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**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

JUNE 2023

TECHNICAL SCIENCES: CHEMISTRY P2

MARKS: 75

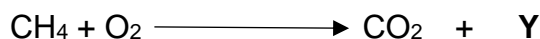
TIME: 1½ hours

This question paper consists of 14 pages, including 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your FULL NAME and SURNAME in the appropriate spaces in the ANSWER BOOK.
2. Answer ALL the questions.
3. Start each question on a NEW page in the ANSWER BOOK.
4. You may use a non-programmable calculator.
5. You may use appropriate mathematical instruments.
6. Number the answers according to the numbering system used in this question paper.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions et cetera where required.
10. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.

- 1.3 Study the organic reaction below and answer the following question.



The substance that Y represents is ..., and it is an ... compound.

- A water; organic
 B water; inorganic
 C carbon; organic
 D methane; inorganic (2)

- 1.4 Which of the following set of answers is the correct arrangement of semiconductors?

	Valence electrons	Arrangement of covalent bonds	Element	Material
A	4	tetrahedral	carbon	diamond
B	4	hexagonal	diamond	carbon
C	5	tetrahedral	arsenic	phosphorous
D	5	pentagonal	germanium	silicon

(2)

- 1.5 Extrinsic and intrinsic semiconductors:

- (i) In doping, an impurity is added to a semiconductor to improve the conductivity of the semiconductor
 (ii) In doping, a catalyst is added to a semiconductor to improve the conductivity of the semiconductor
 (iii) A few protons gain enough thermal energy to cross the energy gap (from the valence band) to the conduction band
 (iv) Semiconductors are doped with a trivalent impurity
 (v) A few electrons gain enough thermal energy to cross the energy gap (from the valence band) to the conduction band

Which ONE of the following combinations below is CORRECT?

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

[10]

QUESTION 2 (Start on a NEW page.)

Consider the organic compounds represented by the letters **A** to **G** below and answer the questions that follow.

A	Hex-2-ene	E	2-methylpropan-2-ol
B	$ \begin{array}{cccccc} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\ & & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & & & & & \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array} $	F	$ \begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & & \text{O} & \text{H} & \text{H} \\ & & & & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{O} & - \text{C} & - \text{C} & - \text{H} \\ & & & & & & & \\ & \text{H} & \text{H} & \text{H} & & & \text{H} & \text{H} \end{array} $
C	$ \begin{array}{cccc} & \text{H} & \text{H} & \text{H} & \text{H} \\ & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & & & & \\ & \text{H} & \text{O} & \text{H} & \text{H} \\ & & & & \\ & & \text{H} & & \end{array} $	G	$ \begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{O} \\ & & & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{O} & - \text{H} \\ & & & & & & & \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & & \end{array} $
D	$ \begin{array}{cccccc} & \text{H} & \text{H} & & \text{H} & \text{H} \\ & & & & & \\ \text{H} & - \text{C} & - \text{C} & = \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & & & & & \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array} $	H	$ \begin{array}{ccc} & \text{H} & \text{O} & \text{H} \\ & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & & & \\ & \text{H} & & \text{H} \end{array} $

- 2.1 Define the term *hydrocarbon*. (2)
- 2.2 Write down the letter(s) that represents the following:
- 2.2.1 A secondary alcohol (1)
- 2.2.2 A saturated hydrocarbon (1)
- 2.2.3 Functional isomers (2)
- 2.2.4 Hydrocarbons (1)
- 2.2.5 Positional isomers (2)

2.3 Write down the IUPAC name of the following:

2.3.1 **D** (1)

2.3.2 **H** (1)

2.3.3 **F** (2)

2.4 Write down the:

2.4.1 STRUCTURAL formula of compound **A** (2)

2.4.2 STRUCTURAL formula for the functional group of compound **D** (1)

2.4.3 MOLECULAR formula of compound **B** (1)

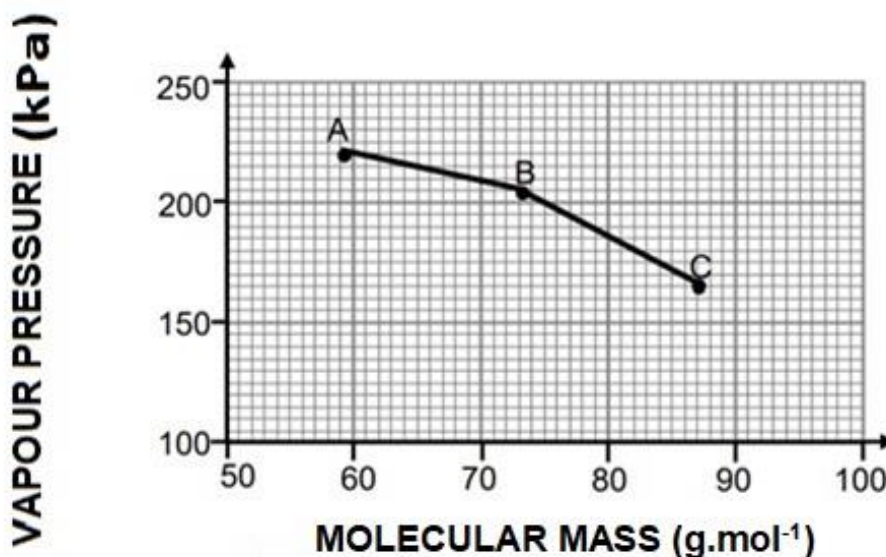
2.4.4 The name of a ketone (1)

2.4.5 STRUCTURAL formula of compound **E** (2)

[20]

QUESTION 3 (Start on a NEW page.)

Students were observing the vapour pressure of three (3) organic compounds from a homologous series with a general formula C_nH_{2n+2} , represented by **A**, **B** and **C**. The number of carbon atoms of these organic compounds ranges between 3 carbon atoms and 5 carbon atoms. Their results were graphed as follows:



- 3.1 Define the term *homologous series*. (2)
- 3.2 What trend can be deduced from the graph? (2)
- 3.3 Identify the type of intermolecular forces that exist between the molecules of these organic compounds. (1)
- 3.4 Write down the names of the compounds in the graph represented by the following letters:
- 3.4.1 **A** (1)
- 3.4.2 **B** (1)
- 3.4.3 **C** (1)
- 3.5 Explain the difference in the vapour pressure of compounds **B** and **C**. Refer to the MOLECULAR MASSES, STRENGTH OF INTERMOLECULAR FORCES and THE ENERGY NEEDED. (4)
- 3.6 Which compound will have the ...? (Write only **A**, **B** or **C**.)
- 3.6.1 highest viscosity (1)
- 3.6.2 lowest melting point (1)
- 3.6.3 highest boiling point (1)

[15]

QUESTION 4 (Start on a NEW page.)

The table below shows the boiling points of four organic compounds, represented by the letters **A** to **D**, of comparable molecular mass.

Compound	Molecular mass	Boiling point (°C)
A	Butane	0
B	Propanone	49
C	Propan-1-ol	97
D	Ethanoic acid	118

4.1 Which compound can be used as a fuel in gas burners? (1)

4.2 Explain your answer to QUESTION 4.1. (2)

4.3 How will the boiling point of 2-methylpropane compare to that of compound **A**?

Write HIGHER THAN, LOWER THAN or EQUAL TO.

Refer to MOLECULAR STRUCTURES, INTERMOLECULAR FORCES and the ENERGY needed to explain the answer. (4)

4.4 What is the relationship between compound **A** and 2-methyl propane? Explain. (2)

4.5 Consider the vapour pressure of compounds **B** and **C**. These compounds have different vapour pressure.

4.5.1 Give a reason for this difference in vapour pressure by referring to the intermolecular forces present in EACH of these compounds. (4)

Which ONE of compounds **B** or **C** has the:

4.5.2 Highest vapour pressure (1)

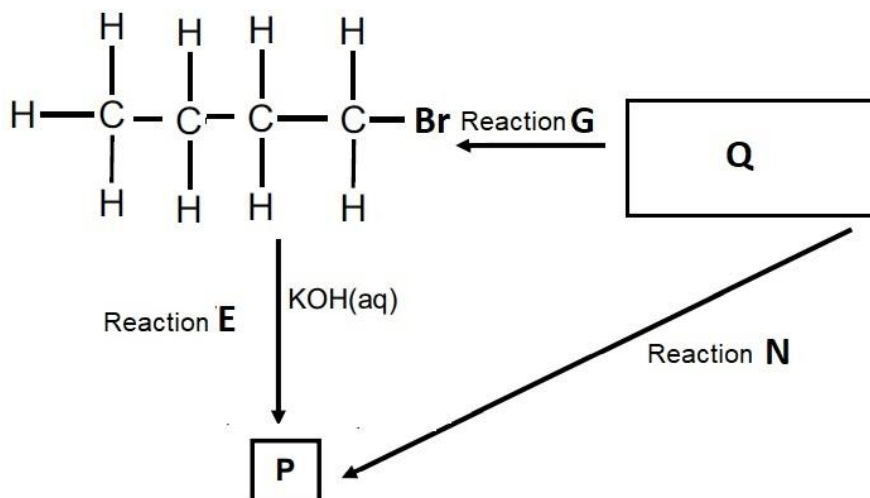
4.5.3 Highest melting point (1)

4.5.4 Lowest viscosity (1)

[16]

QUESTION 5 (Start on a NEW page.)

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



5.1 Write down the type of reaction represented by the following:

5.1.1 **G** (1)

5.1.2 **E** (1)

5.1.3 **N** (1)

5.2 For Reaction **E**, write the following down:

5.2.1 The homologous series to which compound **P** belongs (1)

5.2.2 ONE reaction condition (1)

5.2.3 The balanced chemical equation using STRUCTURAL FORMULAE (3)

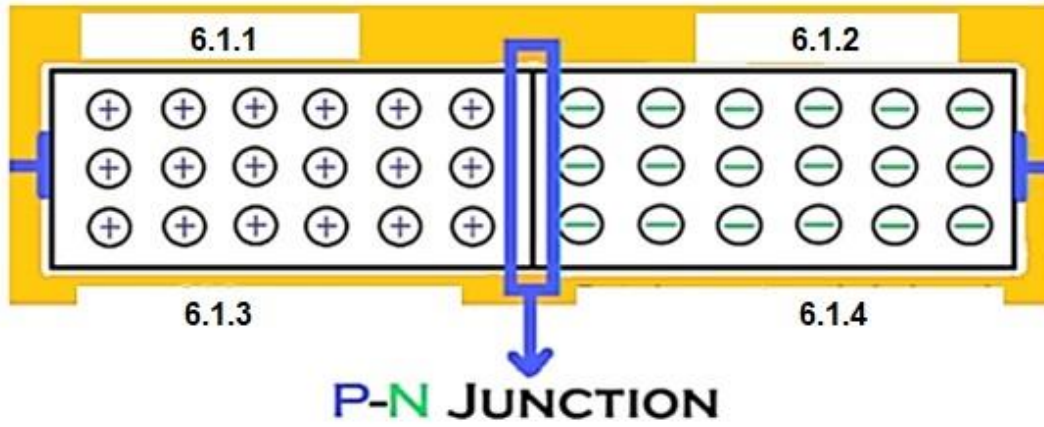
5.3 Write down the structural formula for compound **Q**. (2)

[10]

QUESTION 6 (Start on a NEW page.)

A p-n junction is formed when a p-doped semiconductor is connected to an n-doped semiconductor.

6.1 Label the following diagram of a p-n junction.



[4]

TOTAL: 75

**NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT**

**DATA FOR TECHNICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)**

**GEGEWENS VIR TEGNIESE WETENSAPPE GRAAD 12
VRAESTEL 2 (CHEMIE)**

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESTE KONSTANTES

NAAM/NAME	SIMBOOL/SYMBOL	WAARDE/VALUE
<i>Avogadro se konstante</i> Avogadro's constant	N_A	$6,02 \times 10^{23} \text{ mol}^{-1}$
<i>Molêre gaskonstante</i> Molar gas constant	R	$8,31 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$
<i>Standaarddruk</i> Standard pressure	p^θ	$1,013 \times 10^5 \text{ Pa}$
<i>Molêre gasvolume teen STD</i> Molar gas volume at STP	V_m	$22,4 \text{ dm}^3\cdot\text{mol}^{-1}$
<i>Standaardtemperatuur</i> Standard temperature	T^θ	273 K

TABLE 2: FORMULAE/TABEL 2: FORMULES

$n = \frac{m}{M}$ or/of $n = \frac{N}{N_A}$ or/of $n = \frac{V}{V_m}$	$c = \frac{n}{V}$ or/of $c = \frac{m}{MV}$ $\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$\text{pH} = -\log[\text{H}_3\text{O}^+]$ $K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$ at /by 298K
$E^\theta_{\text{cell}} = E^\theta_{\text{cathode}} - E^\theta_{\text{anode}} / E^\theta_{\text{sel}} = E^\theta_{\text{katode}} - E^\theta_{\text{anode}}$		
$E^\theta_{\text{cell}} = E^\theta_{\text{reduction}} - E^\theta_{\text{oxidation}} / E^\theta_{\text{sel}} = E^\theta_{\text{reduksie}} - E^\theta_{\text{oksidasie}}$		
$E^\theta_{\text{cell}} = E^\theta_{\text{oxidising agent}} - E^\theta_{\text{reducing agent}} / E^\theta_{\text{sel}} = E^\theta_{\text{oksideermiddel}} - E^\theta_{\text{reduseermiddel}}$		

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																	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 1,6 Nb 92	42 1,8 Mo 96	43 1,9 Tc 98	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 1,3 La 139	72 1,6 Hf 179	73 1,6 Ta 181	74 1,8 W 184	75 1,9 Re 186	76 2,2 Os 190	77 2,2 Ir 192	78 2,2 Pt 195	79 1,9 Au 197	80 1,7 Hg 201	81 1,8 Tl 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po 209	85 2,5 At 210	86 Rn 222
87 0,7 Fr 223	88 0,9 Ra 226	89 Ac 227															
			58 Ce 140	59 Pr 141	60 Nd 144	61 Pm 147	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 231	92 U 238	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 260	

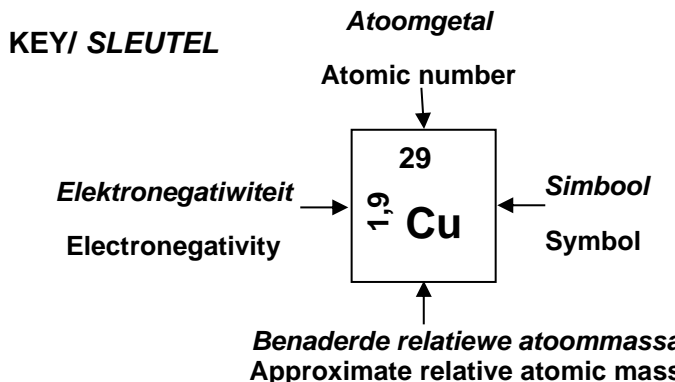


TABLE 4A: STANDARD REDUCTION POTENTIALS
TABEL 4A: STANDAARD REDUKSIEPOTENSIALE

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
$Cl_2(g) + 2e^- \rightleftharpoons 2Cl^-$	+ 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
$Br_2(l) + 2e^- \rightleftharpoons 2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^- \rightleftharpoons NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^- \rightleftharpoons Hg(l)$	+ 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
$Al^{3+} + 3e^- \rightleftharpoons Al$	- 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

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

Half-reactions/Halfreaksies	E^{θ} (V)
$\text{Li}^+ + \text{e}^- \rightleftharpoons \text{Li}$	- 3,05
$\text{K}^+ + \text{e}^- \rightleftharpoons \text{K}$	- 2,93
$\text{Cs}^+ + \text{e}^- \rightleftharpoons \text{Cs}$	- 2,92
$\text{Ba}^{2+} + 2\text{e}^- \rightleftharpoons \text{Ba}$	- 2,90
$\text{Sr}^{2+} + 2\text{e}^- \rightleftharpoons \text{Sr}$	- 2,89
$\text{Ca}^{2+} + 2\text{e}^- \rightleftharpoons \text{Ca}$	- 2,87
$\text{Na}^+ + \text{e}^- \rightleftharpoons \text{Na}$	- 2,71
$\text{Mg}^{2+} + 2\text{e}^- \rightleftharpoons \text{Mg}$	- 2,36
$\text{Al}^{3+} + 3\text{e}^- \rightleftharpoons \text{Al}$	- 1,66
$\text{Mn}^{2+} + 2\text{e}^- \rightleftharpoons \text{Mn}$	- 1,18
$\text{Cr}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cr}$	- 0,91
$2\text{H}_2\text{O} + 2\text{e}^- \rightleftharpoons \text{H}_2(\text{g}) + 2\text{OH}^-$	- 0,83
$\text{Zn}^{2+} + 2\text{e}^- \rightleftharpoons \text{Zn}$	- 0,76
$\text{Cr}^{3+} + 3\text{e}^- \rightleftharpoons \text{Cr}$	- 0,74
$\text{Fe}^{2+} + 2\text{e}^- \rightleftharpoons \text{Fe}$	- 0,44
$\text{Cr}^{3+} + \text{e}^- \rightleftharpoons \text{Cr}^{2+}$	- 0,41
$\text{Cd}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cd}$	- 0,40
$\text{Co}^{2+} + 2\text{e}^- \rightleftharpoons \text{Co}$	- 0,28
$\text{Ni}^{2+} + 2\text{e}^- \rightleftharpoons \text{Ni}$	- 0,27
$\text{Sn}^{2+} + 2\text{e}^- \rightleftharpoons \text{Sn}$	- 0,14
$\text{Pb}^{2+} + 2\text{e}^- \rightleftharpoons \text{Pb}$	- 0,13
$\text{Fe}^{3+} + 3\text{e}^- \rightleftharpoons \text{Fe}$	- 0,06
$2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2(\text{g})$	0,00
$\text{S} + 2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{S}(\text{g})$	+ 0,14
$\text{Sn}^{4+} + 2\text{e}^- \rightleftharpoons \text{Sn}^{2+}$	+ 0,15
$\text{Cu}^{2+} + \text{e}^- \rightleftharpoons \text{Cu}^+$	+ 0,16
$\text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{SO}_2(\text{g}) + 2\text{H}_2\text{O}$	+ 0,17
$\text{Cu}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cu}$	+ 0,34
$2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^- \rightleftharpoons 4\text{OH}^-$	+ 0,40
$\text{SO}_2 + 4\text{H}^+ + 4\text{e}^- \rightleftharpoons \text{S} + 2\text{H}_2\text{O}$	+ 0,45
$\text{Cu}^+ + \text{e}^- \rightleftharpoons \text{Cu}$	+ 0,52
$\text{I}_2 + 2\text{e}^- \rightleftharpoons 2\text{I}^-$	+ 0,54
$\text{O}_2(\text{g}) + 2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O}_2$	+ 0,68
$\text{Fe}^{3+} + \text{e}^- \rightleftharpoons \text{Fe}^{2+}$	+ 0,77
$\text{NO}_3^- + 2\text{H}^+ + \text{e}^- \rightleftharpoons \text{NO}_2(\text{g}) + \text{H}_2\text{O}$	+ 0,80
$\text{Ag}^+ + \text{e}^- \rightleftharpoons \text{Ag}$	+ 0,80
$\text{Hg}^{2+} + 2\text{e}^- \rightleftharpoons \text{Hg}(\ell)$	+ 0,85
$\text{NO}_3^- + 4\text{H}^+ + 3\text{e}^- \rightleftharpoons \text{NO}(\text{g}) + 2\text{H}_2\text{O}$	+ 0,96
$\text{Br}_2(\ell) + 2\text{e}^- \rightleftharpoons 2\text{Br}^-$	+ 1,07
$\text{Pt}^{2+} + 2\text{e}^- \rightleftharpoons \text{Pt}$	+ 1,20
$\text{MnO}_2 + 4\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{Mn}^{2+} + 2\text{H}_2\text{O}$	+ 1,23
$\text{O}_2(\text{g}) + 4\text{H}^+ + 4\text{e}^- \rightleftharpoons 2\text{H}_2\text{O}$	+ 1,23
$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightleftharpoons 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$	+ 1,33
$\text{Cl}_2(\text{g}) + 2\text{e}^- \rightleftharpoons 2\text{Cl}^-$	+ 1,36
$\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightleftharpoons \text{Mn}^{2+} + 4\text{H}_2\text{O}$	+ 1,51
$\text{H}_2\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightleftharpoons 2\text{H}_2\text{O}$	+ 1,77
$\text{Co}^{3+} + \text{e}^- \rightleftharpoons \text{Co}^{2+}$	+ 1,81
$\text{F}_2(\text{g}) + 2\text{e}^- \rightleftharpoons 2\text{F}^-$	+ 2,87

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Increasing reducing ability/Toenemende reduserende vermoë