
D It increases the number of moles of products formed. (2)

TOTAL SECTION A: 14

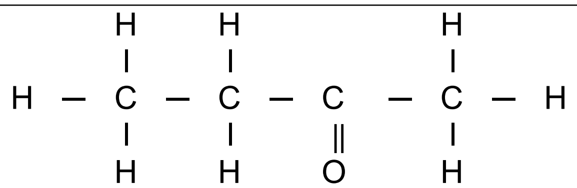
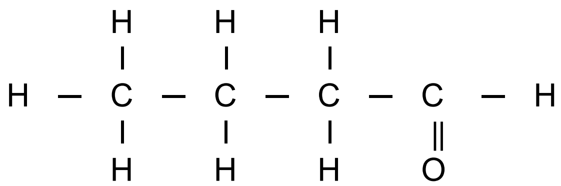
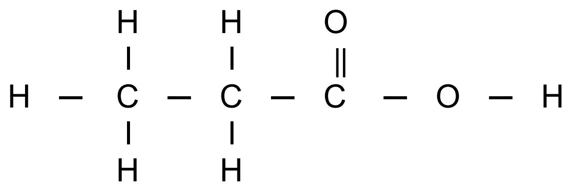
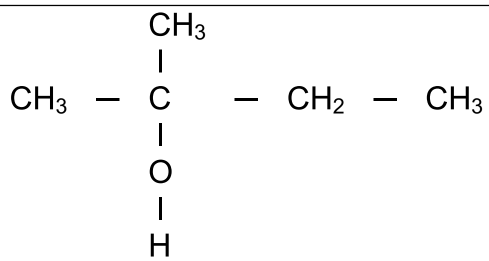
SECTION B

INSTRUCTIONS

1. Start EACH question on a NEW page.
2. Leave ONE line between two subquestions, for example between QUESTON 2.1 and QUESTION 2.2.
3. Show the formulae and substitution in all calculations.
4. Round off your final numerical answers to a minimum of TWO decimal places.

QUESTION 2

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

A	Methyl ethanoate	**B**	
C		**D**	
E		**F**	$(–CH_2 – CH_2–)_n$

2.1 Write down the:

2.1.1 Name of the homologous series to which compound **D** belongs. (1)

2.1.2 IUPAC name of compound **C**. (1)

2.1.3 Structural formula of monomer of compound **F**. (2)

2.2 Compound **E** represents an alcohol. Classify this alcohol as primary, secondary or tertiary. (1)

2.3 Briefly explain why compounds **B** and **C** are classified as FUNCTIONAL ISOMERS. (2)
[7]

QUESTION 3

The table below shows the boiling points for some hydrocarbons.

	COMPOUND	BOILING POINT (°C)
A	CH_3 I $CH_3 - C - CH_3$ I CH_3	9
B	$CH_3 - CH_2 - CH - CH_3$ I CH_3	28
C	$CH_3 - CH_2 - CH_2 - CH_2 - CH_3$	36

3.1 What are hydrocarbons? (1)

3.2 Consider the boiling point of the compounds in the above table.

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

3.2.2 Explain this trend in terms of the strength of intermolecular forces and energy. (3)

3.3 Which compound, A, B or C will have the highest vapour pressure? (1)
[6]

QUESTION 4

4.1 You are provided with a sample of butan-1-ol.

4.1.1 Write down the condensed structural formula of this compound. (2)

4.1.2 You are required to convert butan-1-ol to butan-2-ol.
Show, by means of a sequence of reaction steps using condensed structural formula, how this can be achieved.
Indicate the reagents and reaction conditions for each step of the reaction sequence. (4)

4.2 Hydrolysis and hydration are two types of organic reactions with the same organic product.

4.2.1 What is the organic product of these reactions? (1)

4.2.2 Write down, using condensed structural formula, an example of a **hydration reaction**. Indicate the reaction conditions. (You may use any organic compound of your choice). (3)

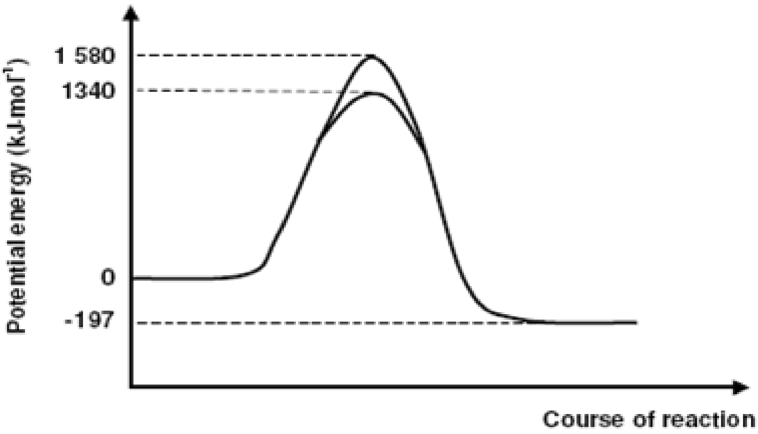
4.2.3 Write down, using condensed structural formula, an example of a **hydrolysis reaction**. Indicate the reaction conditions. (You may use any organic compound of your choice). (3)
[13]

QUESTION 5

The contact process is used to prepare sulphuric acid in the high concentrations needed for industrial purposes. This process involves the oxidation of sulphur dioxide in the presence of a vanadium (V) oxide catalyst:

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

Use the reaction and the graph, where applicable, to answer the questions that follow.



5.1 Is the forward reaction exothermic or endothermic? Prove your answer by calculating the value of ΔH for this reaction. (2)

5.2 What is the activation energy for the forward reaction in the absence of the anadium(V) oxide catalyst? (1)

5.3 The graph indicates that 1580 kJ.mol^{-1} is needed to break the bonds in the SO_2(g) and O_2(g) molecules. How much energy is released when the new bonds in the SO_3(g) molecules form? (1)

5.4 Determine the activation energy for the REVERSE REACTION in the presence of the vanadium(V) oxide catalyst. (1)
[5]

QUESTION 6

The grade 12 teacher investigates one of the factors that affect the rate of reaction.

In **Experiment 1**, 5 g zinc granules are added to 50 cm^3 of 0,3 mol.dm^{-3} hydrochloric acid.
In **Experiment 2**, 5 g zinc powder is added to 50 cm^3 of 0,3 mol.dm^{-3} hydrochloric acid.

For both experiments the volume of hydrogen gas produced is measured every 10 seconds.

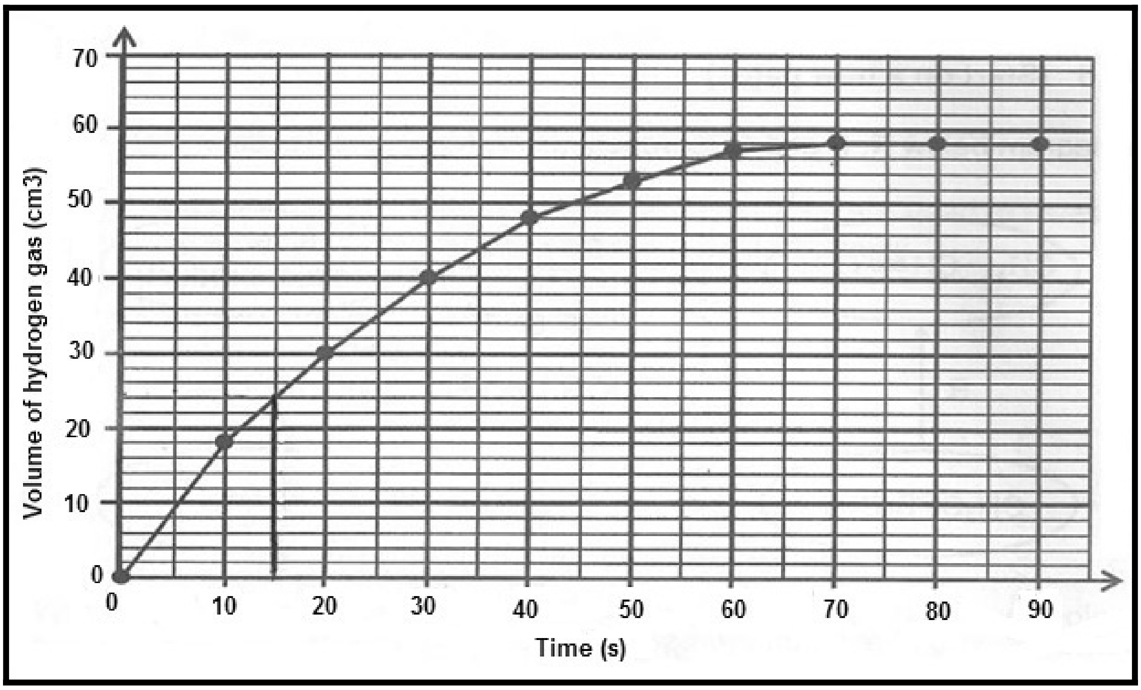
6.1 Write down a balanced equation for the reaction taking place. (3)

6.2 Name the factor affecting the rate of reaction that is investigated here. (1)

6.3 Why should the teacher ensure that equal masses of zinc are used in each experiment? (1)

6.4 Hydrochloric acid in both experiments is in excess. Give a reason why the excess hydrochloric acid in both experiments does not influence the results. (1)

The teacher asks learners to draw the graph using the results obtained in **Experiment 1**. The learners use the results in **Experiment 1** to draw the graph below.



6.5 Calculate the average rate of the reaction between the 20^{th} and 40^{th} second. (3)

6.6 How will the average rate of the reaction between the 20^{th} and 40^{th} second in **Experiment 2** compare with that in **Experiment 1**? Write down only GREATER THAN, LESS THAN or EQUAL TO. (1)

6.7 Use the collision theory to explain your answer in QUESTION 6.6. (2)

Experiment one is repeated, but this time a few small pieces of copper are added to the reaction vessel.

6.8 How will this affect in the following, when compared to experiment one? (Write down only INCREASES, DECREASES or REMAINS THE SAME.)

6.8.1 Volume of hydrogen gas produced (1)

6.8.2 The gradient of the graph (1)

6.9 Explain your answer to QUESTION 6.8.2 above. (2)
[16]

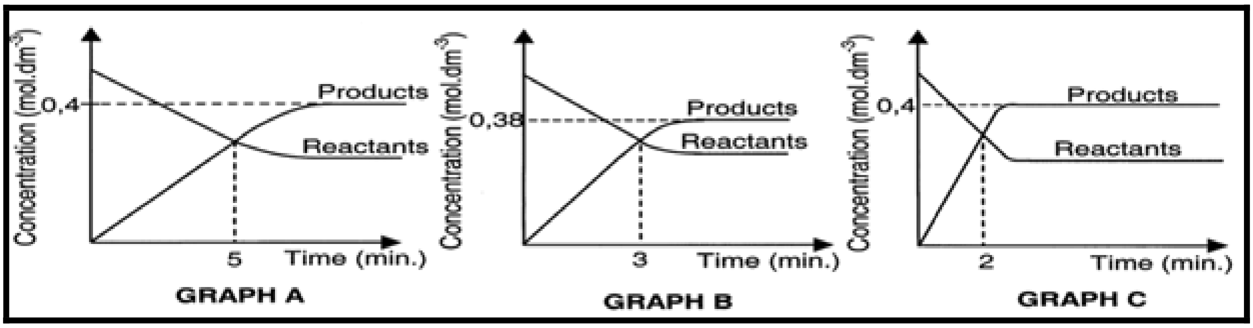
QUESTION 7

Consider the following reversible reaction in a sealed container:

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

The experiment was done three times under different conditions. In each case 1 g H_2 and 127 g I_2 reacted in 2,0 dm^3 container.

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



- Graph A was obtained at 500 °C.
- Graph B was obtained at 600 °C, but under the same conditions as graph A.
- Graph C was also obtained at 500 °C but under different conditions as graph A.

7.1 Is the above reaction an example of homogeneous or heterogeneous equilibrium? Give a reason for your answer. (2)

7.2 What factor is responsible for the difference between graph A and graph C? (1)

7.3 Give an explanation for the answer to QUESTION 7.2 with reference to the graph. (2)

7.4 Is the reaction in this experiment exothermic or endothermic? (1)

7.5 Use Le Chatelier's principle to give an explanation for your answer to QUESTION 7.4. (2)

7.6 Use the supplied information to calculate the equilibrium constant at 500 °C. (8)

[16]

QUESTION 8

The following solutions are provided:

Solution A: 0,1 mol.dm^{-3} H_2SO_4
Solution B: 0,1 mol.dm^{-3} $HC\ell$
Solution C: 0,1 mol.dm^{-3} Na_2SO_4
Solution D: 0,1 mol.dm^{-3} Na_2CO_3
Solution E: 0,1 mol.dm^{-3} NaOH

8.1 Use the symbols A, B, C, D or E to indicate the solution that:

8.1.1 may have a pH = 7 (1)
8.1.2 has the highest concentration of H_3O^+ (1)
8.1.3 is a strong base (1)
8.1.4 is a monoprotic acid (1)

8.2 Calculate the pH of solution A (assuming the temperature of the solution is 298 K). (3)

8.3 When a piece of litmus paper is placed in solution D, it turns blue.

Write down the equation for the reaction of this compound (D) with water that explains this observation. (3)

[10]

QUESTION 9

A grade 12 learner finds some sulphuric acid (H_2SO_4) solution in a bottle labelled "dilute sulphuric acid". The learner wishes to determine the concentration of the sulphuric acid solution. To do this the learner decided to titrate the sulphuric acid against a standard potassium hydroxide (KOH) solution.

9.1 What is meant by a 'diluted acid'? (1)

9.2 What is a standard solution? (1)

9.3 Calculate the mass of potassium hydroxide which the learner must use to make 300 cm^3 of 0,2 mol.dm^{-3} KOH solution. (4)

During the titration the learner finds that 15,04 cm^3 of the KOH solution neutralises 20,15 cm^3 of the H_2SO_4 solution. The equation for the reaction is …

$$2KOH_{(aq)} + H_2SO_{4(aq)} \rightarrow K_2SO_{4(aq)} + 2H_2O_{(\ell)}$$

9.4 What is the importance of adding an indicator during titration? (1)

9.5 Which ONE of the indicators listed in the table below is most suitable to use during this titration? Explain your choice. (2)

Indicator	pH range
Methyl orange	2,9 – 4,0
Bromothymol blue	6,0 – 7,6
Phenolphthalein	8,3 – 10,0

9.6 Calculate the concentration of the H_2SO_4 solution. (4)

[13]

TOTAL SECTION B: 86

GRAND TOTAL: 100

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* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ 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* $E^{\theta}_{cell} = E^{\theta}_{oxidising\ agent} - E^{\theta}_{reducing\ agent}$ / $E^{\theta}_{sel} = E^{\theta}_{oksideermiddel} - E^{\theta}_{reduseermiddel}$	

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

(Each cell: electronegativity, atomic number, symbol, approximate relative atomic mass)

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
$2H^+ + 2e^-$	⇌	**$H_2(g)$**	**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
$A\ell^{3+} + 3e^-$	⇌	$A\ell$	– 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