Education and Sport Development

Department of Education and Sport Development
Departement van Onderwys en Sportontwikkeling
Lefapha la Thuto le Tlhabololo ya Metshameko
NORTH WEST PROVINCE

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY (P2)

SEPTEMBER 2019

MARKS: 150

DURATION: 3 hours

This question paper consists of 14 pages, 4 data sheets and a GRAPH PAPER.

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on your ANSWER BOOK.
2. This question paper consists of TEN questions. Answer QUESTION 5 2.3 on the attached GRAPH PAPER. 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 sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable 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.
10. Give brief motivations, discussions, et cetera where required.
11. You are advised to use the attached DATA SHEETS
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (Aï D) next to the question numbers (1.1ï 1.10) in the ANSWER BOOK,
for example 1.11 D.

1.1 Which ONE of the following compounds is saturated?

A $CH_3CH(CH_3)CH_3$

B $CH_3CH_2CHCH_2$

C $CH_3CHCHCH_3$

D $CH_3C(CH_3)_2CHCH_2$ (2)

1.2 Which ONE of the following pair of compounds are FUNCTIONAL isomers?

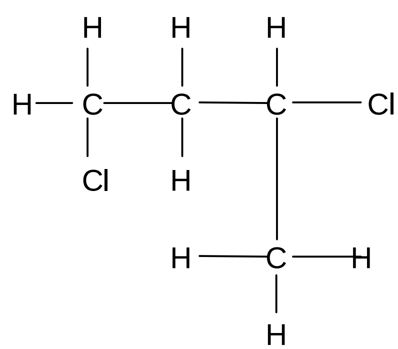
A Methanol and methanal

B Butane and 2-methylpropane

C Propan-1-ol and propan-2-ol

D Propanoic acid and methyl ethanoate (2)

1.3 The structural formula of an organic compound is shown below:



Which ONE of the following is the correct IUPAC name of this compound?

A 2,4-dichloro-2-methylpropane

B 1,3-dichloro-3-methylpropane

C 1,3-dichlorobutane

D 2,4-dichlorobutane (2)

1.4 Which ONE of the following is the EMPIRICAL FORMULA of 1,2-dichloroethane?

A $CHC\ell$

B $CH_2C\ell$

C $CHC\ell_2$

D $C_2H_4C\ell_2$ (2)

1.5 In which ONE of the solutions will the metallic ion be displaced by lead (Pb)? Use the Table of Standard Reduction Potentials to determine your answer.

A Magnesium nitrate

B Zinc nitrate

C Silver nitrate

D Potassium nitrate (2)

1.6 In a chemical reaction, the difference between the potential energy of the products and the potential energy of the reactants is equal to the ...

A change in enthalpy of the reaction.

B rate of the reaction.

C activation energy of the reaction.

D total potential energy of the particles. (2)

1.7 The solution that will have the LOWEST concentration of H^+ ions if complete ionisation takes place, is ...

A 0,4 dm^3 of a 1 mol·dm^{-3} H_2SO_4 solution.

B 0,4 dm^3 of a 1 mol·dm^{-3} $HC\ell$ solution.

C 0,4 dm^3 of a 1 mol·dm^{-3} CH_3COOH solution.

D 1 dm^3 of a 1 mol·dm^{-3} $HC\ell$ solution. (2)

1.8 Consider the following equilibrium constants for the same reaction at two different temperatures:

298 K : K_c = 0,03

318 K : K_c = 0,005

Which ONE of the following is CORRECT?

	HEAT OF REACTION	**YIELD OF PRODUCTS AS THE TEMPERATURE INCREASES**
A	æH > 0	Increases
B	æH < 0	Decreases
C	æH > 0	Decreases
D	æH < 0	Remains the same

(2)

1.9 Consider the reaction represented by the balanced equation below:

$$Cu(s) + 2Ag^{+}(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$$

In the above reaction, Cu(s) is the é

A oxidizing agent and is reduced.

B oxidizing agent and is oxidised.

C reducing agent and is reduced.

D reducing agent and is oxidised. (2)

1.10 The NPK ratio for a 20 kg bag of fertilizer is 4:3:2(40). The percentage phosphorous in the bag is:

A 8,89%

B 13,33%

C 17,78%

D 6,67% (2)

[20]

QUESTION 2 (Start on a new page.)

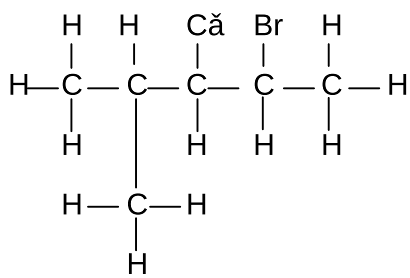
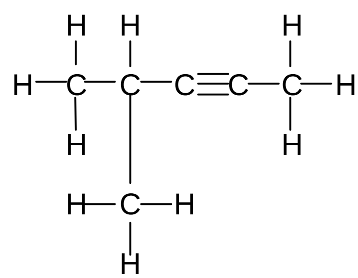
2.1 Define the term *functional group* of organic compounds. (2)

2.2 The IUPAC name of an organic compound is 3,4-dimethylpentan-2-one.
For this compound, write down the:

2.2.1 Homologous series to which it belongs (1)

2.2.2 Structural formula (3)

2.3 Study the organic compounds represented by the letters **A** to **C** below:

A	$CH_3COCH_2CH_3$		
B		**C**	

Write down the:

2.3.1 General formula for compound **C** (1)

2.3.2 Structural formula of the compound that is a functional isomer of compound **A** (2)

2.3.3 IUPAC name of compound **B** (3)
[12]

QUESTION 3 (Start on a new page.)

The vapour pressures of straight-chain alkanes and straight-chain alcohols, together with their molecular masses, are given in the table below.
(Compounds **A**, **B**, **C** and **D**)

	COMPOUNDS	**VAPOUR PRESSURE (kPa)**	**MOLECULAR MASS ($g \cdot mol^{-1}$)**
A	Propane	853,16	44
B	Butane	112	58
C	Propan-1-ol	2,4	60
D	Butan-1-ol	0,1	74

3.1 The vapour pressures of compound **C** and **D** are compared. Write down the:

3.1.1 Independent variable (1)

3.1.2 Dependent variable (1)

3.2 Explain the difference between the vapour pressure of the alkane and the alcohol, each having FOUR carbon atoms per molecule, by referring to the TYPE of intermolecular forces in each compound. (4)

3.3 Compound **B** has an isomer.

3.3.1 Write down the structural formula of this isomer. (2)

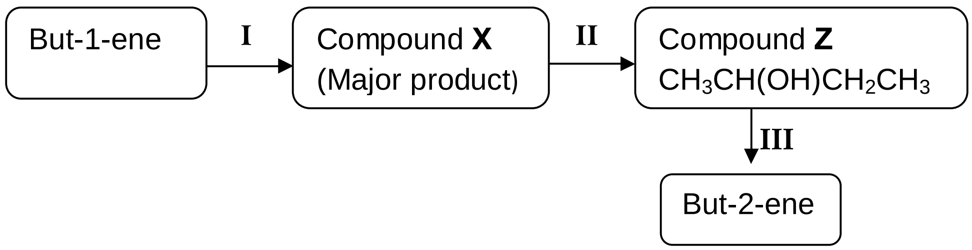
3.3.2 Give the IUPAC name of the isomer in QUESTION 3.3.1. (2)

3.3.3 State what type of isomer this is. Choose from CHAIN, POSITIONAL or FUNCTIONAL isomer. (1)

3.4 Which ONE of compounds **A** to **D** has the highest boiling point? Explain your answer. (2)
[13]

QUESTION 4 (Start on a new page.)

The flow diagram below shows the steps that a learner follows to convert but-1-ene to but-2-ene. **I, II** and **III** represent different types of reactions.



4.1 Compound **X** is formed when but-1-ene reacts with $HC\ell(g)$.

Write down:

4.1.1 TWO reaction conditions for this reaction (2)

4.1.2 The IUPAC name of compound **X** (2)

4.2 Name the type of reactions represented by

4.2.1 **I** (1)

4.2.2 **II** (1)

4.2.3 **III** (1)

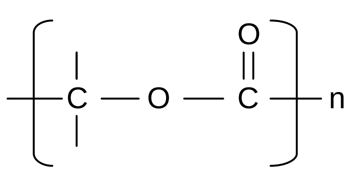
4.3 Compound **Z** is converted to but-2-ene in the presence of concentrated sulphuric acid, in a warm water bath.

4.3.1 Is compound **Z** a PRIMARY, SECONDARY or TERTIARY alcohol? Explain your answer. (3)

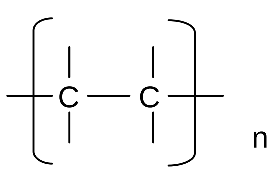
4.3.2 Why is compound **Z** heated in a water bath? (1)

4.4 Polymerisation can occur by an addition or condensation reaction. The repeating units of two polymers, **A** and **B**, are shown below.

A



B



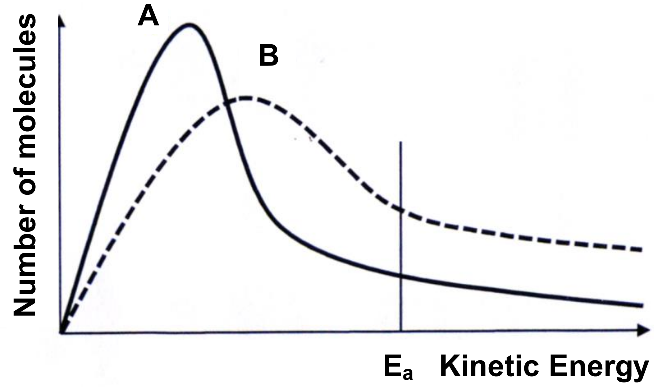
4.4.1 Explain what a condensation polymer is. (2)

4.4.2 Which unit, **A** or **B**, is a condensation polymer? (1)

4.4.3 Give the molecular formula of the monomer for polymer **B**. (1)
[15]

QUESTION 5 (Start on a new page.)

5.1 Below is the Maxwell-Boltzmann distribution curves of the kinetic energy of molecules at two different temperatures.



5.1.1 What do the areas beneath both graphs **A** and **B** and to the right of E_a, represent? (1)

5.1.2 Which ONE of the graphs, **A** or **B**, represents the reaction taking place at the higher temperature? (1)

5.2 A group of learners use the reaction between excess hydrochloric acid with magnesium to investigate one of the factors that influences the rate of a chemical reaction. The balanced equation for this reaction is given below:

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

Two experiments are conducted. In **Experiment 1**, 5 g of magnesium ribbon is used, and in **Experiment 2**, 5 g magnesium powder is used. The volume of hydrogen gas produced in each experiment is measured. The results obtained are shown in the tables below:

EXPERIMENT 1: Using Mg ribbon

TIME (minutes)	**0**	**0,5**	**1,0**	**1,5**	**2,0**	**2,5**	**3,0**	**3,5**	**4,0**
Volume of H_2 collected in cm^3	0	15	25	30	33	35	35	35	35

EXPERIMENT 2: Using Mg powder

TIME (minutes)	**0**	**0,5**	**1,0**	**1,5**	**2,0**	**2,5**	**3,0**	**3,5**	**4,0**
Volume of H_2 collected in cm^3	0	23	30	33	35	35	35	35	35

5.2.1 For this investigation, write down the:

(a) Investigative question (2)

(b) Controlled variables (2)

5.2.2 Refer to the table for experiment **1**. Explain why the volume of H_2 collected remains constant after 2,5 minutes. (1)

5.2.3 Plot TWO line-graphs for the volume of H_2 collected versus time for Experiments **1** and **2** for both on the same set of axes. Clearly label your graphs **1** and **2**. (4)

5.2.4 Which ONE of the experiments, **1** or **2**, occurred at a higher rate? (1)

5.2.5 Explain your answer to QUESTION 5.2.4 in terms of the collision theory. (3)

5.2.6 Determine the average rate of formation of H_2 gas in Experiment **1** for t = 0 min to t = 0,5 minutes. (3)
[18]

QUESTION 6 (Start on a new page.)

Carbon dioxide reacts with carbon in a closed system to produce carbon monoxide (CO), according to the following balanced equation:

$$CO_2(g) + C(s) + heat \rightleftharpoons 2CO(g)$$

6.1 Explain the term *closed system*. (2)

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

Initially an unknown amount of carbon dioxide is exposed to hot carbon at 800 °C in a sealed 2 dm^3 container. The equilibrium constant, K_c, for the reaction is 14. At equilibrium it is found that 168 g carbon monoxide is present.

6.3 How will the equilibrium concentration of the product compare to that of the reactants? Choose from: LARGER THAN, SMALLER THAN or EQUAL TO. Give a reason for your answer. (No calculation is required.) (2)

6.4 Calculate the initial amount (in moles) of $CO_2(g)$ present. (9)

6.5 If more carbon is added at a constant temperature, how will this affect the yield of CO(g) at equilibrium? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)
[16]

QUESTION 7 (Start on a new page.)

7.1 A monoprotic acid HY ionises completely when dissolved in water. The hydroxide ion concentration $[OH^-]$ in the solution is 1×10^{-11} mol·dm^{-3}.

7.1.1 Define an acid in terms of the Brønsted-Lowry theory. (2)

7.1.2 Define the term *monoprotic acid.* (2)

7.1.3 Is acid HY a WEAK or a STRONG acid? Give a reason for your answer. (2)

7.1.4 Calculate the following:

(a) The concentration of hydronium ions $[H_3O^+]$ in the solution. (3)

(b) The pH of the solution (3)

7.2 A sample of sodium carbonate (Na_2CO_3) is dissolved in water.

Write down:

7.2.1 Equation for the hydrolysis of the carbonate ion (CO_3^{2-}) in water (3)

7.2.2 Formula of the conjugate acid of the carbonate ion (CO_3^{2-}) (1)

4,24 g of sodium carbonate (Na_2CO_3) is dissolved in water. The solution is neutralised by 250 cm^3 of a hydrochloric acid ($HCℓ$) solution according to the following balanced equation:

$$Na_2CO_3(s) + 2HCℓ(aq) \rightarrow 2NaCℓ(aq) + CO_2(g) + H_2O(ℓ)$$

7.2.3 Calculate the concentration of the HCℓ solution. (6)
[22]

QUESTION 8 (Start on a new page.)

A standard electrochemical cell is set up. The overall (net) balanced equation is shown below.

$$Ba(s) + 2I^{-}(aq) \rightarrow Ba^{2+}(aq) + 2I^{-}(aq)$$

When this cell is in operation under standard conditions, chemical energy is converted into electrical energy.

8.1 What type of electrochemical cell is this? (1)

8.2 Write down the:

8.2.1 Oxidation half-reaction that takes place in this cell (2)

8.2.2 Direction in which electrons will flow? Choose from IODINE TO BARIUM half-cell or BARIUM TO IODINE half-cell (1)

8.2.3 Cell notation for this cell (3)

8.3 Calculate the emf of the cell. (4)

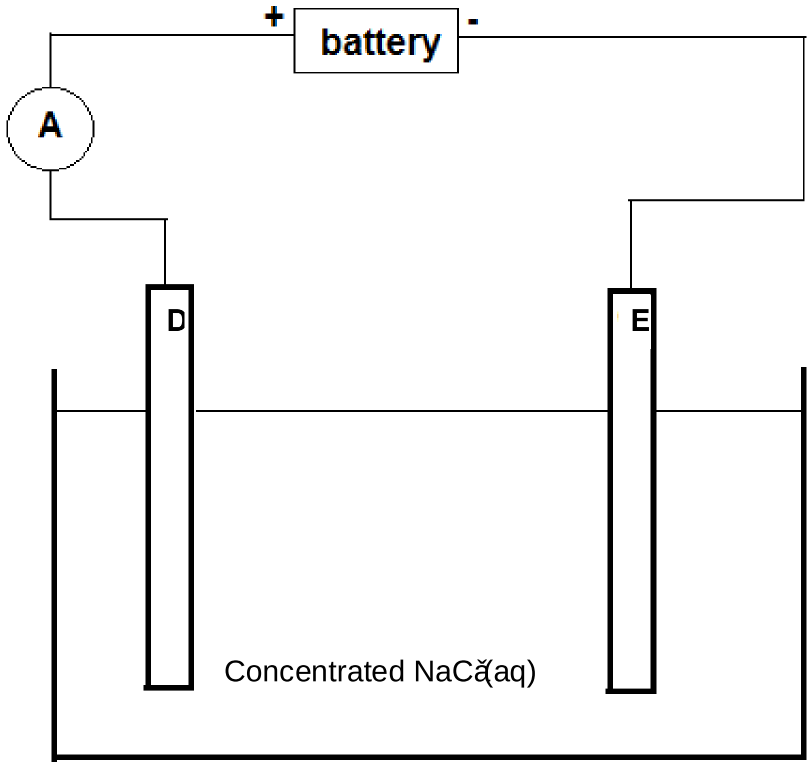
8.4 Is the cell reaction spontaneous or a non-spontaneous? Give a reason for your answer. (2)

8.5 How will the voltmeter reading in QUESTION 8.3 be affected if the concentration of barium ions [Ba^{2+}(aq)] is increased? Choose from: INCREASE, DECREASE or REMAINS THE SAME. (1)

[14]

QUESTION 9 (Start on a new page.)

In the simplified sketch below, carbon electrodes are used during the electrolysis of a concentrated sodium chloride solution.



9.1 Define the term *electrolysis*. (2)

9.2 Write down the:

9.2.1 Half-reaction that takes place at electrode **E** (2)

9.2.2 NAME or FORMULA of the gas released at electrode **D** (1)

9.2.3 Balanced equation for the net (overall) cell reaction (3)
[8]

QUESTION 10 (Start on a new page.)

Ammonia is an important fertiliser and is produced on a large scale in the industry.

10.1 For the industrial preparation of ammonia, write down the:

10.1.1 NAME of the process during which ammonia is prepared (1)

10.1.2 NAME of the catalyst used in this process (1)

10.1.3 A balanced chemical equation for this process (3)

10.1.4 FORMULAE of two fertilisers prepared form ammonia (2)

10.2 A farmer grows spinach on his farm and wants to use a fertiliser which promotes green leaves. He needs to choose from the following available fertilisers:

Potassium chloride, calcium hydrogen phosphate and ammonium nitrate.
.

10.2.1 Which ONE the above fertilisers will be the best choice? Give a reason for your answer. (2)

10.2.2 Calculate the percentage mass of NITROGEN in ammonium nitrate. (3)
[12]

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^{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

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 63,5 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*			**(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 redusing ability/*Toenemende reduserende vermoë* ↑

Half-reactions/*Halfreaksies*			**(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
$Aǎ^{3+} + 3e^-$	⇌	Aǎ	− 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(ǎ)	+ 0,85
$NO_3^- + 4H^+ + 3e^-$	⇌	$NO(g) + 2H_2O$	+ 0,96
Br_2(ǎ) $+ 2e^-$	⇌	$2Br^-$	+ 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
$Cǎ_2(g) + 2e^-$	⇌	$2Cǎ^-$	+ 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

ANSWER SHEET/*ANTWOORDBLAD*

NAME/*NAAM*: ______________________ **GRADE/*GRAAD* 12:** ______

QUESTION 5.2.3/*VRAAG 5.2.3*

Hand in the ANSWER SHEET with your ANSWER BOOK.

Handig hierdie ANTWOORDBLAD saam met jou ANTWOORDBOEK in.