higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(Second Paper)
NQF LEVEL 4

(10021004)

28 November 2018 (Y-Paper)
13:00–16:00

This question paper consists of 14 pages, 1 page consisting of physical constants tables and a formula sheet, 1 periodic table and 2 tables of standard reduction potentials.

TIME: 3 HOURS
MARKS: 150

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.

2. Read ALL the questions carefully.

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

4. Write your EXAMINATION NUMBER in the space provided on the graph paper and hand it in with your ANSWER BOOK.

5. Cross out any work that you do not want to be marked.

6. Write with BLUE or BLACK ink only.

7. ALL final answers must be accurately approximated to TWO decimal places unless otherwise stated.

8. Write neatly and legibly.

SECTION A

QUESTION 1

Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 The change in concentration per unit time.

1.2 A solution that conducts electricity through the movement of ions.

1.3 Type of polymer that can be liquefied and recycled repeatedly.

1.4 An atom, group of atoms or a chemical bond that gives a compound is characteristic properties.

1.5 An aqueous solution that has a fixed pH, even if small amounts of an acid or a base is added to it.

(5 × 1) **[5]**

QUESTION 2

Choose a description from COLUMN B that matches a word/term in COLUMN A. Write only the letter (A–I) next to the question number (2.1–2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	Alkanes	A	type of reaction in which an atom or group of atoms is added to a compound
2.2	Elimination	B	has the general formula C_nH_{2n-2}
2.3	Organic acid	C	an organic compound that contains –OH group
2.4	Alcohol	D	type of reaction in which an atom or group of atoms is removed from a compound
2.5	Alkenes	E	an organic compound that contains the carboxyl group
		F	compounds that contain at least one double bond between the carbon atoms
		G	non-sustainable source of fuel
		H	form polymers at high pressures and high temperatures
		I	type of reaction in which atoms are replaced in a compound

(5 × 1) **[5]**

QUESTION 3

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (3.1–3.5) in the ANSWER BOOK.

3.1 Alpha particles are positively charged.

3.2 The addition of a catalyst reduces the heat of a reaction.

3.3 The hydrostatic pressure is independent of the depth of a liquid.

3.4 In the industrial process to manufacture ammonia, hydrogen is obtained from the atmosphere.

3.5 Viscosity is a measure of a fluid's resistance to flow.

(5 × 2) **[10]**

QUESTION 4

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (4.1–4.5) in the ANSWER BOOK.

4.1 A nuclear reaction is represented as $^{14}_{7}N + ^{4}_{2}He \rightarrow ^{17}_{8}O + X$.
What does X represent?

A $^{0}_{-1}e$

B $^{0}_{1}e$

C $^{1}_{1}H$

D $^{2}_{1}H$

4.2 5 g of granulated zinc is added to a test tube containing an excess of 0,5 mol·dm^{-3} HCℓ solution.

Which ONE of the following will NOT affect the rate of this reaction?

A The use of powdered zinc
B The use of a hot HCℓ solution
C The addition of water to the reaction test tube
D The increase in the volume of 0,5 mol·dm^{-3} HCℓ solution

4.3 The cracking of a hydrocarbon is represented by the following equation:

$$C_{12}H_{26} \rightarrow 2C_2H_4 + X + C_5H_{12}$$

Which ONE of the following is the name of product X?

A Prop-1-ene
B But-1-ene
C Propane
D Butane

4.4 Which ONE of the following is SUBSTITUTION REACTION?

A $CH_2 = CH_2 + HBr \rightarrow CH_3CH_2Br$

B $CH_2 = CH_2 + H_2O \rightarrow CH_3CH_2OH$

C $CH_3CH_2OH \rightarrow CH_2 = CH_2 + H_2O$

D $CH_3CH_2OH + HBr \rightarrow CH_3CH_2Br + H_2O$

4.5 Which ONE of the following is the empirical formula of 1,2-dibromoethene?

A $C_3H_4Br_2$

B $C_2H_4Br_2$

C $C_2H_2Br_2$

D CH_2Br_2

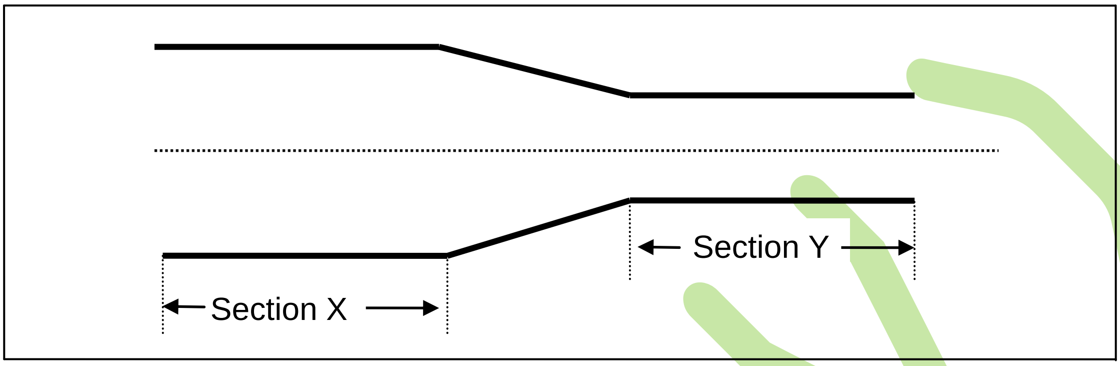
(5 × 3) **[15]**
TOTAL SECTION A: 35

SECTION B

QUESTION 5

The sketch represents a circular pipe with a fluid flowing through the pipe.

In section X, which has a cross-sectional area of 0,5 m^2, the flow rate of the fluid is 1,2 $m \cdot s^{-1}$ and the pressure is 150 kPa.



5.1 Name the instrument that is used to measure the flow rate in the pipe. (1)

5.2 State TWO properties of an ideal fluid. (1 × 2) (2)

5.3 Calculate the diameter of the pipe in section Y, if the flow rate there is 1,5 $m \cdot s^{-1}$. (Area of circle = πr^2 and π is 3,14) (6)

5.4 Compare the pressure in section Y with that in section X. Choose from GREATER THAN, LESS THAN or EQUAL TO 150 kPa? (2)

[11]

QUESTION 6

The boiling points of a number of organic compounds are tabulated below.

	ORGANIC COMPOUNDS	**BOILING POINT in ^0C**
A	Butane	- 1,0
B	Butan-1-ol	117,7
C	Butanoic acid	163,5

6.1 Define the term 'boiling point'. (2)

6.2 Name the dominant inter molecular forces in:

6.2.1 Butane (1)

6.2.2 Butan-1-ol (1)

6.3 Write down TWO reasons why butanoic acid has the highest boiling point of the three compounds in the table. (4)

6.4 Write a balanced chemical equation for the complete oxidation of butane. (3)

6.5 Write down the structural formula for a positional isomer of butan-1-ol and NAME the compound. (3)

[14]

QUESTION 7

7.1 A hydrogen peroxide solution dissociates slowly at room temperature according to the following equation:

$$2H_2O_2(aq) \rightarrow 2H_2O(\ell) + O_2(g)$$

Bulelwa obtained the following results for the decomposition of hydrogen peroxide:

TIME (s)	H_2O_2 CONCENTRATION ($mol \cdot dm^{-3}$)
0	0,0200
200	0,0160
400	0,0131
600	0,0106
800	0,0086

Calculate the AVERAGE rate of decomposition (in $mol \cdot dm^{-3} \cdot s^{-1}$) of $H_2O_2(aq)$ in the first 400 s. (4)

7.2 *A suitable catalyst is added to the hydrogen peroxide solution.* Would you anticipate that the $H_2O_2(aq)$ concentration at 200 s will be GREATER THAN, LESS THAN or EQUAL TO that recorded by Bulelwa above? Explain the answer. (4)

7.3 Bulelwa notices that the hydrogen peroxide solution heats up as it decomposes.

Sketch a rough graph of potential energy versus reaction time for the decomposition of hydrogen peroxide. (3)

7.4 Calculate the mass of oxygen produced in the first 600 s if 50 cm^3 of hydrogen peroxide decomposes in 600 s. (5)

[16]

QUESTION 8

The industrial production of sulphuric acid involves the following reaction:

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \qquad \Delta H < 0$$

8.1 Is this an EXOTHERMIC or ENDOTHERMIC reaction? Give a reason for the answer. (2)

8.2 Name the principle that is applicable to systems in chemical equilibrium. (1)

8.3 State the effect, INCREASE, DECREASE or NO EFFECT, that the increase in pressure will have on the following:

8.3.1 Quantity of $O_{2(g)}$

8.3.2 The equilibrium constant

8.3.3 Rate of the reverse reaction

(3 × 2) (6)

8.4 6 moles of $SO_2(g)$ and 5 moles $O_2(g)$ and 2 moles of $SO_3(g)$ are placed in a 2 dm^3 flask and allowed to reach chemical equilibrium. At equilibrium it was found that the concentration of $SO_3(g)$ was 2 $mol{\cdot}dm^{-3}$.

Calculate the equilibrium constant. (8)

[17]

QUESTION 9

9.1 Write down the formula of two acids in the following reaction.

$H_2O(\ell)$ + $H_2O(\ell)$ ⇆ $OH^-(aq)$ + $H_3O^+(aq)$ (2)

9.2 A 3,5 g impure sample of anhydrous sodium carbonate was dissolved in 250 cm^3 of distilled water in a volumetric flask.

In a titration, 18 cm^3 of a 0,263 $mol{\cdot}dm^{-3}$ hydrochloric acid solution was required to reach the end point with 25 cm^3 of this sodium carbonate solution.

The balanced equation for the reaction is:

$$Na_2CO_3(s) + 2HC\ell(aq) \rightarrow 2NaC\ell(aq) + CO_2(g) + H_2O(\ell)$$

The pH range of some indicators is tabulated below:

INDICATOR	pH RANGE
Methyl orange	3,1 - 4,4
Phenolphthalein	8,2 - 10,0
Bromothymol blue	6,0 - 7,6

9.2.1 From the list above, select a suitable indicator for this titration. (1)

9.2.2 Give a reason for your choice of indicator in QUESTION 9.2.1 (2)

9.2.3 Calculate the quantity (in mole) of hydrochloric acid used to reach the end point. Work correct to FOUR decimal places. (3)

9.2.4 Calculate the concentration of the sodium carbonate solution. Work correct to FOUR decimal places. (4)

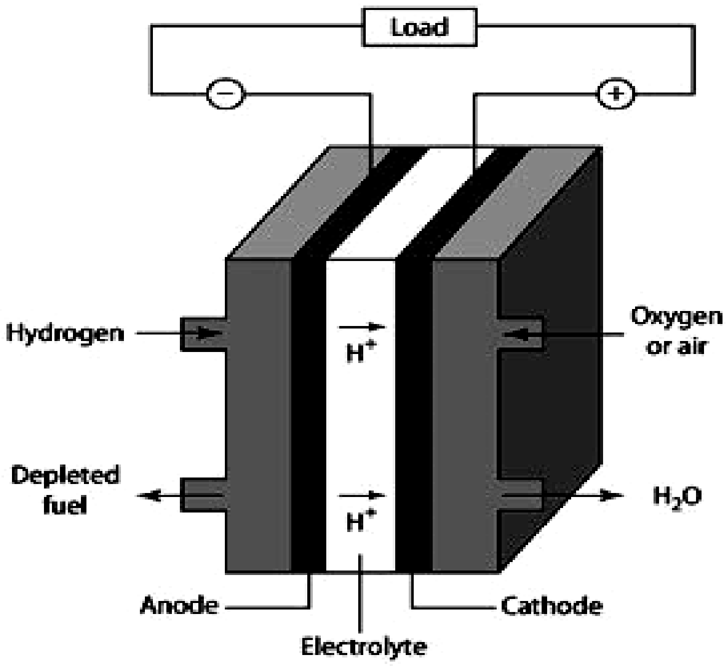
9.2.5 Determine the percentage purity of the sodium carbonate solution. (6)

[18]

QUESTION 10

A fuel-cell is an electrochemical cell designed to replace the alkaline battery as a source of energy.

The sketch below illustrates a fuel-cell. In this cell hydrogen is regarded as the fuel.



The half-reactions that take place in this fuel cell are:

A $2\,H^+ + 2e^- \rightleftharpoons H_2$ $E^\ominus = 0{,}00\ V$

B $O_2 + 4\,H^+ + 4e^- \rightleftharpoons 2\,H_2O$ $E^\ominus = 0{,}68\ V$

10.1 Which reaction, A or B, occurs at the anode? (2)

10.2 Write the balanced equation for the net cell reaction. (3)

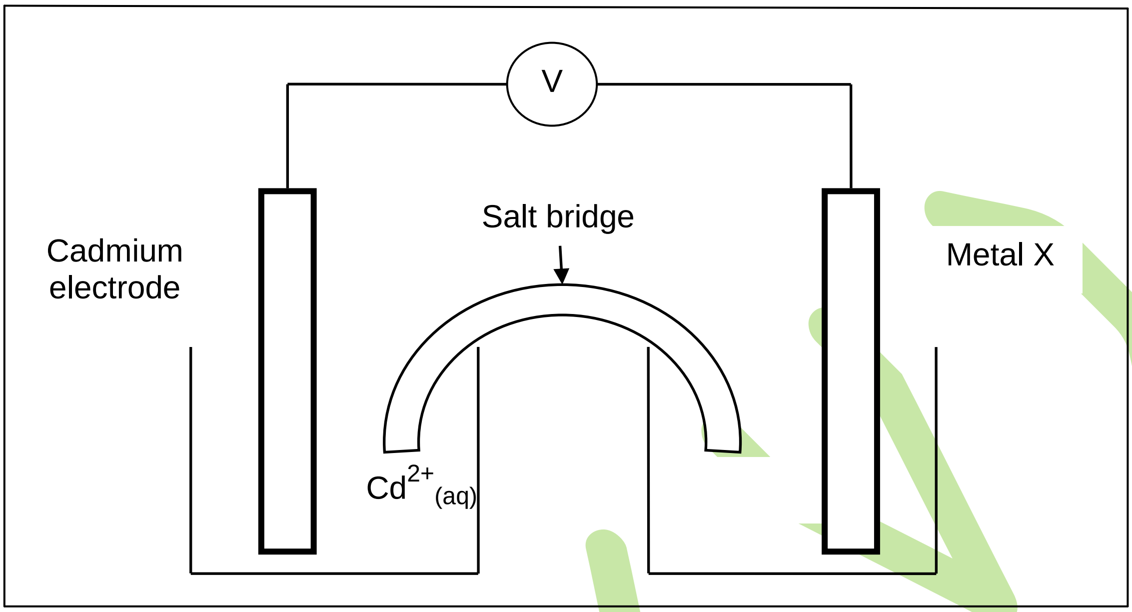
10.3 Calculate the potential difference provided if 10 of these fuel cells are connected in series. (2)

10.4 Give one reason why this cell may be used when astronauts embark on long distance space travel. (2)

[9]

QUESTION 11

A standard cell is constructed by connecting an unknown metal X to a cadmium half-cell as shown in the sketch below. Metal X is placed in a solution of its ions. Electrons flow through the external circuit from the cadmium electrode to metal X.



11.1 What energy conversion occurs in this voltaic cell? (2)

11.2 Calculate the change in the mass of the cadmium electrode if 0,03 moles of electrons are transferred from cadmium to metal X. (4)

11.3 If the initial voltmeter reading is 1,2 V, NAME metal X. Use a relevant calculation to justify your answer. (5)

11.4 As the cell delivers a current, state whether the following INCREASES, DECREASES or REMAINS CONSTANT:

11.4.1 The mass of metal X

11.4.2 The concentration of Cd^{2+} ions

11.4.3 The potential difference across the electrodes

(3 × 2) (6)

[17]

QUESTION 12

12.1 In 1986 a massive nuclear accident took place at the nuclear power station at Chernobyl in the Ukraine. There was a huge release of radioactive isotopes into the atmosphere. Now, more than 30 years later, scientists are still monitoring the risk of cancer caused by the accident.
Two of the main risks are associated with the radioactive isotopes iodine-131, with a half-life of 8 days and caesium-137, with a half-life of 30 years.

12.1.1 Define the term ‘radioactive’. (2)

12.1.2 What are isotopes? (2)

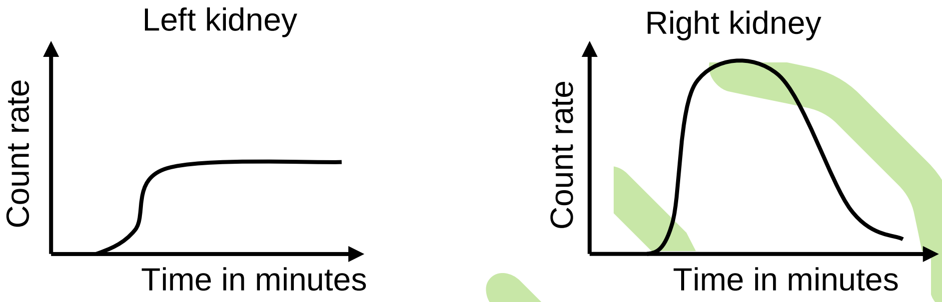
12.1.3 People are still kept out of the 4 000 km^2 area around the power station. Which ONE of the two radioactive isotopes noted above is the reason for the continued risk in the area? (1)

12.1.4 Give a reason for your answer to QUESTION 12.1.3 using the concept of half-life. (2)

12.1.5 In the weeks and months immediately after the accident contamination from radioactive isotopes in milk was a main risk. Suggest a route by which radioactive isotopes released into the atmosphere could end up in milk. (2)

12.2 A doctor uses the radioactive isotope technetium-99 to find out if a patient's kidneys are working correctly. The doctor injects a small amount of technetium-99 into the patient's bloodstream. Technetium-99 emits gamma radiation. If the patient's kidneys are working correctly, the technetium-99 will pass from the bloodstream into the kidneys and then into the patient's urine.

Detectors are used to measure the radiation emitted from the kidneys. The level of radiation emitted from each kidney is recorded on a graph.



12.2.1 By looking at the graphs, select ONE of the following:

A Only the right kidney is working correctly.
B Only the left kidney is working correctly.
C Both kidneys are working correctly. (2)

12.2.2 Explain the reason for your answer to QUESTION 12.2.1. (2)
[13]

TOTAL SECTION B: 115
GRAND TOTAL: 150

DATA FOR PHYSICAL SCIENCES
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE
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

TABLE 2: FORMULA SHEET/TABEL 2: FORMULEBLAD

$n = \frac{m}{M}$	$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$
$q = I\Delta t$ $W = Vq$	$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ OR $E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ OR $E^{\theta}_{cell} = E^{\theta}_{oxidisingagent} - E^{\theta}_{reducingagent}$

TABLE 3: PERIODIC TABLE OF ELEMENTS/TABEL 3: PERIODIEKE TABEL

KEY

Electronegativity	Atomic number	Symbol	Approximate relative atomic mass
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)
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/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/STANDAARD REDUKSIEPOTENSIALE

Ioenemende oksiderende vermoë/Increasing oxidising ability (↓)

Toenemende reduserende vermoë/Increasing reducing ability (↑)

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