DEPARTMENT OF EDUCATION
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SENIOR CERTIFICATE EXAMINATION - 2005
SENIORSERTIFIKAAT-EKSAMEN - 2005

PHYSICAL SCIENCE P2 : CHEMISTRY
NATUUR- EN SKEIKUNDE V2 : CHEMIE

STANDARD GRADE
STANDAARDGRAAD

FEBRUARY/MARCH 2005
FEBRUARIE/MAART 2005

304-2/2

Marks: 150
Punte : 150

2 Hours
2 Ure

This question paper consists of 13 pages and a data sheet of 4 pages.
Hierdie vraestel bestaan uit 13 bladsye en 'n gegewensblad van 4 bladsye.

PHYSICAL SCIENCE SG: Paper 2
Chemistry

304 2 2 SG

X05

ALGEMENE INSTRUKSIES

1. Skryf jou **eksamennommer** (en **sentrumnommer** indien van toepassing) in die aangewese spasies op die antwoordeboek.
2. Beantwoord **AL** die vrae.
3. Nie-programmeerbare sakrekenaars mag gebruik word.
4. Toepaslike wiskundige instrumente mag gebruik word.
5. 'n Gegewensblad is vir jou gebruik aangeheg.
6. Punte kan verbeur word indien instruksies nie gevolg word nie.

VRAAG 1

INSTRUKSIES

1. Beantwoord hierdie vraag op die spesiaal gedrukte **ANTWOORDBLAD.** *[LET WEL: Die antwoordblad kan óf 'n afsonderlike blad wees wat as deel van die vraestel verskaf word, óf dit kan as deel van die antwoordeboek gedruk word.]*
   Skryf jou **EKSAMENNOMMER** (en **sentrumnommer** indien van toepassing) in die aangewese spasies, indien 'n afsonderlike antwoordblad verskaf word.

2. Vier moontlike antwoorde, voorgestel deur A, B, C en D, word by elke vraag voorsien. Elke vraag het slegs EEN korrekte antwoord. Kies slegs die antwoord wat na jou mening die regte of die beste een is, en merk die toepaslike blokkie op die antwoordblad met 'n kruis.

3. Moenie enige ander merke op die antwoordblad maak nie. Enige berekenings of skryfwerk wat nodig mag wees wanneer hierdie vraag beantwoord word, moet in die antwoordeboek gedoen word en duidelik met 'n skuins streep oor die bladsy deurgehaal word.

4. Indien meer as een blokkie gemerk is, sal geen punte vir die antwoord toegeken word nie.

PLAAS DIE VOLTOOIDE ANTWOORBLAD BINNE DIE VOORSTE OMSLAG VAN JOU ANTWOORDEBOEK, INDIEN 'N AFSONDERLIKE ANTWOORDBLAD GEBRUIK IS.

VOORBEELD:

VRAAG: Die simbool van die SI-eenheid van tyd is ...

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

ANTWOORD:

A	B	~~C~~	D

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. A data sheet is 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 symbol for the SI unit of time is ...

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

ANSWER:

A	B	C	D

1.1 Watter EEN van die volgende stowwe het die sterkste intermolekulêre kragte in die vastestoffase?

A CO_2

B H_2O

C O_2

D CH_4 (3)

1.2 Watter EEN van die volgende is 'n eienskap van 'n ideale gas?

A By hoë druk verander die gas in 'n vloeistof.

B Die botsings tussen die molekule is nie-elasties.

C Daar is sterk aantrekkingskragte tussen die molekule.

D Molekule oefen slegs afstotingskragte op mekaar uit gedurende botsings. (3)

1.3 Die Kontakproses is die naam van die proses wat die katalitiese oksidasie van ... insluit.

A ammoniak

B swaweldioksied

C stikstofdioksied

D waterstofsulfied (3)

1.4 Die gas wat vrygestel word wanneer natriumnitraat sterk verhit word, is ...

A suurstof.

B stikstof.

C ammoniak.

D koolstofdioksied. (3)

1.5 'n Onbekende soutoplossing word gevoeg by 'n oplossing van silwernitraat en by 'n oplossing van swawelsuur. Wit neerslae word in beide gevalle gevorm. Die onbekende soutoplossing is waarskynlik …

A bariumchloried.

B loodnitraat.

C koper(II)chloried.

D bariumnitraat. (3)

1.1 Which ONE of the following substances has the strongest intermolecular forces in the solid phase?

A CO_2

B H_2O

C O_2

D CH_4 (3)

1.2 Which ONE of the following is a property of an ideal gas?

A At high pressure the gas turns into a liquid.

B The collisions between the molecules are inelastic.

C There are strong forces of attraction between molecules.

D Molecules only exert forces of repulsion on each other during collisions. (3)

1.3 The Contact process is the name of the process that involves the catalytic oxidation of …

A ammonia.

B sulphur dioxide.

C nitrogen dioxide.

D hydrogen sulphide. (3)

1.4 The gas liberated (given off) when sodium nitrate is strongly heated, is ...

A oxygen.

B nitrogen.

C ammonia.

D carbon dioxide. (3)

1.5 An unknown salt solution is added to a solution of silver nitrate and to a solution of sulphuric acid. A white precipitate forms in each case. The unknown salt solution is probably …

A barium chloride.

B lead nitrate.

C copper(II)chloride.

D barium nitrate. (3)

1.6 Waterstofgas word berei deur sinkkorrels met 'n oormaat van 'n 1 mol.dm^{-3} soutsuur-oplossing (HCℓ) te laat reageer.
Watter EEN van die volgende sal **NIE** die tempo van die reaksie verhoog **NIE**?

A Verhit die suur

B Gebruik sinkpoeier

C Gebruik 1,5 mol.dm^{-3} HCℓ -oplossing

D Verdubbel die volume van die HCℓ -oplossing (3)

1.7 Ammoniumchloried los in water op en die temperatuur van die oplossing daal skerp. Vanaf hierdie inligting kan jy tot die gevolgtrekking kom dat dit 'n ... is.

A reduksie-reaksie

B oksidasie-reaksie

C endotermiese reaksie

D eksotermiese reaksie (3)

1.8 Die volgende reaksie is in ewewig in 'n geslote houer:

$$X_2(g) + Y_2(g) \rightleftharpoons 2XY(g) \qquad \Delta H < 0$$

Die hoeveelheid XY kan vermeerder word deur ...

A die temperatuur te verlaag.

B die temperatuur te verhoog.

C die druk te verlaag deur die volume te verhoog.

D die druk te verhoog deur die volume te verlaag. (3)

1.9 Watter EEN van die volgende kan óf as 'n suur óf as 'n basis optree?

A H_3O^+

B CO_3^{2-}

C $C\ell^-$

D HSO_4^- (3)

1.6 Hydrogen gas is prepared by reacting zinc granules with an excess of a 1 mol.dm^{-3} hydrochloric acid (HCℓ) solution.
Which ONE of the following will **NOT** increase the rate of the reaction?

A Heating the acid

B Using zinc powder

C Using 1,5 mol.dm^{-3} HCℓ solution

D Doubling the volume of the HCℓ solution (3)

1.7 Ammonium chloride dissolves in water and the temperature of the solution drops sharply. From this information you can conclude that this is a(n) ...

A reduction reaction.

B oxidation reaction.

C endothermic reaction.

D exothermic reaction. (3)

1.8 The following reaction is in equilibrium in a closed container:

$$X_2(g) + Y_2(g) \rightleftharpoons 2XY(g) \qquad \Delta H < 0$$

The amount of XY can be increased by ...

A decreasing the temperature.

B increasing the temperature.

C decreasing the pressure by increasing the volume.

D increasing the pressure by decreasing the volume. (3)

1.9 Which ONE of the following can act either as an acid or a base?

A H_3O^+

B CO_3^{2-}

C $C\ell^-$

D HSO_4^- (3)

1.10 Watter EEN van die volgende verdunde oplossings het 'n pH kleiner as 7?

A Suiker
B Asyn
C Ammoniak
D Tafelsout (3)

1.11 Die konsentrasie(s) van watter ioon/ione sal toeneem wanneer 'n sink-koper elektrochemiese sel in werking is?

A Slegs Cu^{2+}
B Slegs Zn^{2+}
C SO_4^{2-}
D Beide Zn^{2+} en Cu^{2+} (3)

1.12 Tydens die reaksie:

$$Mg + Fe^{2+} \rightarrow Mg^{2+} + Fe$$

A word protone oorgedra na Fe^{2+}
B word protone oorgedra na Mg
C word elektrone oorgedra na Fe^{2+}
D word elektrone oorgedra na Mg (3)

1.13 Oorweeg die volgende redoksreaksie:

$$H_2S(g) + 2FeC\ell_3(aq) \rightarrow 2FeC\ell_2(aq) + S(s) + 2HC\ell(aq)$$

Die oksidasie-halfreaksie van die bostaande reaksie is:

A $H_2S \rightarrow S + 2H^+ + 2e^-$
B $2Fe^{3+} + 2e^- \rightarrow 2Fe^{2+}$
C $S + 2H^+ + 2e^- \rightarrow H_2S$
D $C\ell_2 + 2e^- \rightarrow 2C\ell^-$ (3)

1.10 Which ONE of the following dilute solutions has a pH less than 7?

A Sugar
B Vinegar
C Ammonia
D Table salt (3)

1.11 In a zinc-copper electrochemical cell, the concentration(s) of which ion(s) will increase when the cell is in operation?

A Only Cu^{2+}
B Only Zn^{2+}
C SO_4^{2-}
D Both Zn^{2+} and Cu^{2+} (3)

1.12 In the reaction:

$$Mg + Fe^{2+} \rightarrow Mg^{2+} + Fe$$

A protons are transferred to Fe^{2+}
B protons are transferred to Mg
C electrons are transferred to Fe^{2+}
D electrons are transferred to Mg (3)

1.13 Consider the following redox reaction:

$$H_2S(g) + 2FeC\ell_3(aq) \rightarrow 2FeC\ell_2(aq) + S(s) + 2HC\ell(aq)$$

The oxidation half-reaction for the above reaction is:

A $H_2S \rightarrow S + 2H^+ + 2e^-$
B $2Fe^{3+} + 2e^- \rightarrow 2Fe^{2+}$
C $S + 2H^+ + 2e^- \rightarrow H_2S$
D $C\ell_2 + 2e^- \rightarrow 2C\ell^-$ (3)

1.14 Watter EEN van die volgende verbindings is 'n voorbeeld van 'n **versadigde** koolwaterstof?

A C_2H_4

B C_3H_8

C $C_2H_2Br_2$

D $C_2C\ell_4$ (3)

1.15 Watter een van die volgende stellings rakende alkane is **NIE WAAR NIE**? Die alkane …

A is almal koolwaterstowwe.

B is 'n homoloë reeks.

C is almal gasse by kamertemperatuur.

D kan voorgestel word deur die formule C_nH_{2n+2}. (3)
[45]

1.14 Which ONE of the following compounds is an example of a **saturated** hydrocarbon?

A C_2H_4

B C_3H_8

C $C_2H_2Br_2$

D $C_2C\ell_4$ (3)

1.15 Which ONE of the following statements concerning the alkanes is **NOT CORRECT**? The alkanes …

A are all hydrocarbons.

B are a homologous series.

C are all gases at room temperature.

D can be represented by the formula C_nH_{2n+2}. (3)

[45]

BEANTWOORD VRAAG 2 – 7 IN DIE ANTWOORDEBOEK.

INSTRUKSIES

1. Begin elke vraag op 'n nuwe bladsy in jou antwoordeboek.
2. Laat 'n reël oop tussen onderafdelings, byvoorbeeld tussen VRAAG 2.1 en 2.2.
3. Verskaf ALLE formules wat gebruik word en toon jou bewerkings (dit sluit substitusies in).
4. Nommer jou antwoorde soos wat die vrae genommer is.

VRAAG 2

2.1 Oorweeg die volgende lys chemiese stowwe voorgestel deur die letters A tot E:

A. $NaC\ell(s)$ B. $S(s)$ C. $H_2O(\ell)$

D. $SO_2(g)$ E. $C_6H_{14}(g)$

Kies uit die bostaande lys 'n stof wat:

2.1.1 Allotrope het (2)

2.1.2 'n Suur vorm wanneer dit in water oplos (2)

2.1.3 As 'n brandstof gebruik word (2)

2.1.4 Elektrisiteit gelei wanneer dit in die gesmelte toestand is (2)

ANSWER QUESTIONS 2 – 7 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 Consider the following list of chemical substances represented by the letters A to E:

A. $NaC\ell(s)$ B. $S(s)$ C. $H_2O(\ell)$

D. $SO_2(g)$ E. $C_6H_{14}(g)$

Select from the above list, a substance which:

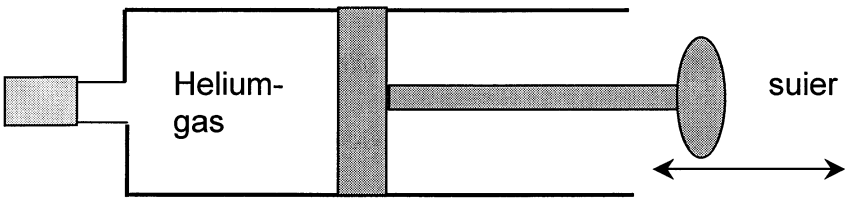
2.1.1 Has allotropes (2)

2.1.2 Forms an acid when dissolved in water (2)

2.1.3 Is used as a fuel (2)

2.1.4 Conducts electricity in the molten state (2)

2.2 Die onderstaande diagram toon 'n gasspuit wat heliumgas bevat.
Die suier van die spuit **kan vrylik beweeg**.



Die heliumgas is by **STD** en dit beslaan 'n volume van 40,0 cm^3.

2.2.1 Skryf die druk neer van die heliumgas in die gasspuit. (2)

Die temperatuur van die sisteem word nou na 80°C verhoog.

2.2.2 Noem wat jy waarneem met die suier gebeur as die temperatuur van die sisteem tot 80°C toeneem. (2)

2.2.3 Verduidelik jou waarneming in VRAAG 2.2.2 in terme van die kinetiese-molekulêre teorie. (3)

2.2.4 Bereken die volume van die heliumgas by 80°C en standaarddruk. (4)
[19]

VRAAG 3 (BEGIN OP 'N NUWE BLADSY)

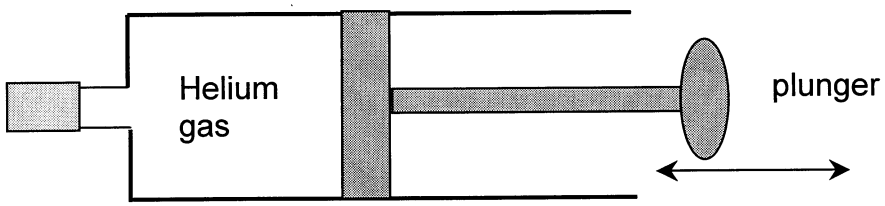
3.1 'n Stukkie magnesiumlint word aan die brand gesteek en in 'n gassilinder wat gevul is met swaweldioksiedgas geplaas.

3.1.1 Skryf die gebalanseerde vergelyking neer van die reaksie wat plaasvind. (3)

3.1.2 Noem watter tipe reaksie dit is.
(Kies uit SUUR-BASIS-, REDOKS- of NEERSLAGREAKSIE.) (2)

3.1.3 Watter eienskap van swaweldioksied word deur hierdie reaksie gedemonstreer? (2)

2.2 The diagram below shows a gas syringe containing helium gas. The plunger of the syringe **can move freely**.



The helium gas is at **STP**, and it occupies a volume of 40,0 cm^3.

2.2.1 Write the pressure of the helium gas in the syringe. (2)

The temperature of the system is now increased to 80°C.

2.2.2 State what you would observe happening to the plunger as the temperature of the system increases to 80°C. (2)

2.2.3 Explain your observation in QUESTION 2.2.2 in terms of the kinetic molecular theory. (3)

2.2.4 Calculate the volume of the helium gas at 80°C and standard pressure. (4)
[19]

QUESTION 3 (START ON A NEW PAGE)

3.1 A piece of magnesium ribbon is set alight and placed in a gas cylinder that is filled with sulphur dioxide gas.

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

3.1.2 State what type of reaction this is.
(Choose from ACID-BASE, REDOX or PRECIPITATION REACTION.) (2)

3.1.3 Which property of sulphur dioxide is demonstrated in this reaction? (2)

3.2 Salpetersuur is termies onstabiel en ontbind wanneer dit verhit word.

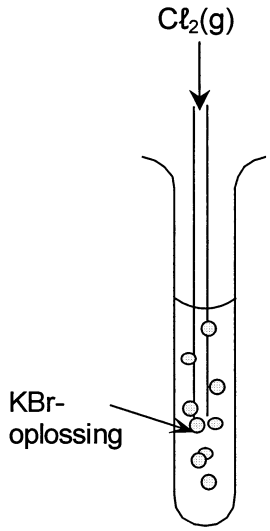
3.2.1 Skryf die gebalanseerde vergelyking van hierdie reaksie neer. (3)

Salpetersuur verkleur ook (word geel) wanneer dit in sonlig laat staan word.

3.2.2 Skryf die **NAAM** neer van die stof wat vir die geel kleur verantwoordelik is. (2)

3.3 Chloorgas ($C\ell_2$) word deur 'n waterige oplossing van kaliumbromied (KBr) in 'n proefbuis geborrel.

Die oplossing verkleur.



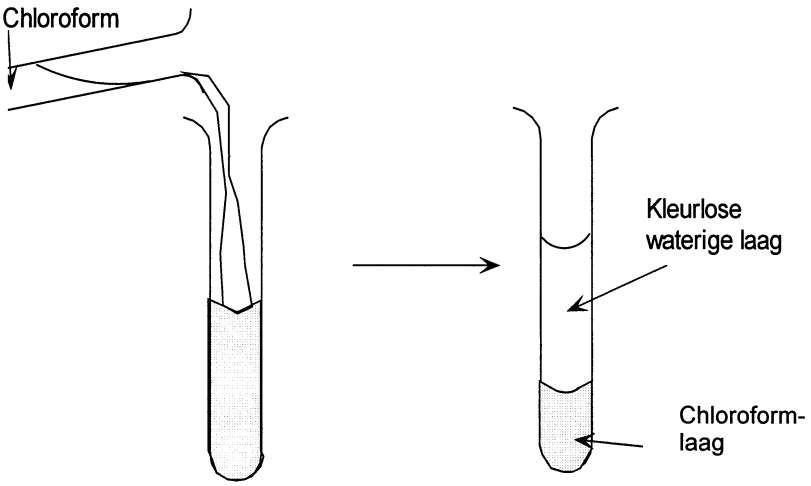
3.3.1 Skryf die gebalanseerde vergelyking neer van die reaksie wat hierdie kleurverandering sal verduidelik. (3)

'n Hoeveelheid chloroform word daarna by hierdie proefbuis gevoeg.

Die proefbuis word versigtig geskud.

Die oplossing skei in twee lae.

Die waterige laag word kleurloos, terwyl die chloroformlaag verkleur.



3.3.2 Gee die **NAAM** van die opgeloste stof in die waterige laag (boonste laag). (2)

3.3.3 Gee die **NAAM** van die opgeloste stof in die chloroformlaag (onderste laag). (2)
[19]

3.2 Nitric acid is thermally unstable and decomposes when heated.

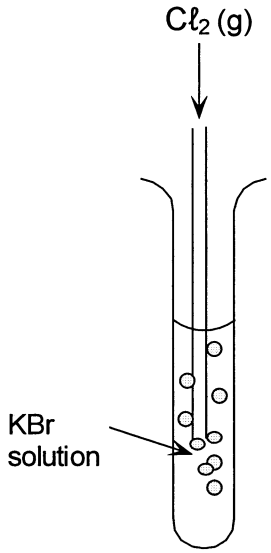
3.2.1 Write the balanced equation for this reaction. (3)

Nitric acid also discolours (turns yellow) when left in sunlight.

3.2.2 Write the **NAME** of the substance responsible for the yellow colour. (2)

3.3 Chlorine gas ($C\ell_2$) is bubbled through an aqueous solution of potassium bromide (KBr) in a test tube.

The solution changes colour.



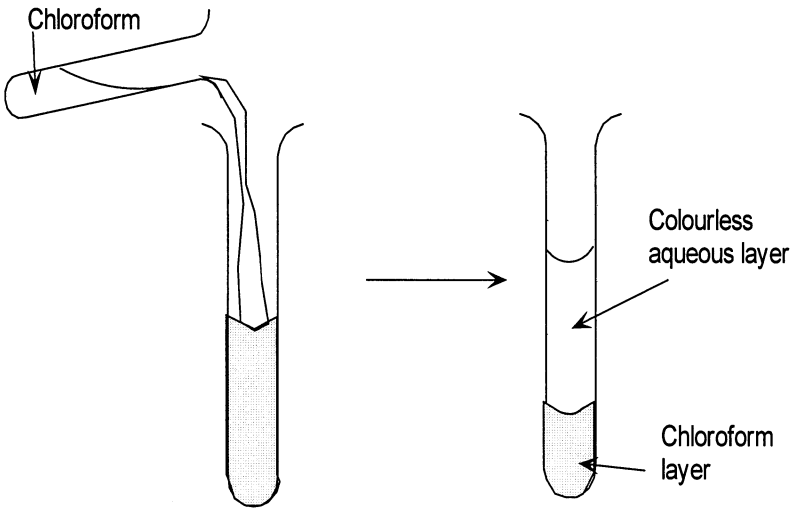
3.3.1 Write the balanced equation for the reaction that will explain this colour change. (3)

Some chloroform is then added to this test tube.

The test tube is carefully shaken.

The solution separates into two layers.

The aqueous layer becomes colourless, while the chloroform layer takes on a colour.



3.3.2 Give the **NAME** of the solute (dissolved substance) in the aqueous layer (top layer). (2)

3.3.3 Give the **NAME** of the solute (dissolved substance) in the chloroform layer (bottom layer). (2)
[19]

VRAAG 4 (BEGIN OP 'N NUWE BLADSY)

4.1 Twee proefbuise, X en Y, bevat verskillende oplossings van natriumtiosulfaat soos aangedui in die onderstaande tabel.

	Proefbuis X	**Proefbuis Y**
Konsentrasie van natriumtiosulfaat	1,0 mol.dm^{-3}	1,5 mol.dm^{-3}
Temperatuur van oplossing	10°C	20°C

Gelyke volumes van 'n 2,0 mol.dm^{-3}-soutsuuroplossing word nou by elke proefbuis gevoeg en 'n reaksie vind plaas.

4.1.1 In watter proefbuis (X of Y) sal die reaksie teen die hoogste tempo plaasvind? (1)

4.1.2 Gee TWEE redes vir die antwoord op VRAAG 4.1.1 hierbo. (4)

4.2 Die volgende reaksie is in ewewig in 'n geslote houer:

$$4X(g) + Y_2(g) \rightleftharpoons 2X_2Y(g) + 1\ 300\ kJ$$

4.2.1 Wat dui die dubbelpyl ($\rightleftharpoons$) aan? (2)

4.2.2 Skryf die waarde neer van die reaksiewarmte (ΔH) vir die voorwaartse reaksie. (2)

4.2.3 Is die voorwaartse reaksie eksotermies of endotermies?
Gee 'n rede vir jou antwoord. (3)

*Hoe sal die **hoeveelheid** Y_2 in die houer beïnvloed word as:*
(Skryf slegs NEEM TOE, NEEM AF of BLY DIESELFDE neer.)

4.2.4 Die temperatuur verhoog word (2)

4.2.5 X_2Y voortdurend uit die sisteem verwyder word (2)

4.2.6 Die druk van die sisteem verlaag word (deur die volume te vergroot) (2)

4.2.7 'n Geskikte katalisator bygevoeg word (2)
[20]

QUESTION 4 (START ON A NEW PAGE)

4.1 Two test tubes, X and Y, contain different solutions of sodium thiosulphate as shown in the table below.

	Test tube X	**Test tube Y**
Concentration of sodium thiosulphate	1,0 mol.dm^{-3}	1,5 mol.dm^{-3}
Temperature of solution	10°C	20°C

Equal volumes of a 2,0 mol.dm^{-3} solution of hydrochloric acid is then added to each test tube and a reaction takes place.

4.1.1 In which test tube (X or Y) will the reaction occur at the fastest rate? (1)

4.1.2 Give TWO reasons for the answer to QUESTION 4.1.1 above. (4)

4.2 The following reaction is in equilibrium in a closed container:

$$4X(g) + Y_2(g) \rightleftharpoons 2X_2Y(g) + 1\ 300\ kJ$$

4.2.1 What does the double arrow ($\rightleftharpoons$) indicate? (2)

4.2.2 Write the value of the heat of reaction (ΔH) for the forward reaction. (2)

4.2.3 Is the forward reaction exothermic or endothermic? Give a reason for your answer. (3)

*How will the **amount** of Y_2 in the container be influenced if:*
(Write only INCREASES, DECREASES or STAYS THE SAME.)

4.2.4 The temperature is increased (2)

4.2.5 X_2Y is continuously removed from the system (2)

4.2.6 The pressure of the system is decreased (by increasing the volume) (2)

4.2.7 A suitable catalyst is added (2)
[20]

VRAAG 5 (BEGIN OP 'N NUWE BLADSY)

5.1 Swawelsuur word in water opgelos.

5.1.1 Skryf die gebalanseerde vergelyking van die reaksie van swawelsuur met water neer. (3)

5.1.2 Skryf EEN gekonjugeerde suur-basispaar van die reaksie in VRAAG 5.1.1 neer. (2)

5.2 In 'n titrasie neutraliseer 20 cm^3 van 'n 0,1 $mol.dm^{-3}$ natriumhidroksied (NaOH)-oplossing 25 cm^3 van 'n etanoësuur (CH_3COOH)-oplossing.

5.2.1 Gee EEN rede waarom CH_3COOH beskou word as 'n swak suur. (2)

5.2.2 Skryf die gebalanseerde vergelyking neer van die neutralisasie-reaksie wat plaasvind. (3)

5.2.3 Bereken die aantal mol natriumhidroksied wat gebruik word in hierdie reaksie. (2)

5.2.4 Bereken die konsentrasie van die etanoësuur deur die antwoord op VRAAG 5.2.3 te gebruik. (4)

5.2.5 Uit die onderstaande tabel, noem 'n geskikte indikator wat gebruik kan word tydens hierdie titrasie.

NAAM VAN INDIKATOR	pH-GEBIED VAN INDIKATOR
metieloranje	3,1 – 4,4
metielrooi	4,4 – 6,2
fenolftaleïen	8,3 – 10,0

(2)
[18]

QUESTION 5 (START ON A NEW PAGE)

5.1 Sulphuric acid is dissolved in water.

5.1.1 Write the balanced equation for the reaction of sulphuric acid with water. (3)

5.1.2 Write ONE conjugate acid-base pair in the reaction in QUESTION 5.1.1. (2)

5.2 In a titration, 20 cm^3 of a 0,1 $mol.dm^{-3}$ sodium hydroxide (NaOH) solution neutralises 25 cm^3 of an ethanoic acid (CH_3COOH) solution.

5.2.1 Give ONE reason why CH_3COOH is regarded as a weak acid. (2)

5.2.2 Write the balanced equation for the neutralisation reaction that takes place. (3)

5.2.3 Calculate the number of moles of sodium hydroxide used in this reaction. (2)

5.2.4 Using the answer to QUESTION 5.2.3, calculate the concentration of the ethanoic acid. (4)

5.2.5 From the table below, name a suitable indicator for use in this titration.

NAME OF INDICATOR	pH RANGE OF INDICATOR
methyl orange	3,1 – 4,4
methyl red	4,4 – 6,2
phenolphthalein	8,3 – 10,0

(2)
[18]

VRAAG 6 (BEGIN OP 'N NUWE BLADSY)

6.1 Lindile stel 'n elektrochemiese sel op deur die volgende reaksie te gebruik:

$$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$$

6.1.1 Skryf die gebalanseerde vergelyking neer van die halfreaksie wat by die katode plaasvind. (2)

6.1.2 Noem die tipe reaksie wat by die anode plaasvind. (2)

6.1.3 Skryf die **FORMULE** neer van 'n geskikte sout wat gebruik kan word in die sink-halfsel. (2)

6.1.4 Skryf die selnotasie van hierdie sel neer. (3)

6.1.5 Watter elektrode se massa neem af?
Skryf die vergelyking neer van 'n halfreaksie om jou antwoord te regverdig. (3)

6.1.6 Gee die energieverandering wat plaasvind in hierdie sel wanneer dit in werking is. (2)

6.2 Gekonsentreerde soutsuur reageer met mangaan(IV)oksied (MnO_2) om chloorgas te vorm.

Gebruik die Tabel van Standaard Reduksiepotensiale (Tabel 4) om die volgende neer te skryf:

6.2.1 Die oksidasie-halfreaksie (2)

6.2.2 Die reduksie-halfreaksie (2)
[18]

QUESTION 6 (START ON A NEW PAGE)

6.1 Lindile sets up an electrochemical cell using the following reaction:

$$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$$

6.1.1 Write the balanced equation for the half-reaction taking place at the cathode. (2)

6.1.2 Name the type of reaction that takes place at the anode. (2)

6.1.3 Write the **FORMULA** of a suitable salt that can be used in the zinc half-cell. (2)

6.1.4 Write the cell notation for this cell. (3)

6.1.5 Which electrode undergoes a decrease in mass? Write the equation of a half-reaction to justify your answer. (3)

6.1.6 State the energy conversion that takes place in the cell when it is in operation. (2)

6.2 Concentrated hydrochloric acid reacts with manganese(IV)oxide (MnO_2) to produce chlorine gas.

Use the Table of Standard Reduction Potentials (Table 4) to write the following:

6.2.1 The oxidation half-reaction (2)

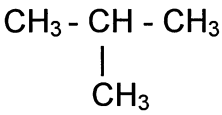
6.2.2 The reduction half-reaction (2)
[18]

VRAAG 7 (BEGIN OP 'N NUWE BLADSY)

7.1 Beskou die volgende lys organiese verbindings voorgestel deur die letters A tot D:

A: $CH_3 - CH_2 - CH_2 - CH_3$

B: $CH_3 - CH = CH - CH_3$

C:


D: $CH \equiv C - CH_2 - CH_3$

Vanaf die bostaande lys, skryf **slegs die letter(s)** van:

7.1.1 TWEE verbindings wat isomere is van mekaar (2)

7.1.2 TWEE verbindings wat onversadigde koolwaterstowwe is (2)

7.1.3 Die verbinding wat behoort tot die homoloë reeks met die algemene formule C_nH_{2n-2} (2)

7.2 Skryf die IUPAC-naam van verbinding B in VRAAG 7.1 hierbo neer. (2)

7.3 Skryf die struktuurformule van tetrachlooreteen neer. (3)
[11]

TOTAAL: 150

QUESTION 7 (START ON A NEW PAGE)

7.1 Consider the following list of organic compounds, represented by the letters A to D:

A: $CH_3 - CH_2 - CH_2 - CH_3$

B: $CH_3 - CH = CH - CH_3$

C:
$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$$

D: $CH \equiv C - CH_2 - CH_3$

From the list above, write **only the letter(s)** representing:

7.1.1 TWO compounds that are isomers of each other (2)

7.1.2 TWO compounds that are unsaturated hydrocarbons (2)

7.1.3 The compound that belongs to the homologous series with the general formula C_nH_{2n-2} (2)

7.2 Write the IUPAC name of compound B in QUESTION 7.1 above. (2)

7.3 Write the structural formula for tetrachloroethene. (3)

[11]

TOTAL: 150

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 KONSTANTES

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^θ	$1{,}013 \times 10^5$ Pa
Molêre gasvolume by STD Molar gas volume at STP	V_m	22,4 dm^3.mol^{-1}
Standaardtemperatuur Standard temperature	T^θ	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
$n = \frac{m}{M}$	$pH = -\log[H^+]$
$c = \frac{n}{V}$	$E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$
$c = \frac{m}{MV}$	$E^\theta_{cell} = E^\theta_{oxidising\ agent} - E^\theta_{reducing\ agent}$
	$E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$
	$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$

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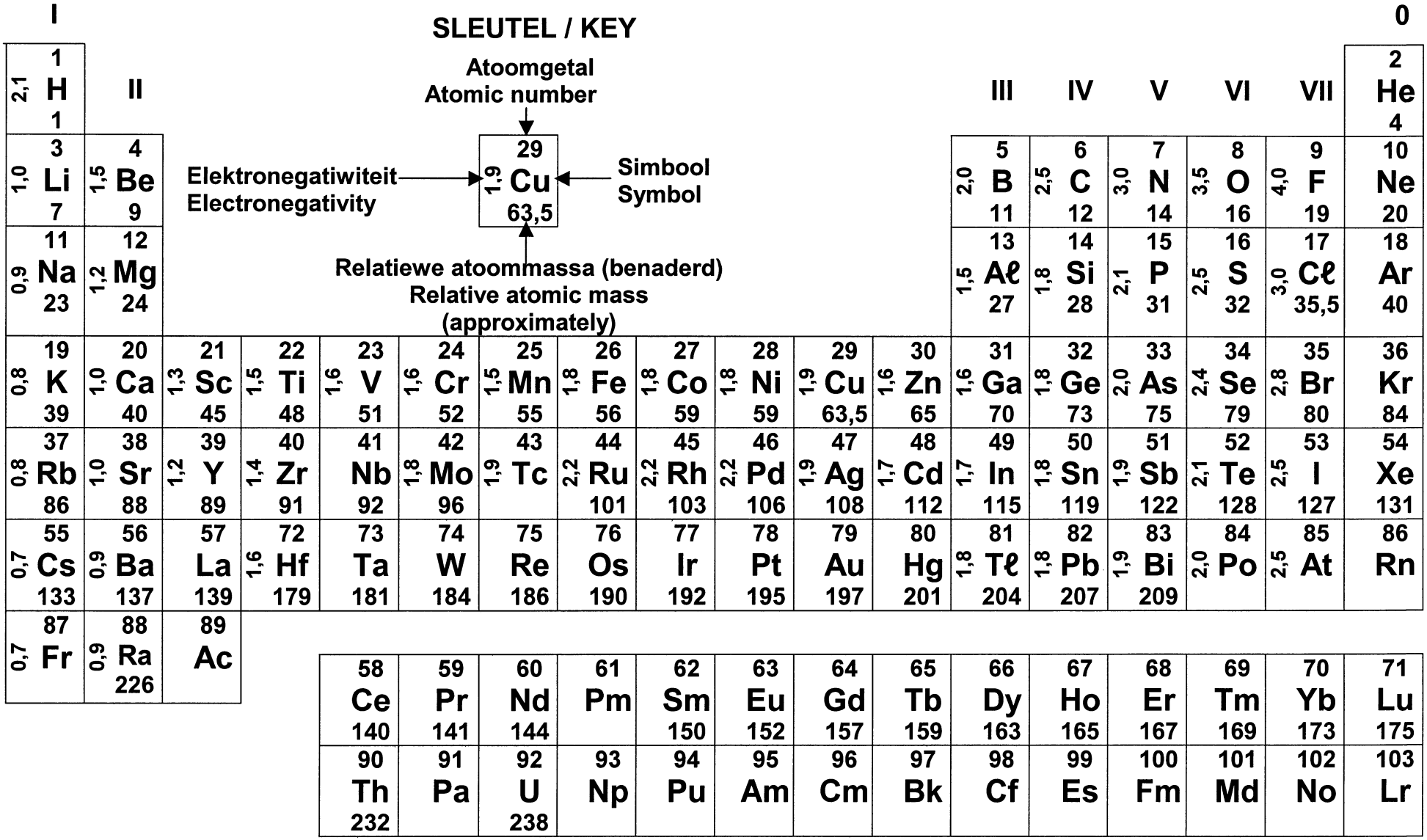
$c = \frac{m}{MV}$	$E^\theta_{\text{cell}} = E^\theta_{\text{oxidising agent}} - E^\theta_{\text{reducing agent}}$
	$E^\theta_{\text{sel}} = E^\theta_{\text{katode}} - E^\theta_{\text{anode}}$
	$E^\theta_{\text{cell}} = E^\theta_{\text{cathode}} - E^\theta_{\text{anode}}$

TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE

TABLE 3: THE PERIODIC TABLE OF ELEMENTS



TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

SLEUTEL / KEY

Atoomgetal / Atomic number

Elektronegatiwiteit / Electronegativity — 29 | 1,9 | Cu | 63,5 — Simbool / Symbol

Relatiewe atoommassa (benaderd) / Relative atomic mass (approximately)

I	II	III	IV	V	VI	VII	0
1 H 2,1 1							2 He 4
3 Li 1,0 7	4 Be 1,5 9	5 B 2,0 11	6 C 2,5 12	7 N 3,0 14	8 O 3,5 16	9 F 4,0 19	10 Ne 20
11 Na 0,9 23	12 Mg 1,2 24	13 Aℓ 1,5 27	14 Si 1,8 28	15 P 2,1 31	16 S 2,5 32	17 Cℓ 3,0 35,5	18 Ar 40
19 K 0,8 39	20 Ca 1,0 40	21 Sc 1,3 45	22 Ti 1,5 48	23 V 1,6 51	24 Cr 1,6 52	25 Mn 1,5 55	26 Fe 1,8 56
27 Co 1,8 59	28 Ni 1,8 59	29 Cu 1,9 63,5	30 Zn 1,6 65	31 Ga 1,6 70	32 Ge 1,8 73	33 As 2,0 75	34 Se 2,4 79
35 Br 2,8 80	36 Kr 84						
37 Rb 0,8 86	38 Sr 1,0 88	39 Y 1,2 89	40 Zr 1,4 91	41 Nb 92	42 Mo 1,8 96	43 Tc 1,9	44 Ru 2,2 101
45 Rh 2,2 103	46 Pd 2,2 106	47 Ag 1,9 108	48 Cd 1,7 112	49 In 1,7 115	50 Sn 1,8 119	51 Sb 1,9 122	52 Te 2,1 128
53 I 2,5 127	54 Xe 131						
55 Cs 0,7 133	56 Ba 0,9 137	57 La 139	72 Hf 1,6 179	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 Tℓ 1,8 204	82 Pb 1,8 207	83 Bi 1,9 209	84 Po 2,0
85 At 2,5	86 Rn						
87 Fr 0,7	88 Ra 0,9 226	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

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

Increasing oxidising ability / Toenemende oksideervermoë ↑

Halfreaksie / Half-reaction	E° /volt
$F_2 + 2e^- \rightleftharpoons 2F^-$	+2,87
$H_2O_2 + 2H^+ + 2e^- \rightleftharpoons 2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O$	+1,51
$Au^{3+} + 3e^- \rightleftharpoons Au$	+1,42
$C\ell_2 + 2e^- \rightleftharpoons 2C\ell^-$	+1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O$	+1,33
$O_2 + 4H^+ + 4e^- \rightleftharpoons 2\ H_2O$	+1,23
$MnO_2 + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O$	+1,21
$Pt^{2+} + 2e^- \rightleftharpoons Pt$	+1,20
$Br_2 + 2e^- \rightleftharpoons 2Br^-$	+1,09
$NO_3^- + 4H^+ + 3e^- \rightleftharpoons NO + 2H_2O$	+0,96
$Ag^+ + e^- \rightleftharpoons Ag$	+0,80
$NO_3^- + 2H^+ + e^- \rightleftharpoons NO_2 + H_2O$	+0,80
$Hg^{2+} + 2e^- \rightleftharpoons Hg$	+0,79
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	+0,77
$O_2 + 2H^+ + 2e^- \rightleftharpoons H_2O_2$	+0,68
$I_2 + 2e^- \rightleftharpoons 2I^-$	+0,54
$SO_2 + 4H^+ + 4e^- \rightleftharpoons S + 2H_2O$	+0,45
$2H_2O + O_2 + 4e^- \rightleftharpoons 4OH^-$	+0,40
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+0,34
$SO_4^{2-} + 4H^+ + 2e^- \rightleftharpoons SO_2 + 2H_2O$	+0,17
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	+0,16
$Sn^{4+} + 2e^- \rightleftharpoons Sn^{2+}$	+0,15
$S + 2H^+ + 2e^- \rightleftharpoons H_2S$	+0,14
$\mathbf{2H^+ + 2e^- \rightleftharpoons H_2}$	**0,00**
$Fe^{3+} + 3e^- \rightleftharpoons Fe$	-0,04
$Pb^{2+} + 2e^- \rightleftharpoons Pb$	-0,13
$Sn^{2+} + 2e^- \rightleftharpoons Sn$	-0,14
$Ni^{2+} + 2e^- \rightleftharpoons Ni$	-0,25
$Co^{2+} + 2e^- \rightleftharpoons Co$	-0,28
$Cd^{2+} + 2e^- \rightleftharpoons Cd$	-0,40
$Fe^{2+} + 2e^- \rightleftharpoons Fe$	-0,44
$Cr^{3+} + 3e^- \rightleftharpoons Cr$	-0,74
$Zn^{2+} + 2e^- \rightleftharpoons Zn$	-0,76
$2H_2O + 2e^- \rightleftharpoons H_2 + 2OH^-$	-0,83
$Mn^{2+} + 2e^- \rightleftharpoons Mn$	-1,18
$A\ell^{3+} + 3e^- \rightleftharpoons A\ell$	-1,66
$Mg^{2+} + 2e^- \rightleftharpoons Mg$	-2,37
$Na^+ + e^- \rightleftharpoons Na$	-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 reducing ability / Toenemende reduseervermoë ↓

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

Increasing oxidising ability / Toenemende oksideervermoë ↑

Increasing reducing ability / Toenemende reduseervermoë ↓

Halfreaksie / Half-reaction	E° /volt
$F_2 + 2e^- \rightleftharpoons 2F^-$	+2,87
$H_2O_2 + 2H^+ + 2e^- \rightleftharpoons 2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O$	+1,51
$Au^{3+} + 3e^- \rightleftharpoons Au$	+1,42
$C\ell_2 + 2e^- \rightleftharpoons 2C\ell^-$	+1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O$	+1,33
$O_2 + 4H^+ + 4e^- \rightleftharpoons 2\ H_2O$	+1,23
$MnO_2 + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O$	+1,21
$Pt^{2+} + 2e^- \rightleftharpoons Pt$	+1,20
$Br_2 + 2e^- \rightleftharpoons 2Br^-$	+1,09
$NO_3^- + 4H^+ + 3e^- \rightleftharpoons NO + 2H_2O$	+0,96
$Ag^+ + e^- \rightleftharpoons Ag$	+0,80
$NO_3^- + 2H^+ + e^- \rightleftharpoons NO_2 + H_2O$	+0,80
$Hg^{2+} + 2e^- \rightleftharpoons Hg$	+0,79
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	+0,77
$O_2 + 2H^+ + 2e^- \rightleftharpoons H_2O_2$	+0,68
$I_2 + 2e^- \rightleftharpoons 2I^-$	+0,54
$SO_2 + 4H^+ + 4e^- \rightleftharpoons S + 2H_2O$	+0,45
$2H_2O + O_2 + 4e^- \rightleftharpoons 4OH^-$	+0,40
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+0,34
$SO_4^{2-} + 4H^+ + 2e^- \rightleftharpoons SO_2 + 2H_2O$	+0,17
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	+0,16
$Sn^{4+} + 2e^- \rightleftharpoons Sn^{2+}$	+0,15
$S + 2H^+ + 2e^- \rightleftharpoons H_2S$	+0,14
$\mathbf{2H^+ + 2e^- \rightleftharpoons H_2}$	**0,00**
$Fe^{3+} + 3e^- \rightleftharpoons Fe$	-0,04
$Pb^{2+} + 2e^- \rightleftharpoons Pb$	-0,13
$Sn^{2+} + 2e^- \rightleftharpoons Sn$	-0,14
$Ni^{2+} + 2e^- \rightleftharpoons Ni$	-0,25
$Co^{2+} + 2e^- \rightleftharpoons Co$	-0,28
$Cd^{2+} + 2e^- \rightleftharpoons Cd$	-0,40
$Fe^{2+} + 2e^- \rightleftharpoons Fe$	-0,44
$Cr^{3+} + 3e^- \rightleftharpoons Cr$	-0,74
$Zn^{2+} + 2e^- \rightleftharpoons Zn$	-0,76
$2H_2O + 2e^- \rightleftharpoons H_2 + 2OH^-$	-0,83
$Mn^{2+} + 2e^- \rightleftharpoons Mn$	-1,18
$A\ell^{3+} + 3e^- \rightleftharpoons A\ell$	-1,66
$Mg^{2+} + 2e^- \rightleftharpoons Mg$	-2,37
$Na^+ + e^- \rightleftharpoons Na$	-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

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

Halfreaksie / Half-reaction	E° /volt
$Li^+ + e^- \rightleftharpoons Li$	-3,05
$K^+ + e^- \rightleftharpoons K$	-2,93
$Cs^+ + e^- \rightleftharpoons Cs$	-2,92
$Ba^{2+} + 2e^- \rightleftharpoons Ba$	-2,90
$Sr^{2+} + 2e^- \rightleftharpoons Sr$	-2,89
$Ca^{2+} + 2e^- \rightleftharpoons Ca$	-2,87
$Na^+ + e^- \rightleftharpoons Na$	-2,71
$Mg^{2+} + 2e^- \rightleftharpoons Mg$	-2,37
$A\ell^{3+} + 3e^- \rightleftharpoons A\ell$	-1,66
$Mn^{2+} + 2e^- \rightleftharpoons Mn$	-1,18
$2H_2O + 2e^- \rightleftharpoons H_2 + 2OH^-$	-0,83
$Zn^{2+} + 2e^- \rightleftharpoons Zn$	-0,76
$Cr^{3+} + 3e^- \rightleftharpoons Cr$	-0,74
$Fe^{2+} + 2e^- \rightleftharpoons Fe$	-0,44
$Cd^{2+} + 2e^- \rightleftharpoons Cd$	-0,40
$Co^{2+} + 2e^- \rightleftharpoons Co$	-0,28
$Ni^{2+} + 2e^- \rightleftharpoons Ni$	-0,25
$Sn^{2+} + 2e^- \rightleftharpoons Sn$	-0,14
$Pb^{2+} + 2e^- \rightleftharpoons Pb$	-0,13
$Fe^{3+} + 3e^- \rightleftharpoons Fe$	-0,04
$2H^+ + 2e^- \rightleftharpoons H_2$	**0,00**
$S + 2H^+ + 2e^- \rightleftharpoons H_2S$	+0,14
$Sn^{4+} + 2e^- \rightleftharpoons Sn^{2+}$	+0,15
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	+0,16
$SO_4^{2-} + 4H^+ + 2e^- \rightleftharpoons SO_2 + 2H_2O$	+0,17
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+0,34
$2H_2O + O_2 + 4e^- \rightleftharpoons 4OH^-$	+0,40
$SO_2 + 4H^+ + 4e^- \rightleftharpoons S + 2H_2O$	+0,45
$I_2 + 2e^- \rightleftharpoons 2I^-$	+0,54
$O_2 + 2H^+ + 2e^- \rightleftharpoons H_2O_2$	+0,68
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	+0,77
$Hg^{2+} + 2e^- \rightleftharpoons Hg$	+0,79
$NO_3^- + 2H^+ + e^- \rightleftharpoons NO_2 + H_2O$	+0,80
$Ag^+ + e^- \rightleftharpoons Ag$	+0,80
$NO_3^- + 4H^+ + 3e^- \rightleftharpoons NO + 2H_2O$	+0,96
$Br_2 + 2e^- \rightleftharpoons 2Br^-$	+1,09
$Pt^{2+} + 2e^- \rightleftharpoons Pt$	+1,20
$MnO_2 + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O$	+1,21
$O_2 + 4H^+ + 4e^- \rightleftharpoons 2\,H_2O$	+1,23
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$Au^{3+} + 3e^- \rightleftharpoons Au$	+1,42
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O$	+1,51
$H_2O_2 + 2H^+ + 2e^- \rightleftharpoons 2H_2O$	+1,77
$F_2 + 2e^- \rightleftharpoons 2F^-$	+2,87

Increasing oxidising ability / Toenemende oksideervermoë ↓

↑ Increasing reducing ability / Toenemende reduseervermoë

TABEL 4B: STANDAARD-REDUKSIEPOTENSIALE
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$Ba^{2+} + 2e^- \rightleftharpoons Ba$	-2,90
$Sr^{2+} + 2e^- \rightleftharpoons Sr$	-2,89
$Ca^{2+} + 2e^- \rightleftharpoons Ca$	-2,87
$Na^+ + e^- \rightleftharpoons Na$	-2,71
$Mg^{2+} + 2e^- \rightleftharpoons Mg$	-2,37
$A\ell^{3+} + 3e^- \rightleftharpoons A\ell$	-1,66
$Mn^{2+} + 2e^- \rightleftharpoons Mn$	-1,18
$2H_2O + 2e^- \rightleftharpoons H_2 + 2OH^-$	-0,83
$Zn^{2+} + 2e^- \rightleftharpoons Zn$	-0,76
$Cr^{3+} + 3e^- \rightleftharpoons Cr$	-0,74
$Fe^{2+} + 2e^- \rightleftharpoons Fe$	-0,44
$Cd^{2+} + 2e^- \rightleftharpoons Cd$	-0,40
$Co^{2+} + 2e^- \rightleftharpoons Co$	-0,28
$Ni^{2+} + 2e^- \rightleftharpoons Ni$	-0,25
$Sn^{2+} + 2e^- \rightleftharpoons Sn$	-0,14
$Pb^{2+} + 2e^- \rightleftharpoons Pb$	-0,13
$Fe^{3+} + 3e^- \rightleftharpoons Fe$	-0,04
$2H^+ + 2e^- \rightleftharpoons H_2$	**0,00**
$S + 2H^+ + 2e^- \rightleftharpoons H_2S$	+0,14
$Sn^{4+} + 2e^- \rightleftharpoons Sn^{2+}$	+0,15
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	+0,16
$SO_4^{2-} + 4H^+ + 2e^- \rightleftharpoons SO_2 + 2H_2O$	+0,17
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+0,34
$2H_2O + O_2 + 4e^- \rightleftharpoons 4OH^-$	+0,40
$SO_2 + 4H^+ + 4e^- \rightleftharpoons S + 2H_2O$	+0,45
$I_2 + 2e^- \rightleftharpoons 2I^-$	+0,54
$O_2 + 2H^+ + 2e^- \rightleftharpoons H_2O_2$	+0,68
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	+0,77
$Hg^{2+} + 2e^- \rightleftharpoons Hg$	+0,79
$NO_3^- + 2H^+ + e^- \rightleftharpoons NO_2 + H_2O$	+0,80
$Ag^+ + e^- \rightleftharpoons Ag$	+0,80
$NO_3^- + 4H^+ + 3e^- \rightleftharpoons NO + 2H_2O$	+0,96
$Br_2 + 2e^- \rightleftharpoons 2Br^-$	+1,09
$Pt^{2+} + 2e^- \rightleftharpoons Pt$	+1,20
$MnO_2 + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O$	+1,21
$O_2 + 4H^+ + 4e^- \rightleftharpoons 2\ H_2O$	+1,23
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O$	+1,33
$C\ell_2 + 2e^- \rightleftharpoons 2C\ell^-$	+1,36
$Au^{3+} + 3e^- \rightleftharpoons Au$	+1,42
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O$	+1,51
$H_2O_2 + 2H^+ + 2e^- \rightleftharpoons 2H_2O$	+1,77
$F_2 + 2e^- \rightleftharpoons 2F^-$	+2,87

Increasing oxidising ability / Toenemende oksideervermoë ↓

↑ Increasing reducing ability / Toenemende reduseervermoë