education

Department:
Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATION - 2006

PHYSICAL SCIENCE P2
CHEMISTRY

HIGHER GRADE

FEBRUARY/MARCH 2006

Marks: 200

2 Hours

**This paper consists of 15 pages,
a datasheet of 4 pages and 1 multiple-choice answer sheet.**

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GENERAL INSTRUCTIONS

1. Write your **examination number** (and **centre number** if applicable) in the appropriate spaces on the answer book.
2. Answer **ALL** the questions.
3. Non-programmable calculators may be used.
4. Appropriate mathematical instruments may be used.
5. Data sheets are attached for your use.
6. Marks may be forfeited if instructions are not followed.

QUESTION 1

INSTRUCTIONS

1. Answer this question on the specially printed **ANSWER SHEET.** *[NOTE: The answer sheet may be either a separate sheet provided as part of your question paper, or printed as part of the answer book.]* Write your **EXAMINATION NUMBER** (and **centre number** if applicable) in the appropriate spaces if a separate answer sheet is used**.**

2. Four possible answers, indicated by A, B, C and D, are supplied with each question. Each question has only ONE correct answer. Choose only that answer, which in your opinion, is the correct or best one and mark the appropriate block on the answer sheet with a cross.

3. Do not make any other marks on the answer sheet. Any calculations or writing that may be necessary when answering this question should be done in the answer book and must be deleted clearly by means of a diagonal line drawn across the page.

4. If more than one block is marked, no marks will be awarded for that answer.

PLACE THE COMPLETED ANSWER SHEET INSIDE THE FRONT COVER OF YOUR ANSWER BOOK, IF A SEPARATE ANSWER SHEET HAS BEEN USED.

EXAMPLE:

QUESTION: The SI unit of time is ...

A t.
B h.
C s.
D m.

ANSWER:

A	B	C (crossed)	D

1.1 Which one of the following industrial processes is used to prepare ammonia gas?

A Contact process

B Haber process

C Catalytic oxidation of ammonia

D Ostwald process (4)

1.2 Consider the halogen hydrides HF, HCl, HBr and HI.

Hydride	Boiling point (°C)
HF	19,5
HCl	-84,9
HBr	-67,0
HI	-35,4

The halogen hydride in which the intermolecular forces are the weakest, is . . .

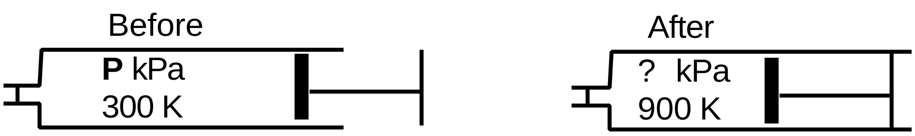
A HF

B HCl

C HBr

D HI (4)

1.3 The pressure inside a gas syringe filled with helium gas is **P** kPa at a temperature of 300 K. The syringe is now heated while the plunger is at the same time pushed in to decrease the volume.



By the time the temperature of the gas reaches 900 K, the volume has decreased to half of the original volume.

What is the pressure of the gas inside the gas syringe?

A $\frac{P}{6}$

B $\frac{3P}{2}$

C $\frac{2P}{3}$

D 6P (4)

1.4 Consider the following statements with regard to the properties of chlorine gas:

I. Cl_2 can be collected through the upward displacement of air.

II. Cl_2 is a very strong reducing agent.

III. When Cl_2 is added to NaCl crystals, dense white fumes are released.

IV. Cl_2 is a pale green gas at room temperature.

Which of the statements above are correct?

A I, II and IV

B II, III and IV

C II and III

D I and IV (4)

1.5 $SO_{2(g)}$ is bubbled through an aqueous solution of potassium permanganate. Which one of the following observations **WITH** the corresponding reason is correct?

	OBSERVATION	REASON
A	Colourless solution turns purple.	MnO_4^- changes to Mn^{7+} ions.
B	Purple solution turns milky.	SO_2 changes to free sulphur.
C	Purple solution turns colourless.	MnO_4^- changes to Mn^{2+} ions.
D	Purple solution turns colourless.	MnO_4^- changes to Mn^{7+} ions.

(4)

1.6 Which one of the following salts, when dissolved in water, will give a solution with a pH less than 7?

A K_2SO_4

B KCl

C NH_4Cl

D CH_3COONa (4)

1.7 Zinc granules, mass 3,25 g, are added to 100 cm^3 of a 0,5 $mol.dm^{-3}$ HCl solution in a test tube.

Which one of the following will increase the rate at which the hydrogen is produced?

A Use 100 cm^3 of a 0,1 $mol.dm^{-3}$ HCl solution.

B Use 50 cm^3 of a 0,5 $mol.dm^{-3}$ HCl solution.

C Use 200 cm^3 of a 0,05 $mol.dm^{-3}$ HCl solution.

D Use 80 cm^3 of a 1,0 $mol.dm^{-3}$ HCl solution. (4)

1.8 The following equilibrium exists in a test tube:

$$CH_3COOH(aq) \text{ ? } CH_3COO^-(aq) + H^+(aq)$$

A few grams of sodium ethanoate crystals (CH_3COONa) are now added to the test tube and shaken. Which one of the following statements concerning the pH **WITH** the corresponding reason is true once equilibrium is re-established?

	pH	**Reason**
A	Increases	Both the [CH_3COO^-] and [H^+] decreases.
B	Increases	The [CH_3COO^-] increases and the [H^+] decreases.
C	Decreases	Both the [CH_3COO^-] and [H^+] increases.
D	Stays the same	The [CH_3COO^-] increases.

(4)

1.9 A dilute solution of sodium carbonate is gradually added to water at a temperature of 25 °C.
How will this affect the values of K_w and [H^+]?

	K_w	**[H^+]**
A	Increases	Increases
B	Decreases	Decreases
C	Remains the same	Decreases
D	Remains the same	Remains the same

(4)

1.10 The reversible reaction

$$2HI(g) \text{ ? } H_2(g) + I_2(g)$$

has reached equilibrium in a closed container. The K_c value for this reaction is 0,016 at 793 K.

Which one of the following statements for this reaction at equilibrium is **TRUE**?

A n(HI) = n(H_2)

B n(HI) = n(H_2) + n(I_2)

C [HI] = constant

D [HI] < [I_2] (4)

1.11 Chlorine is harmful to goldfish. If the chlorine in a municipal pond were converted to chloride ions, the goldfish would survive because chloride ions are not harmful to them. When Cl_2 is bubbled through which one of the following 1,0 mol.dm^{-3} solutions can it be converted to chloride ions? (Refer to Table of Reduction Potentials.)

A $Fe_2(SO_4)_3$

B Na_2SO_4

C $FeSO_4$

D NaF (4)

1.12 In which one of the following cases will a redox reaction **NOT** take place spontaneously?

A A piece of Mn is placed in a 1,0 mol.dm^{-3} HCl solution.

B A 1,0 mol.dm^{-3} $FeSO_4$ solution is mixed with H_2O_2 in acid medium.

C A piece of Cu is added to a 1,0 mol.dm^{-3} solution of sulphuric acid.

D Powdered aluminium is added to a 1,0 mol.dm^{-3} $Hg(NO_3)_2$ solution. (4)

1.13 Consider the following hypothetical redox reactions involving the metals W, X, Y, and Z and their ions.

$$W + 3Y^{+} \rightarrow W^{3+} + 3Y$$

$$2X + 3Z^{2+} \rightarrow 2X^{3+} + 3Z$$

$$3Y + X^{3+} \rightarrow 3Y^{+} + X$$

The sequence of these metals in order of their increasing strength as reducing agent is (that is from weak to strong) ...

A W, X, Y, Z.

B Z, Y, X, W.

C W, Y, X, Z.

D Z, X, Y, W. (4)

1.14 Which one of the following compounds is an isomer of propanoic acid ($C_3H_6O_2$)?

A Ethyl ethanoate

B Methyl ethanoate

C Propan-1,2,3-triol

D 2-methylpropan-1-ol (4)

1.15 Which one of the following statements concerning the compound $C_3H_8O_3$ is correct?

A It is an alcohol.

B It is an ester.

C Its functional group is –COOH.

D It is used in an oxy-acetylene torch. (4)

[60]

ANSWER QUESTIONS 2 – 9 IN YOUR ANSWER BOOK.

INSTRUCTIONS

1. Start each question on a new page in your answer book.
2. Leave one line between subsections, for example between QUESTIONS 2.1 and 2.2.
3. Give ALL formulae used and show your workings (this includes substitutions).
4. Number your answers in the same way that the questions are numbered.

QUESTION 2

2.1 Oxygen gas is sealed in a container.

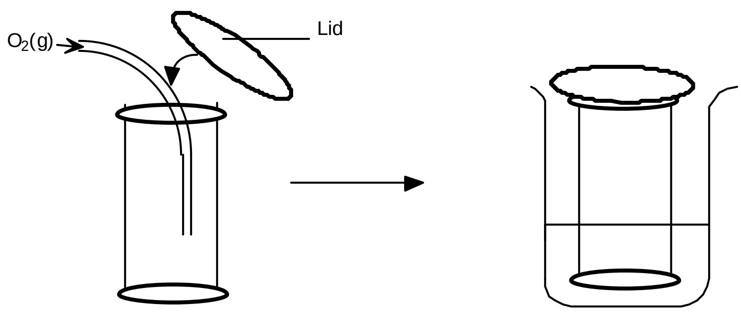
2.1.1 Under which conditions of pressure and temperature will oxygen gas act like an ideal gas? (2)

2.1.2 Assuming that oxygen gas acts like an ideal gas, draw a sketch graph that represents the relationship between the pressure and temperature of the oxygen gas inside the cylinder. (3)

2.1.3 How can the gradient of the graph in QUESTION 2.1.2 be used to determine the number of moles of oxygen gas that was sealed in the cylinder? (2)

2.2 A gas cylinder has a volume of 500 cm^3 and contains 1,0 g of oxygen gas. Calculate the pressure inside the cylinder if the temperature of the gas inside the cylinder is 80 °C. (6)

2.3 Oxygen gas is sealed in a gas cylinder with a lid as shown in the sketch. When the cylinder is placed in a beaker with hot water, the lid of the gas cylinder blows off.



Why does the lid of the cylinder blow off when it is placed in the beaker with hot water? Explain your answer by making use of the Kinetic Model of matter. (4)
[17]

QUESTION 3 (START ON A NEW PAGE)

Hydrogen sulphide gas and sulphur dioxide gas are two compounds containing sulphur.

3.1 H_2S gas can be prepared through the reaction of a metal sulphide and hydrochloric acid. Write a balanced equation for this preparation. (3)

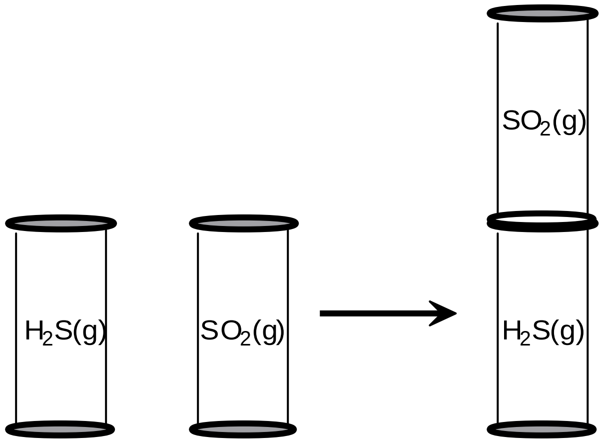
3.2 SO_2 gas is prepared by means of a redox reaction between copper metal and hot concentrated sulphuric acid. Make use of the table of Standard Reduction Potentials and write balanced **ionic** equations for the:

3.2.1 Oxidation half reaction (2)

3.2.2 Reduction half reaction (2)

3.2.3 Overall reaction (without spectator ions) (2)

To investigate the properties of H_2S and SO_2, two gas cylinders are filled respectively with each gas. The two cylinders are now placed on top of each other as indicated in the diagram. The gases are allowed to mix and react.



3.3 Write down the observations that are made after the gases reacted with each other. (2)

3.4 Write down the balanced equation of the reaction that explains the observations in QUESTION 3.3 above. (3)

3.5 Give a reason why SO_2 should be in the top cylinder. (1)

3.6 How will the observation differ if the H_2S gas cylinder is placed on top of the SO_2 gas cylinder? (2)

[17]

QUESTION 4 (START ON A NEW PAGE)

4.1 Sandile must prepare nitrogen dioxide gas in the laboratory. He places copper turnings in a test tube and adds nitric acid. He expects to find a reddish brown gas to be liberated. However, a colourless gas is formed.

4.1.1 Was the nitric acid that Sandile added diluted or concentrated? (1)

4.1.2 Make use of the table of Standard Reduction Potentials and write down the equation of the half reaction that explains the formation of the colourless gas. (2)

4.1.3 When some water is added, the solution in the test tube turns to a blue colour. Write down the **FORMULA** of the substance responsible for the blue colour. (2)

4.2 A learner prepares a solution of potassium bromide in water and pours it into two separate test tubes **X** and **Y**. She adds a few drops of silver nitrate solution to test tube **X**.

4.2.1 Write down the balanced equation for the reaction taking place in test tube **X**. (3)

*She adds some $CHCl_3$ (chloroform) to test tube **Y**. Two distinct layers are formed. She then bubbles chlorine gas through the contents of test tube **Y** and shakes it thoroughly. A reaction takes place. The bottom layer turns yellowish brown .*

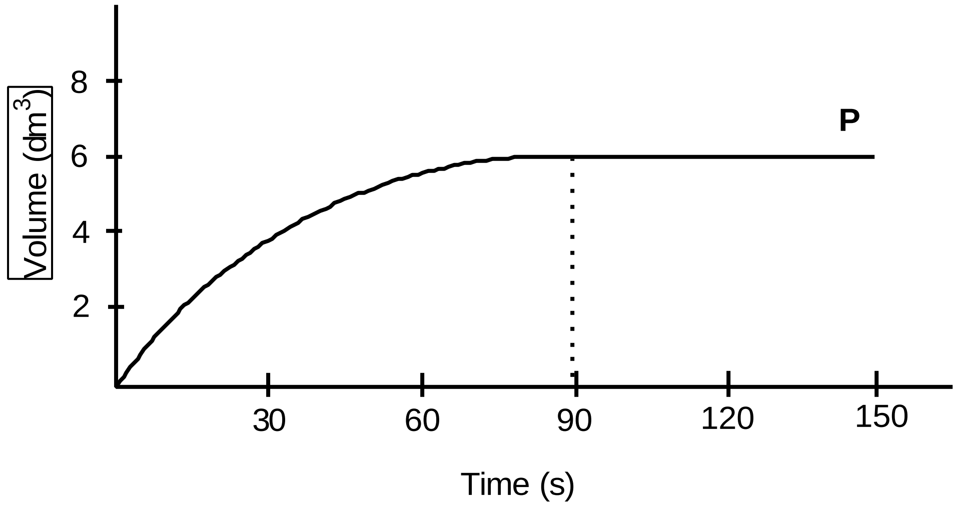
4.2.2 Write down the **FORMULA** of the product of the reaction responsible for the yellowish brown colour in the bottom layer. (2)

4.2.3 Write down the **FORMULA** of the product of the reaction that will be found mainly in the top layer. (2)

[12]

QUESTION 5 (START ON A NEW PAGE)

A piece of magnesium ribbon of mass 6,4 g reacts with an excess of dilute hydrochloric acid of concentration 2 mol.dm^{-3} at 22 ºC. Hydrogen gas is produced. The total volume of hydrogen is recorded every 30 seconds.



5.1 Redraw the graph in your answer book and mark the curve with a **P** (as in the graph above). Now on the same system of axes, draw graphs that will be obtained if the following changes were to be made:

5.1.1 A 6,4 g sample of magnesium powder is added to the same volume of dilute 2 mol.dm^{-3} hydrochloric acid. (Mark the graph **K**.) (2)

5.1.2 A 3,2 g piece of magnesium ribbon is added to the same volume of dilute 2 mol.dm^{-3} hydrochloric acid. (Mark the graph **L**.) (2)

5.2 Write down the balanced equation for the reaction that takes place. (3)

5.3 Is the reaction in QUESTION 5**.**2 a redox or an acid-base reaction? (1)
[8]

QUESTION 6 (START ON A NEW PAGE)

For the reaction

$$CO_{2(g)} + H_{2(g)} \ ? \ CO_{(g)} + H_2O_{(g)}$$

2,0 mol of carbon dioxide gas and 1,0 mol of hydrogen are sealed in a 2,0 dm^3 container and allowed to reach equilibrium at 1 000 ºC. At this point the amount of water vapour is found to be 0,723 mol.

6.1 Calculate the value of the equilibrium constant at this temperature. (8)

6.2 It is found that at a temperature of 1 500 ºC, the value of the equilibrium constant is lower than in QUESTION 6.1. What is the sign of ?H? (1)

6.3 Explain your answer to QUESTION 6.2. (3)

6.4 An additional 0,277 mol of water vapour is now pumped into the sealed 2,0 dm^3 container, and equilibrium is re-established at 1 000 °C.

6.4.1 How will the concentration of CO(g) change?
(Write only **INCREASES, DECREASES** or **STAYS THE SAME**.) (2)

6.4.2 Explain your answer to QUESTION 6.4.1 by making use of Le Chatelier's principle. (3)

6.5 The volume of the container, containing the equilibrium mixture, is increased to 2,5 dm^3 at 1 000 ºC.

6.5.1 Will the increase in volume have any effect on the concentration of CO(g)? Answer only **YES** or **NO**. (1)

6.5.2 Explain the answer to QUESTION 6.5.1. (3)
[21]

QUESTION 7 (START ON A NEW PAGE)

7.1 Consider separate solutions of two substances HX and HY and the information supplied on their pH, $[OH^-]$ and $[H^+]$.

	$[OH^-]$	$[H^+]$	pH
HX	10^{-11}	7.1.1	7.1.2
HY	7.1.3	7.1.4	10

Complete the table by writing down the numbers 7.1.1 to 7.1.4 and next to each number the correct answer. (8)

7.2 A 5,3 g sample of sodium carbonate (Na_2CO_3) is dissolved in pure water.

7.2.1 Write down the equation for the hydrolysis of the carbonate ion in water. (3)

7.2.2 Write down the conjugate acid-base pairs in QUESTION 7.2.1. (4)

7.2.3 The sodium carbonate solution is now neutralised by 200 cm^3 of a solution of an acid HZ according to the equation:

$$Na_2CO_3(g) + 2HZ(g) \rightarrow 2NaZ(aq) + CO_2(g) + H_2O(l)$$

Calculate the concentration of the HZ solution. (7)

[22]

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QUESTION 8 (START ON A NEW PAGE)

8.1 A learner prepared a solution of copper sulphate in a silver pot. When she stirred the solution with an iron spoon, she observed that a precipitate had formed.

Write down the:

8.1.1 **NAME** of the precipitate formed (2)

8.1.2 Relevant balanced equation to show the formation of the precipitate in QUESTION 8.1.1 (2)

8.2 The black tarnish that forms on pure silver is silver sulphide (Ag_2S). It can be changed (converted) to silver metal by placing the tarnished object in an aluminium pan containing a basic solution.

8.2.1 For the reaction that takes place during the conversion of silver sulphide, write down the balanced equation for the reduction half reaction. (2)

The aluminium pan is now replaced with a platinum pan.

8.2.2 Will a reaction take place? Write only **YES** or **NO**. (1)

8.2.3 By referring to the relative strength of the oxidising and reducing agents, explain the answer to QUESTION 8.2.2. (3)

8.3 A standard voltaic cell is set up using a Cd-electrode as the negative electrode. The cell has an *emf* of 1,82 V.

Identify the positive electrode. Show how you arrived at the answer. (5)

8.4 Consider the following half reaction:

$$O_2 + 2H^+ + 2e^- \ ? \ H_2O_2$$

When MnO_2 is added to H_2O_2, oxygen gas is produced as one of the products but the MnO_2 remains unchanged.

8.4.1 Write down the balanced equation for the reduction half reaction. (2)

8.4.2 Write down the balanced equation for the overall reaction that occurs. (3)

8.4.3 What is the function of the MnO_2 in this reaction? (2)

[22]

QUESTION 9 (START ON A NEW PAGE)

9.1 Crude oil is a mixture of saturated and unsaturated hydrocarbons.

9.1.1 What are hydrocarbons? (2)

9.1.2 Write down the structural formula **AND** the systematic (IUPAC) name of an **unsaturated** hydrocarbon containing three carbon atoms. (4)

9.2 Acidified potassium dichromate is added to methanol in a test tube and the test tube is gently heated.

9.2.1 What type of reaction does the methanol undergo? (2)

9.2.2 Write down the **NAME** of the organic product formed in the reaction in QUESTION 9.2.1. (2)

9.3 Many fruits contain organic compounds that have pleasant odours, for example, ethyl ethanoate (ethyl acetate) is responsible for the odour of pineapples.

9.3.1 Name the homologous series of compounds to which ethyl ethanoate belongs. (2)

9.3.2 Write down the structural formula of ethyl ethanoate. (3)

9.3.3 Write down the structural formulae **AND** the systematic (IUPAC) names of TWO organic compounds that could be used to prepare ethyl ethanoate in the laboratory. (6)
[21]

TOTAL: 200

DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

DATA FOR PHYSICAL SCIENCE
PAPER 2 (CHEMISTRY)

GEGEWENS VIR NATUUR- EN SKEIKUNDE
VRAESTEL 2 (CHEMIE)

TABEL 1: FISIESE KONSTANTE
TABLE 1: PHYSICAL CONSTANTS

Avogadro-konstante Avogadro's constant	N_A of/or L	$6,02 \times 10^{23}$ mol^{-1}
Molêre gaskonstante Molar gas constant	R	8,31 J.K^{-1}.mol^{-1}
Standaarddruk Standard pressure	p^{q}	$1,013 \times 10^{5}$ Pa
Molêre gasvolume by STD Molar gas volume at STP	V_m	22,4 dm^{3}.mol^{-1}
Standaardtemperatuur Standard temperature	T^{q}	273 K

TABEL 2: FORMULES
TABLE 2: FORMULAE

$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$	$\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$
$pV = nRT$	$K_w = [H^+][OH^-] = 10^{-14}$ by/at 298 K
$n = \frac{m}{M}$	$pH = -\log[H^+]$
$c = \frac{n}{V}$	$E^{q}_{sel} = E^{q}_{oksideermiddel} - E^{q}_{reduseermiddel}$
$c = \frac{m}{MV}$	$E^{q}_{cell} = E^{q}_{oxidising\ agent} - E^{q}_{reducing\ agent}$
	$E^{q}_{sel} = E^{q}_{katode} - E^{q}_{anode}$
	$E^{q}_{cell} = E^{q}_{cathode} - E^{q}_{anode}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKETABEL VAN ELEMENTE

KEY/SLEUTEL

Atoomgetal / Atomic number	29
Elektronegatiwiteit / Electronegativity	1,9
Simbool / Symbol	Cu
Relatiewe atoommassa (benaderd) / Relative atomic mass (approximately)	63,5

I	II											III	IV	V	VI	VII	0
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

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

Increasing oxidising ability / Toenemende oksideervermoë ↑

Increasing reducing ability / Toenemende reduseervermoë ↓

Halfreaksie / Half-reaction	E° /volt
$F_2 + 2e^-$? $2F^-$	+2,87
$H_2O_2 + 2H^+ + 2e^-$? $2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^-$? $Mn^{2+} + 4H_2O$	+1,51
$Au^{3+} + 3e^-$? Au	+1,42
$Cl_2 + 2e^-$? $2Cl^-$	+1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^-$? $2Cr^{3+} + 7H_2O$	+1,33
$O_2 + 4H^+ + 4e^-$? $2H_2O$	+1,23
$MnO_2 + 4H^+ + 2e^-$? $Mn^{2+} + 2H_2O$	+1,21
$Pt^{2+} + 2e^-$? Pt	+1,20
$Br_2 + 2e^-$? $2Br^-$	+1,09
$NO_3^- + 4H^+ + 3e^-$? $NO + 2H_2O$	+0,96
$Ag^+ + e^-$? Ag	+0,80
$NO_3^- + 2H^+ + e^-$? $NO_2 + H_2O$	+0,80
$Hg^{2+} + 2e^-$? Hg	+0,79
$Fe^{3+} + e^-$? Fe^{2+}	+0,77
$O_2 + 2H^+ + 2e^-$? H_2O_2	+0,68
$I_2 + 2e^-$? $2I^-$	+0,54
$SO_2 + 4H^+ + 4e^-$? $S + 2H_2O$	+0,45
$2H_2O + O_2 + 4e^-$? $4OH^-$	+0,40
$Cu^{2+} + 2e^-$? Cu	+0,34
$SO_4^{2-} + 4H^+ + 2e^-$? $SO_2 + 2H_2O$	+0,17
$Cu^{2+} + e^-$? Cu^+	+0,16
$Sn^{4+} + 2e^-$? Sn^{2+}	+0,15
$S + 2H^+ + 2e^-$? H_2S	+0,14
$2H^+ + 2e^-$? H_2	**0,00**
$Fe^{3+} + 3e^-$? Fe	-0,04
$Pb^{2+} + 2e^-$? Pb	-0,13
$Sn^{2+} + 2e^-$? Sn	-0,14
$Ni^{2+} + 2e^-$? Ni	-0,25
$Co^{2+} + 2e^-$? Co	-0,28
$Cd^{2+} + 2e^-$? Cd	-0,40
$Fe^{2+} + 2e^-$? Fe	-0,44
$Cr^{3+} + 3e^-$? Cr	-0,74
$Zn^{2+} + 2e^-$? Zn	-0,76
$2H_2O + 2e^-$? $H_2 + 2OH^-$	-0,83
$Mn^{2+} + 2e^-$? Mn	-1,18
$Al^{3+} + 3e^-$? Al	-1,66
$Mg^{2+} + 2e^-$? Mg	-2,37
$Na^+ + e^-$? 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 oxidising ability / Toenemende oksideervermoë (↓)

Increasing reducing ability / Toenemende reduseervermoë (↑)

Half-reaction / Halfreaksie	E° /volt
$Li^+ + e^-$? 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	-2,37
$Al^{3+} + 3e^-$? Al	-1,66
$Mn^{2+} + 2e^-$? Mn	-1,18
$2H_2O + 2e^-$? $H_2 + 2OH^-$	-0,83
$Zn^{2+} + 2e^-$? Zn	-0,76
$Cr^{3+} + 3e^-$? Cr	-0,74
$Fe^{2+} + 2e^-$? Fe	-0,44
$Cd^{2+} + 2e^-$? Cd	-0,40
$Co^{2+} + 2e^-$? Co	-0,28
$Ni^{2+} + 2e^-$? Ni	-0,25
$Sn^{2+} + 2e^-$? Sn	-0,14
$Pb^{2+} + 2e^-$? Pb	-0,13
$Fe^{3+} + 3e^-$? Fe	-0,04
$2H^+ + 2e^-$? H_2	**0,00**
$S + 2H^+ + 2e^-$? H_2S	+0,14
$Sn^{4+} + 2e^-$? Sn^{2+}	+0,15
$Cu^{2+} + e^-$? Cu^+	+0,16
$SO_4^{2-} + 4H^+ + 2e^-$? $SO_2 + 2H_2O$	+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
$I_2 + 2e^-$? $2I^-$	+0,54
$O_2 + 2H^+ + 2e^-$? H_2O_2	+0,68
$Fe^{3+} + e^-$? Fe^{2+}	+0,77
$Hg^{2+} + 2e^-$? Hg	+0,79
$NO_3^- + 2H^+ + e^-$? $NO_2 + H_2O$	+0,80
$Ag^+ + e^-$? Ag	+0,80
$NO_3^- + 4H^+ + 3e^-$? $NO + 2H_2O$	+0,96
$Br_2 + 2e^-$? $2Br^-$	+1,09
$Pt^{2+} + 2e^-$? Pt	+1,20
$MnO_2 + 4H^+ + 2e^-$? $Mn^{2+} + 2H_2O$	+1,21
$O_2 + 4H^+ + 4e^-$? $2\ H_2O$	+1,23
$Cr_2O_7^{2-} + 14H^+ + 6e^-$? $2Cr^{3+} + 7H_2O$	+1,33
$Cl_2 + 2e^-$? $2Cl^-$	+1,36
$Au^{3+} + 3e^-$? Au	+1,42
$MnO_4^- + 8H^+ + 5e^-$? $Mn^{2+} + 4H_2O$	+1,51
$H_2O_2 + 2H^+ + 2e^-$? $2H_2O$	+1,77
$F_2 + 2e^-$? $2F^-$	+2,87

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PHYSICAL SCIENCE HIGHER GRADE SECOND PAPER (CHEMISTRY)
NATUUR- EN SKEIKUNDE HOËR GRAAD TWEEDE VRAESTEL (CHEMIE)

1.1	A	B	C	D
1.2	A	B	C	D
1.3	A	B	C	D
1.4	A	B	C	D
1.5	A	B	C	D
1.6	A	B	C	D
1.7	A	B	C	D
1.8	A	B	C	D
1.9	A	B	C	D
1.10	A	B	C	D
1.11	A	B	C	D
1.12	A	B	C	D
1.13	A	B	C	D
1.14	A	B	C	D
1.15	A	B	C	D

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