

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN



OCTOBER / NOVEMBER
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2004

FUNCTIONAL
PHYSICAL SCIENCE

FUNKSIONELE
NATUUR- EN
SKEIKUNDE

(Second Paper: Chemistry)
(Tweede Vraestel: Chemie)

SG

305-2/2

12 pages
12 bladsye

FUNCTIONAL PHYSICAL SCIENCE SG: Paper 2
Chemistry



305 2 2

SG

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GAUTENGSE DEPARTEMENT VAN ONDERWYS

SENIORSERTIFIKAAT-EKSAMEN

**FUNKSIONELE NATUUR- EN
SKEIKUNDE SG**
(Tweede Vraestel: Chemie)

TYD: 2 uur

PUNTE: 150

BENODIGDHEDE:

- 'n Goedgekeurde (nie-programmeerbare, wetenskaplike) sakrekenaar. Kandidate moet hulle eie sakrekenaars voorsien.

INSTRUKSIES:

- Skryf jou eksamennommer in die spasies wat voor op die antwoordboek daarvoor voorsien word.
 - Beantwoord ALLE vrae.
 - Beantwoord Vraag 1 op die **antwoordblad** aan die **binnekant van die omslag** van jou **antwoordboek**. Trek 'n kruisie (X) oor die letter A, B, C of D om aan te dui watter letter jy kies.
 - Beantwoord alle ander vrae in die antwoordboek. Indien jy 'n antwoord moet oordoen, moet dit op 'n nuwe bladsy gedoen word. Nommer alle antwoorde duidelik.
 - Begin elke vraag op 'n nuwe bladsy.
 - 'n Datatabel word aan die einde van hierdie vraestel voorsien. Dit bevat formules en konstantes. Die inligting wat voorsien word, mag jou in die beantwoording van die vrae van hulp wees.
 - Rofwerk mag agter in jou antwoordboek op die blanko bladsye gedoen word.
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GAUTENG DEPARTMENT OF EDUCATION
SENIOR CERTIFICATE EXAMINATION

**FUNCTIONAL PHYSICAL SCIENCE SG
(Second Paper: Chemistry)**

TIME: 2 hours

MARKS: 150

REQUIREMENTS:

- An approved (non-programmable, scientific) pocket calculator. Candidates should supply their own calculators.

INSTRUCTIONS:

- Write your examination number in the spaces provided for this purpose on the front of your answer book.
 - Answer ALL questions.
 - Answer Question 1 on the **answer sheet** on the **inside cover** of your **answer book**. Make a cross (X) over the letter A, B, C or D, to indicate the letter you have chosen.
 - Answer all the other questions in the answer book. If you need to redo an answer, redo it on a new page. Number all answers clearly.
 - Start each question on a new page.
 - A data sheet is provided at the end of this question paper. It contains formulae and constants. The information provided may be useful in answering the questions.
 - Rough work may be done on the blank pages at the back of your answer book.
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VRAAG 1
MEERVOUDIGE KEUSEVRAE

Bestudeer elke item en die voorgestelde antwoorde wat met die letters **A, B, C** en **D** aangedui word. Maak 'n kruisie (**X**) oor die ooreenstemmende letter op die antwoordblad nadat jy besluit het watter antwoord die korrekte een is. As daar meer as een kruisie in enige antwoord voorkom, sal **GEEN PUNTE** toegeken word nie.

VOORBEELD:

Suiwer ys smelt by:

- A. -4°C
- B. 0°C
- C. 0 K
- D. 4°C

ANTWOORD:

A	B	C	D
---	--------------	---	---

- 1.1 Die wetenskaplike wie se navorsing oorspronklik aan die lig gebring het dat die massa van 'n atoom in sy kern gekonsentreer is, is
- A. Thomson.
 - B. Rutherford.
 - C. Bohr.
 - D. Heisenberg.
- 1.2 Die elektrone in die energievlakke die naaste aan die kern, besit
- A. 'n minimum energie.
 - B. dieselfde energie as enige ander elektrone in die atoom.
 - C. zero energie.
 - D. 'n maksimum energie.
- 1.3 Die atome in 'n chloormolekuul word bymekaar gehou deur
- A. 'n elektrostatische aantrekkingskrag tussen gelaaiede atome.
 - B. 'n elektrostatische aantrekkingskrag tussen gelaaiede ione.
 - C. Van der Waalskragte tussen atome.
 - D. 'n elektronpaar wat tussen atome gedeel word.

QUESTION 1
MULTIPLE-CHOICE QUESTIONS

Study each item and the suggested answers which are indicated by the letters **A**, **B**, **C** and **D**. Make a cross (**X**) over the corresponding letter on the answer sheet after you have decided which is the correct one. If more than one cross appears in any answer, **NO MARKS** will be awarded.

EXAMPLE:

Pure ice melts at:

- A. -4°C
- B. 0°C
- C. 0 K
- D. 4°C

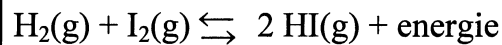
ANSWER:

A	X	C	D
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- 1.1 The scientist whose research originally found that the mass of an atom is concentrated in its nucleus, is
- A. Thomson.
 - B. Rutherford.
 - C. Bohr.
 - D. Heisenberg.
- 1.2 The electrons situated in the energy levels closest to the nucleus, have
- A. a minimum energy.
 - B. the same energy as any of the other electrons in the atom.
 - C. zero energy.
 - D. a maximum energy.
- 1.3 The atoms in a chlorine molecule are bound together by
- A. an electrostatic force of attraction between charged atoms.
 - B. an electrostatic force of attraction between charged ions.
 - C. Van der Waal's forces between atoms.
 - D. sharing of an electron pair between atoms.

- 1.4 Watter van die volgende verbindings behoort die hoogste smeltpunt te hê?
- A. NaCl
 - B. KI
 - C. LiBr
 - D. MgO
- 1.5 'n Proses wat sterk eksotermies is, is die
- A. ontbinding van kaliumchloraat (KClO₃).
 - B. dehidrasie van kopersulfaat (CuSO₄·5H₂O).
 - C. verbranding van 'n waterstof-en-suurstofmengsel.
 - D. vervaardiging van stysel deur plante in sonlig.
- 1.6 As oplossings van HCl en NaOH gemeng word, styg die temperatuur van die mengsel. Die styging in temperatuur is te wyte aan
- A. wrywing tussen die molekule.
 - B. die vorming van bindings tussen natrium- en chlooratome.
 - C. die verbreking van interatomiese bindings in HCl.
 - D. die vorming van watermolekules.

- 1.7 Die volgende reaksie het ewewig bereik:



Die konsentrasie HI kan verhoog word deur die

- A. druk op die sisteem te verhoog.
 - B. temperatuur te verlaag.
 - C. temperatuur te verhoog.
 - D. druk op die sisteem te verlaag.
- 1.8 Die konsentrasie van die produkte wat ontstaan in enige chemiese reaksie wat in ewewig is, kan **ALTYD** verhoog word deur
- A. 'n katalisator by te voeg.
 - B. die druk te verlaag.
 - C. die temperatuur te verhoog.
 - D. die konsentrasie van die reagense te verhoog.

1.4 Which of the following compounds should have the highest melting point?

- A. NaCl
- B. KI
- C. LiBr
- D. MgO

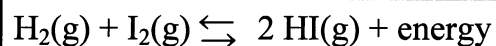
1.5 A process that is strongly exothermic, is the

- A. breaking of bonds in potassium chlorate (KClO₃).
- B. dehydration of copper sulphate (CuSO₄·5H₂O).
- C. burning of a hydrogen and oxygen mixture.
- D. production of starch in plants in sunlight.

1.6 When solutions of HCl and NaOH are mixed, the temperature rises in the mixture. This temperature increase is because of

- A. friction amongst molecules.
- B. the forming of bonds between sodium and chlorine atoms.
- C. the breaking of interatomic bonds in HCl.
- D. the formation of water molecules.

1.7 The following reaction has reached equilibrium:



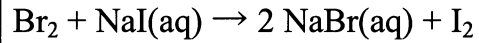
The concentration of HI can be increased by

- A. increasing pressure on the system.
- B. reducing temperature.
- C. increased temperature.
- D. reduction of pressure on the system.

1.8 The concentration of the products formed by any chemical reaction which is in equilibrium, can ALWAYS be increased by

- A. adding a catalyst.
- B. decreasing the pressure.
- C. increasing the temperature.
- D. increasing the concentration of the reactants.

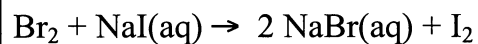
- 1.9 Broomwater word by 'n oplossing van natriumjodied in 'n proefbuis gevoeg. Die reaksie wat plaasvind, word deur die volgende vergelyking voorgestel:



In hierdie reaksie is

- A. broomatome geoksideer tot bromiedione.
 B. broomatome 'n reduseermiddel.
 C. jodiumione geoksideer tot jodiumatome.
 D. jodiedione gereduseer tot jodiumatome.
- 1.10 In watter van die volgende verbindings het Mn 'n oksidasietoestand van +7?
- A. KMnO_4
 B. MnO
 C. MnO_2
 D. Mn_3O_4
- 1.11 Die volgende sal plaasvind as 'n elektrochemiese sel aangeskakel word:
- A. Elektrone vloei uitwendig vanaf sink na koper.
 B. Elektrone vloei uitwendig vanaf koper na sink.
 C. Sink-ione word neergeslaan op die sinkelektrode.
 D. Koperatome word na koper-ione verander.
- 1.12 'n Waterige koperchloried (CuCl_2) oplossing word geëlektrolitiseer. Watter een van die volgende vergelykings bied die beste beskrywing van die reaksie wat by die katode plaasvind?
- A. $\text{CuCl}_2 + \text{H}_2\text{O} \rightarrow \text{Cu}^{+2}_{(\text{aq})} + 2\text{Cl}^{-}_{(\text{aq})}$
 B. $\text{Cu}^{+2}_{(\text{aq})} + 2\text{e}^{-} \rightarrow \text{Cu}_{(\text{s})}$
 C. $2\text{Cl}^{-}_{(\text{aq})} \rightarrow \text{Cl}_{2(\text{g})} + 2\text{e}^{-}$
 D. $\text{Cu}^{+2}_{(\text{aq})} + 2\text{Cl}^{-}_{(\text{aq})} \rightarrow \text{Cu}_{(\text{s})} + \text{Cl}_{2(\text{g})}$
- 1.13 Lindi laat sak 'n klein stukkie brandende kalium (K) in 'n gassilinder, wat met suurstof (O_2) gevul is. Wat neem sy waar?
- A. 'n Rooi vlam
 B. 'n Intense geel vlam
 C. 'n Verblindende wit vlam
 D. 'n Pers vlam

- 1.9 Bromine water is added to a solution of sodium iodide in a test tube. The reaction that takes place is represented by the following equation:



In this reaction

- A. bromine atoms are oxidised to bromide ions.
B. bromine atoms act as a reducing agent.
C. iodide ions are oxidised to iodine atoms.
D. iodide ions are reduced to iodine atoms.
- 1.10 In which of the following bonds does Mn have an oxidation number of +7?
- A. KMnO_4
B. MnO
C. MnO_2
D. Mn_3O_4
- 1.11 The following will happen when an electro-chemical cell is switched on:
- A. Electrons flow externally from zinc to copper.
B. Electrons flow externally from copper to zinc.
C. Zinc ions are deposited on the zinc electrode.
D. Copper atoms change to copper ions.
- 1.12 An aqueous copper chloride (CuCl_2) solution is electrolysed. Which one of the following equations best represents the reaction occurring at the cathode?
- A. $\text{CuCl}_2 + \text{H}_2\text{O} \rightarrow \text{Cu}^{+2}(\text{aq}) + 2\text{Cl}^-(\text{aq})$
B. $\text{Cu}^{+2}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$
C. $2\text{Cl}^-(\text{aq}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$
D. $\text{Cu}^{+2}(\text{aq}) + 2\text{Cl}^-(\text{aq}) \rightarrow \text{Cu}(\text{s}) + \text{Cl}_2(\text{g})$
- 1.13 Lindi lowers a small piece of burning potassium (K) in a gas cylinder, filled with oxygen (O_2). What does she observe?
- A. A red flame
B. An intense yellow flame
C. A blinding white flame
D. A purple flame

1.14 Water en koolstofdiksied is die enigste produkte wat ontstaan as 'n sekere stof in suurstof brand. "Die stof is waarskynlik"

- A. H_2
- B. CH_4
- C. CH_3Cl
- D. CCl_4

1.15 Watter een van die volgende is 'n onversadigde koolwaterstof?

- A. C_2H_2
- B. $CH_3C=O$
 $\quad \quad |$
 $\quad \quad H$
- C. C_4H_{10}
- D. C_2H_5OH

15x3=[45]

VRAAG 2 ATOOMSTRUKTUUR

Maak van die elektronkonfigurasies van die atome **D**, **E**, **F**, **G** en **H** hieronder gegee gebruik om vrae 2.1 tot 2.6 te beantwoord.

- D: $1s^2 2s^2 2p^6 3s^2$
- E: $1s^2 2s^2 2p^6 3s^1$
- F: $1s^2 2s^2 2p^6$
- G: $1s^2 2s^2 2p^5$
- H: $1s^2 2s^1 2p^1$

- 2.1 Gee die periode en groep op die Periodieke Tabel van Elemente waartoe element **G** waarskynlik sal behoort. (4)
- 2.2 Watter element is 'n edelgas? (2)
- 2.3 Met watter een van die elemente sal element **D** verbind om 'n ioniese stof te vorm? (2)
- 2.4 Wat is die massagetal van **E**? (2)
- 2.5 Watter een van die elektronkonfigurasies verteenwoordig nie 'n atoom in sy laagste energietoestand nie? (2)
- 2.6 Skryf die elektronkonfigurasie van die atoom wat in Vraag 2.5 genoem word in sy grondtoestand. (2)

[14]

1.14 Water and carbon dioxide are the only products that form when a certain substance burns in oxygen. "The substance is probably"

- A. H_2
- B. CH_4
- C. CH_3Cl
- D. CCl_4

1.15 Which one of the following is an unsaturated hydrocarbon?

- A. C_2H_2
- B. $CH_3C=O$

|

H
- C. C_4H_{10}
- D. C_2H_5OH

15x3=[45]

QUESTION 2 ATOMIC STRUCTURE

Consider the electron configurations of elements **D**, **E**, **F**, **G** and **H** given below to answer Questions 2.1 to 2.6:

- D: $1s^2 2s^2 2p^6 3s^2$
- E: $1s^2 2s^2 2p^6 3s^1$
- F: $1s^2 2s^2 2p^6$
- G: $1s^2 2s^2 2p^5$
- H: $1s^2 2s^1 2p^1$

- 2.1 Give the period and group on the Periodic Table of Elements to which element **G** would probably belong. (4)
- 2.2 Which element is a noble gas? (2)
- 2.3 With which element would **D** bond to form an ionic substance? (2)
- 2.4 What is the mass number of **E**? (2)
- 2.5 Which one of the electron configurations does not represent an atom in its lowest energy level? (2)
- 2.6 Write the electron configuration of the atom mentioned in Question 2.5 in its ground state. (2)

[14]

VRAAG 3
CHEMIESE BINDING

3.1 Kies uit die onderstaande lys stowwe die een stof waarna daar in elk van die volgende stellings verwys word.

Kies slegs EEN stof by elke stelling.

NH_3 ; C; MgCl_2 ; CH_4 ; F_2 ; Fe

3.1.1 'n Stof saamgestel uit polêre molekules met polêr kovalente bindings. (2)

3.1.2 'n Stof wat bestaan uit nie-polêre molekules met polêr kovalente bindings. (2)

3.1.3 Hierdie stof los op om positiewe en negatiewe ione te vorm. (2)

3.1.4 In die vastestoffase word die deeltjies van hierdie stof deur kovalente bindings bymekaar gehou. (2)

3.2 Maak gebruik van 'n Lewisdiagram, bv. $\text{H} \times \text{H}$, om aan te toon hoe die watermolekule se bindings plaasvind. (4)

[12]

VRAAG 4
INTERMOLEKULÊRE KRAGTE

Gebruik die onderstaande tabel om die volgende vrae te beantwoord:

STOF	SMELTPUNT	KOOKPUNT
	(°C)	(°C)
He	-270	-269
NaCl	800	1 413
CCl_4	-23	77
CO_2	Sublimeer -79	-
Diamant (C)	Bo 3 427	4 229
CH_4	-184	-162
H_2O	0	100

4.1 In water van hierdie stowwe is die bindings wat verantwoordelik is vir die vorming van die vaste toestand hoofsaaklik toe te skryf aan Van der Waalskragte? (4)

4.2 Water van die stowwe vorm 'n molekulêre vloeistof wat uit polêre molekules bestaan? (2)

4.3 In water van die vaste stowwe bestaan die swakste bindings in die vastestoffase? (2)

b.o.

**QUESTION 3
CHEMICAL BONDING**

- 3.1 From the following list of substances select the one substance which is referred to in each of the statements.

For each statement select ONE substance only.

NH₃; C; MgCl₂; CH₄; F₂; Fe

- 3.1.1 A substance consisting of polar molecules with polar covalent bonds. (2)
- 3.1.2 A substance consisting of non-polar molecules with polar covalent bonds. (2)
- 3.1.3 This substance dissolves to form positive and negative ions. (2)
- 3.1.4 In this solid phase the particles of this substance are held together by covalent bonds. (2)
- 3.2 By using a Lewis diagram, for example H x H, show how the water molecule bonds. (4)

[12]

**QUESTION 4
INTERMOLECULAR FORCES**

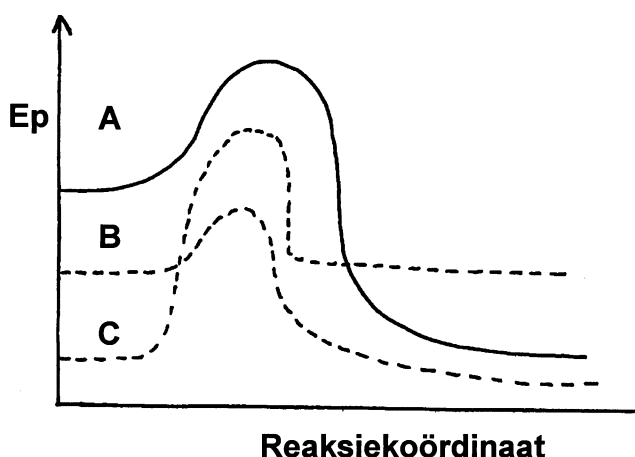
Use the table below to answer the following questions:

SUBSTANCE	MELTING POINT	BOILING POINT
	(°C)	(°C)
He	-270	-269
NaCl	800	1 413
CCl ₄	-23	77
CO ₂	Sublime -79	-
Diamond (C)	Above 3 427	4 229
CH ₄	-184	-162
H ₂ O	0	100

- 4.1 In which of these substances are bonds responsible for the solid phase because of Van der Waals forces? (4)
- 4.2 Which of these substances form a molecular liquid that consists of polar molecules? (2)
- 4.3 In which of these solids do the weakest bonds in the solid phase exist? (2)

- 4.4 In watter van die stowwe kom waterstofbindings voor? (2)
- 4.5 Watter een van die stowwe vorm vastestowwe as gevolg van bindings wat oorwegend ionies van aard is? (2)
- [12]

VRAAG 5
ENERGIE EN CHEMIESE BINDING



Beantwoord die volgende vrae deur te verwys na die simbole A, B en C in die bostaande diagram.

- 5.1 Watter simbool dui op 'n endotermiese proses? (2)
- 5.2 Watter reaksie het die grootste aktiveringsenergie? (2)
- 5.3 In watter reaksie is ΔH positief? (2)
- 5.4 In watter reaksie(s) is ΔH negatief? (2)
- [8]

VRAAG 6
CHEMIESE EWEWIG

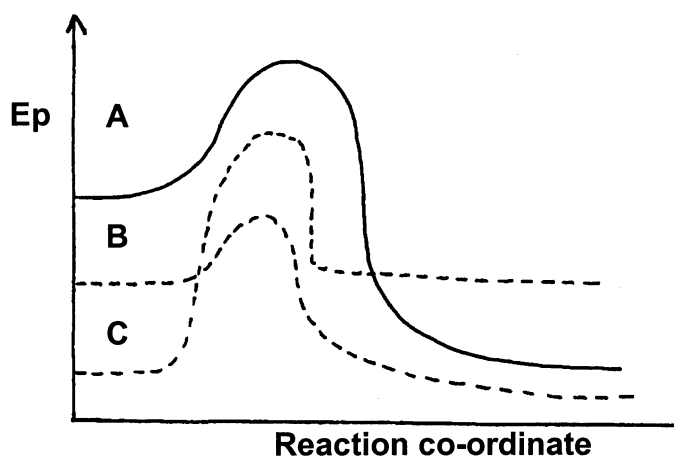
Die ewewig in die volgende vergelyking bestaan in 'n geslote sisteem:



- 6.1 Noem TWEE faktore wat verander kan word om 'n sisteem in ewewig te versteur EN die reaksietempo te verander. (2)
- 6.2 Noem DRIE maniere om die konsentrasie van CO te verlaag. (6)
- 6.3 Waarom beïnvloed druk nie die ewewig nie? (2)
- 6.4 Is die terugwaartse reaksie 'n ekso- of endotermiese reaksie? (2)
- [12]

- 4.4 In which of these substances do we find hydrogen bonds? (2)
- 4.5 Which of these form solids because of bonds which are mainly ionic by nature? (2)
- [12]

QUESTION 5
ENERGY AND CHEMICAL BONDING

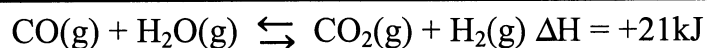


Answer the following questions by referring to the symbols **A**, **B** and **C** from the diagram above.

- 5.1 Which symbols refer to an endothermic process? (2)
- 5.2 Which reaction has the greatest activation energy? (2)
- 5.3 Name the reaction in which ΔH is positive. (2)
- 5.4 Name the reaction in which ΔH is negative. (2)
- [8]

QUESTION 6
CHEMICAL EQUILIBRIUM

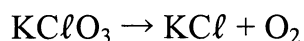
The equilibrium represented in the equation below exists in a closed system:



- 6.1 Name TWO factors which can be changed in order to disturb a system in equilibrium AND disturb the reaction rates. (2)
- 6.2 Name THREE methods to reduce the concentration of CO. (6)
- 6.3 Why does the pressure not influence the equilibrium? (2)
- 6.4 Is the reverse reaction an exothermic or endothermic reaction? (2)
- [12]

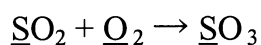
VRAAG 7
REDOKSREAKSIES

Indien kaliumchloraat verhit word, breek dit op in kaliumchloried en suurstof:



7.1 Watter element sal nie van oksidasietoestand verander nie? (2)

7.2 Die volgende vergelyking word gegee:



7.2.1 Skryf die vergelyking oor en skryf die oksidasiegetal van elk van die onderstreepte simbole onder die simbool op jou bladsy in. (3)

7.2.2 Is hierdie 'n voorbeeld van 'n redoksreaksie? Verduidelik jou antwoord. (3)

7.2.3 Balanseer die vergelyking volgens enige toepaslike metode. (3)

7.2.4 Watter stof tree op as die oksideermiddel? (2)

[13]

VRAAG 8
ELEKTROCHEMIESE SELLE

8.1 'n Eenvoudige elektrochemiese sel bestaan uit 'n koperelektrode en sinkelektrode wat in verdunde swaelsuur geplaas is. Die sel is verbind aan 'n laespanning-voltmeter.

8.1.1 Watter grootte emk kan daar oor die pole van die elektrochemiese sel verwag word? (2)

8.1.2 Watter tipe energie-omsetting vind hier plaas? (2)

8.1.3 Die sinkelektrode is verbind aan die negatiewe pool van die voltmeter, terwyl Zn^{++} -ione vrygestel word. Skryf die halfreaksie neer wat plaasvind by die sinkelektrode. (3)

8.1.4 By watter metaalelektrode vind oksidasie plaas? (2)

8.1.5 Watter elektrode se massa verminder? (2)

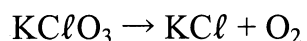
8.1.6 Gee EEN voorbeeld van 'n praktiese toepassing van die beginsel. (1)

[12]

b.o.

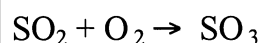
QUESTION 7
REDOX REACTIONS

When potassium chlorate is heated, it decomposes into potassium chloride and oxygen:



7.1 Which element does not change oxidation state? (2)

7.2 The next equation is given:



7.2.1 Rewrite the equation and write down the oxidation number of each of the underlined symbols below the symbol on your page. (3)

7.2.2 Is this an example of a redox reaction? Explain your answer. (3)

7.2.3 Balance the equation by any appropriate method. (3)

7.2.4 Which substance acts as an oxidising agent? (2)

[13]

QUESTION 8
ELECTROCHEMICAL CELLS

8.1 A simple electro-chemical cell consists of a copper electrode and a zinc electrode which are placed in diluted sulphuric acid. The cell is connected to a low voltage voltmeter.

8.1.1 What size emf can be anticipated (expected) at the poles of this electro-chemical cell? (2)

8.1.2 What type of energy conversion takes place here? (2)

8.1.3 The zinc electrode is connected to the negative pole of the voltmeter while Zn^{++} ions are released. Write down the half-reaction that takes place at the zinc electrode. (3)

8.1.4 At which metal electrode does oxidation take place? (2)

8.1.5 Which electrode loses mass? (2)

8.1.6 Give ONE example of a practical application of this principle. (1)

[12]

VRAAG 9
EIENSKAPPE VAN ELEMENTE

- 9.1 9.1.1 Noem DRIE fisiese eienskappe van natrium. (3)
- 9.1.2 Hoe word natrium in die laboratorium bewaar? (2)
- 9.1.3 Skryf die vergelyking vir die reaksie van natrium met water neer. (4)
- 9.1.4 Watter gas word vrygestel indien natrium met water reageer? (2)
- 9.2 Gee die naam vir die elemente van groep VII. (2)
- [13]**

VRAAG 10
ORGANIESE CHEMIE

Laboratoriumgas is 'n mengsel van koolwaterstowwe soos butaan en propaan.

- 10.1 Wat word bedoel met die term **koolwaterstowwe**? (2)
- 10.2 Skryf die struktuurformules van die twee gasse wat hierbo genoem word. (4)
- 10.3 Watter een van hierdie gasse sal die hoër kookpunt hê? (2)
- 10.4 Asetileen brand in suurstof. Hoekom is dit 'n nuttige reaksie? (1)
- [9]**

TOTAAL: 150

**QUESTION 9
PROPERTIES OF ELEMENTS**

- 9.1 9.1.1 Write down THREE physical properties of sodium. (3)
- 9.1.2 How is sodium stored in the laboratory? (2)
- 9.1.3 Write down the equation for the reaction of sodium with water. (4)
- 9.1.4 Which gas is set free in the reaction of sodium with water? (2)
- 9.2 Give the name for the elements of group VII. (2)

[13]

**QUESTION 10
ORGANIC CHEMISTRY**

Laboratory gas is a mixture of hydrocarbons such as butane and propane.

- 10.1 What is meant by the term **hydrocarbons**? (2)
- 10.2 Write down the structure formulas of the two gases mentioned above. (4)
- 10.3 Which one of these gases will have the higher boiling point? (2)
- 10.4 Acetylene burns in oxygen. Why is this a useful reaction? (1)

[9]

TOTAL: 150

STANDARD REDUCTION POTENTIALS OF A NUMBER OF HALF-REACTIONS
 STANDAARDREDUKSIEPOTENSIALE VAN VERSKEIE HALFREAKSIES

Half-reaction / Halfreaksie	E^\ominus volts / volt
$\text{Li}^+ + e^- \rightleftharpoons \text{Li}$	-3,05
$\text{K}^+ + e^- \rightleftharpoons \text{K}$	-2,93
$\text{Cs}^+ + e^- \rightleftharpoons \text{Cs}$	-2,92
$\text{Ba}^{2+} + 2e^- \rightleftharpoons \text{Ba}$	-2,90
$\text{Sr}^{2+} + 2e^- \rightleftharpoons \text{Sr}$	-2,89
$\text{Ca}^{2+} + 2e^- \rightleftharpoons \text{Ca}$	-2,87
$\text{Na}^+ + e^- \rightleftharpoons \text{Na}$	-2,71
$\text{Mg}^{2+} + 2e^- \rightleftharpoons \text{Mg}$	-2,37
$\text{Al}^{3+} + 3e^- \rightleftharpoons \text{Al}$	-1,66
$\text{Mn}^{2+} + 2e^- \rightleftharpoons \text{Mn}$	-1,18
$2\text{H}_2\text{O} + 2e^- \rightleftharpoons \text{H}_2 + 2\text{OH}^-$	-0,83
$\text{Zn}^{2+} + 2e^- \rightleftharpoons \text{Zn}$	-0,76
$\text{Cr}^{3+} + 3e^- \rightleftharpoons \text{Cr}$	-0,74
$\text{Fe}^{2+} + 2e^- \rightleftharpoons \text{Fe}$	-0,44
$\text{Cd}^{2+} + 2e^- \rightleftharpoons \text{Cd}$	-0,40
$\text{Co}^{2+} + 2e^- \rightleftharpoons \text{Co}$	-0,28
$\text{Ni}^{2+} + 2e^- \rightleftharpoons \text{Ni}$	-0,25
$\text{Sn}^{2+} + 2e^- \rightleftharpoons \text{Sn}$	-0,14
$\text{Pb}^{2+} + 2e^- \rightleftharpoons \text{Pb}$	-0,13
$\text{Fe}^{3+} + 3e^- \rightleftharpoons \text{Fe}$	-0,04
$2\text{H}^+ + 2e^- \rightleftharpoons \text{H}_2$	0,00
$\text{S} + 2\text{H}^+ + 2e^- \rightleftharpoons \text{H}_2\text{S}$	+0,14
$\text{Sn}^{4+} + 2e^- \rightleftharpoons \text{Sn}^{2+}$	+0,15
$\text{Cu}^{2+} + e^- \rightleftharpoons \text{Cu}^+$	+0,16
$\text{SO}_4^{2-} + 4\text{H}^+ + 2e^- \rightleftharpoons \text{SO}_2 + 2\text{H}_2\text{O}$	+0,17
$\text{Cu}^{2+} + 2e^- \rightleftharpoons \text{Cu}$	+0,34
$2\text{H}_2\text{O} + \text{O}_2 + 4e^- \rightleftharpoons 4\text{OH}^-$	+0,40
$\text{SO}_2 + 4\text{H}^+ + 4e^- \rightleftharpoons \text{S} + 2\text{H}_2\text{O}$	+0,45
$\text{I}_2 + 2e^- \rightleftharpoons 2\text{I}^-$	+0,54
$\text{O}_2(\text{g}) + 2\text{H}^+ + 2e^- \rightleftharpoons \text{H}_2\text{O}_2$	+0,68
$\text{Fe}^{3+} + e^- \rightleftharpoons \text{Fe}^{2+}$	+0,77
$\text{Hg}^{2+} + 2e^- \rightleftharpoons \text{Hg}$	+0,79
$\text{NO}_3^- + 2\text{H}^+ + e^- \rightleftharpoons \text{NO}_2(\text{g}) + \text{H}_2\text{O}$	+0,80
$\text{Ag}^+ + e^- \rightleftharpoons \text{Ag}$	+0,80
$\text{NO}_3^- + 4\text{H}^+ + 3e^- \rightleftharpoons \text{NO}(\text{g}) + 2\text{H}_2\text{O}$	+0,96
$\text{Br}_2(\text{l}) + 2e^- \rightleftharpoons 2\text{Br}^-$	+1,09
$\text{Pt}^{2+} + 2e^- \rightleftharpoons \text{Pt}$	+1,20
$\text{MnO}_2 + 4\text{H}^+ + 2e^- \rightleftharpoons \text{Mn}^{2+} + 2\text{H}_2\text{O}$	+1,21
$\text{O}_2(\text{g}) + 4\text{H}^+ + 4e^- \rightleftharpoons 2\text{H}_2\text{O}$	+1,23
$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6e^- \rightleftharpoons 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$	+1,33
$\text{Cl}_2(\text{g}) + 2e^- \rightleftharpoons 2\text{Cl}^-$	+1,36
$\text{Au}^{3+} + 3e^- \rightleftharpoons \text{Au}$	+1,42
$\text{MnO}_4^- + 8\text{H}^+ + 5e^- \rightleftharpoons \text{Mn}^{2+} + 4\text{H}_2\text{O}$	+1,51
$\text{H}_2\text{O}_2 + 2\text{H}^+ + 2e^- \rightleftharpoons 2\text{H}_2\text{O}$	+1,77
$\text{F}_2(\text{g}) + 2e^- \rightleftharpoons 2\text{F}^-$	+2,87

Increasing oxidising ability /
Verhoogde oksideervermoë

Increasing reducing ability /
Verhoogde reduseervermoë

E^\ominus CELL = E^\ominus CATHODE - E^\ominus ANODE / E^\ominus SEL = E^\ominus KATODE - E^\ominus ANODE

END / EINDE