Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2010

PHYSICAL SCIENCES – PAPER 2

MARKS: 150

TIME: 3 hours

* P H S C E 2 *

This question paper consists of 20 pages.

INSTRUCTIONS AND INFORMATION

1. Write your centre number and examination number in the appropriate spaces on the ANSWER BOOK.

2. Answer ALL the questions.

3. This question paper consists of TWO sections:

   SECTION A: (25 marks)
   SECTION B: (125 marks)

4. Answer SECTION A and SECTION B in the ANSWER BOOK.

5. Non-programmable calculators may be used.

6. Appropriate mathematical instruments may be used.

7. Number the answers correctly according to the numbering system used in this question paper.

8. Data sheets and a periodic table are attached for your use.

9. Give brief motivations, discussions, etcetera where required.

SECTION A

Answer this section in the ANSWER BOOK.

QUESTION 1: ONE-WORD ITEMS

Give ONE word/term for EACH of the following descriptions. Write only the word/term next to the question number (1.1 – 1.5) in the ANSWER BOOK.

1.1 The homologous series to which the organic compound obtained by the complete oxidation of a primary alcohol belongs to. (1)

1.2 The negative electrode in an electrolytic cell. (1)

1.3 The industrial process by which nitric acid is manufactured. (1)

1.4 The factor that can affect the value of equilibrium constant(K_c)of a reaction that is in equilibrium. (1)

1.5 The substance that gains an electron in a redox reaction. (1)
[5]

QUESTION 2: MULTIPLE-CHOICE QUESTIONS

Four possible options are provided as answers to the following questions. Each question has only **ONE** correct answer. Choose the best answer and make a cross (X) in the correct block (A – D) next to the question number (2.1 – 2.10) in the ANSWER BOOK.

2.1 2-bromo propane dissolved in alcohol reacts with aqueous sodium hydroxide to form propan-2-ol. This reaction is an example of a/an …

A addition reaction.
B substitution reaction.
C elimination reaction.
D dehydration reaction. (2)

2.2 CH_3-CH(CH_3)-CH_2-COOH

The IUPAC name of the above organic compound is …

A 2-methyl butanoic acid.
B pentanoic acid.
C 3-methyl butanoic acid.
D methyl butanoic acid. (2)

2.3 The general formula of the homologous series to which but-2-ene belongs is ...

A $C_nH_{2n+2.}$
B $C_{n+1}H_{2n.}$
C $C_nH_{2n.}$
D $C_nH_{2n-2.}$ (2)

2.4 In an esterification reaction when ethanol and butanoic acid are used as the reagents, the ester formed is …

A butyl ethanoate.
B ethyl butanoate.
C ethyl butane.
D butyl ethane. (2)

2.5 In the following reaction

$$CO_{(g)} + H_20_{(g)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$$

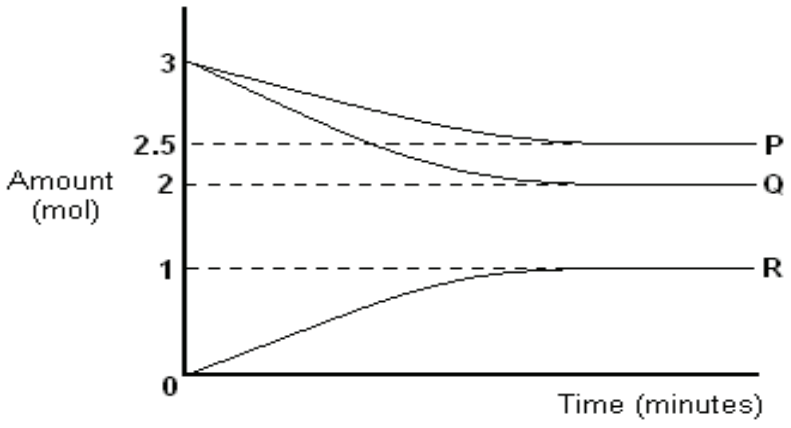
the energy of the reactants is greater than the energy of the products. This implies that for the above reaction …

A ΔH = - ve.
B $\Delta H > 0$.
C ΔH = + ve.
D $\Delta H = 0$. (2)

2.6 The rate of a chemical reaction at constant temperature is directly proportional to …

A the amount of products formed.
B the product of the masses of the reactants.
C the product of the molar concentrations of the reactants.
D the masses of the product formed. (2)

2.7 The accompanying graph shows the change in the amounts of P, Q and R with time during a reaction.



The equation for the reaction can be represented as …

A P + 2Q → 2R
B 2P + Q → R
C 3P + 2Q → R
D 5P + 2Q → 2R (2)

2.8 The symbolic representation (cell notation) of a Mg-Pb electrochemical cell constructed under standard conditions using the necessary electrodes and electrolytes is given below.

$$Mg_{(s)} / Mg^{2+}_{(aq)(1mol.dm^{-3})} // Pb^{2+}_{(aq)(1mol.dm^{-3})} / Pb_{(s)}$$

Which among the following reactions take place at the cathode of the above electrochemical cell?

A $Mg^{2+} + 2e^- \rightarrow Mg$
B $Pb^{2+} + 2e^- \rightarrow Pb$
C $Mg \rightarrow Mg^{2+} + 2e^-$
D $Pb \rightarrow Pb^{2+} + 2e^-$ (2)

2.9 The standard electrode potentials of Ag^+/Ag and Ni^{2+}/Ni electrodes are +0,80 V and -0,27 V respectively. These electrodes are connected through a salt bridge to make an electro chemical cell. In this cell …

A nickel electrode acts as the cathode and the E^0_{Cell} is +1,07 V.
B silver electrode acts as the anode and the E^0_{Cell} is -0,53 V.
C nickel electrode acts as the anode and the E^0_{Cell} is +0,53 V.
D silver electrode acts as the cathode and the E^0_{Cell} is+1,07 V. (2)

2.10 Which among the following can be considered as the reaction taking place at the anode during the extraction of aluminium by electrolysis?

A $Al^{3+}_{(aq)} + 3e^- \rightarrow Al_{(s)}$
B $Al_{(s)} \rightarrow Al^{3+}_{(aq)} + 3e^-$
C $2\ O^{2-}_{(l)} \rightarrow O_{2(g)} + 4e^-$
D $O_{2(g)} + 4e^- \rightarrow 2\ O^{2-}_{(l)}$ (2)

[20]

TOTAL SECTION A: 25

SECTION B

INSTRUCTIONS AND INFORMATION

1. Start each question on a NEW page.

2. Leave one line between two subquestions, for example between QUESTION 3.1 and QUESTION 3.2.

3. The formulae and substitutions must be shown in ALL calculations.

4. Round off your answers to TWO decimal places where applicable.

QUESTION 3 (Start on a new page.)

Different structural isomers are possible for the organic compound with the molecular formula $C_4H_8O_2$.

3.1 What are isomers? (2)

3.2 Write down the IUPAC name, structural formula and the different homologous series of two isomers possible for the organic compound with the molecular formula $C_4H_8O_2$. Redraw the tabular column in your answer book to answer the questions.

Condensed Structural formula	IUPAC name	Homologous series
3.2.1 (2)	3.2.2 (1)	3.2.3 (1)
3.2.4 (2)	3.2.5 (1)	3.2.6 (1)

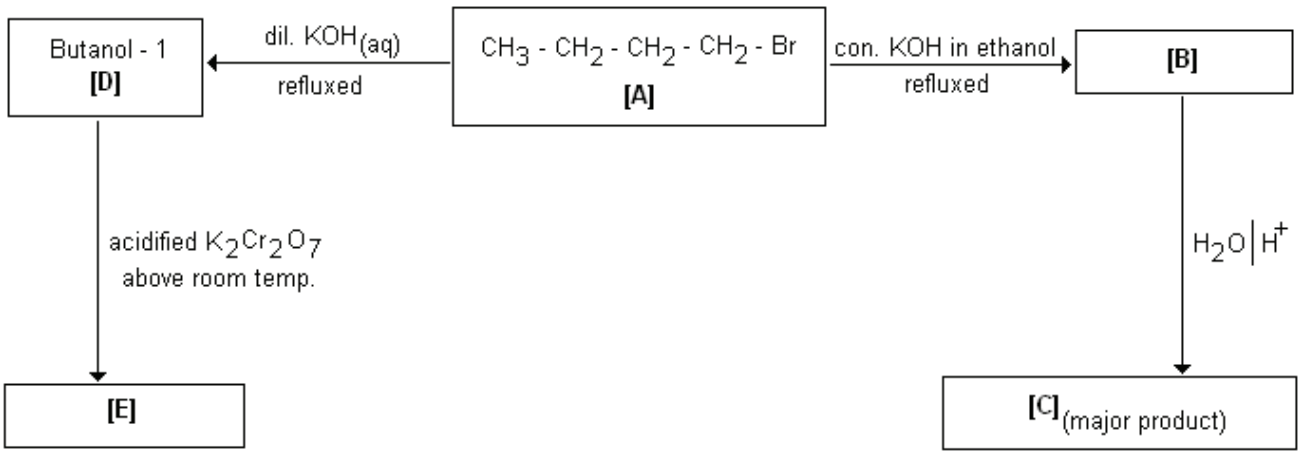
(8)

3.3 The boiling point of carboxylic acids is higher than that of the corresponding alcohols. Referring to the type of intermolecular forces, explain why the boiling point of carboxylic acids is higher than that of alcohols? (3)

[13]

QUESTION 4 (Start on a new page.)

Using the different reactions mentioned in the chart given below answer the following questions.



4.1 Write down the homologous series to which compound **A** belongs. (1)

4.2 Using condensed structural formula write down the equation for the conversion of compound **A** to compound **B.** (2)

4.3 Is the compound **B** saturated or unsaturated? Give a reason for your answer. (3)

4.4 Name the type of elimination reaction that is taking place during the conversion of compound **A** to compound **B**. (2)

4.5 Compound **B** is allowed to react with water in presence of H_2SO_4 to form compound **C**.

Write down the structural formula and IUPAC name of compound **C**. (4)

4.6 Compound **A** when refluxed with dilute aqueous KOH forms compound **D** which is butanol-1. Write down the structural formula of compound **D**. (2)

4.7 Butanol-1 on complete oxidation using acidified potassium dichromate above room temperature gives compound **E**. Compound **E** is responsible for the smell of rancid butter. Write down the functional group of compound **E**. (2)

4.8 Compound E reacts with propanol in presence of concentrated sulphuric acid to form an ester. Write down a balanced equation for the reaction using the STRUCTURAL FORMULA. (3)

[19]

QUESTION 5 (Start on a new page.)

The international demand for petrol has increased considerably. The refineries had large amounts of higher hydrocarbons in excess, which they could not use. After much research and experimentation, scientists developed cracking of higher hydrocarbons at higher temperature using a catalyst as a method to produce petrol, diesel and other fuels.

The presence of more branched alkanes helps in the smooth burning of petrol. Hence compounds such as 2,2,4- trimethyl pentane(Iso-octane) is also added to petrol to increase its combustion property.

5.1 What is meant by cracking? (2)

5.2 Write down the structural formula for 2,2,4- trimethyl pentane. (2)

5.3 Cracking of butane produces two hydrocarbons each with two carbon atoms. Write down the **NAME** of one of the products formed which is an unsaturated hydrocarbon. (2)

5.4 Write down the balanced chemical equation for the complete combustion of butane gas in oxygen. (3)

[9]

QUESTION 6 (Start on a new page)

The use of fossil fuels for the generation of energy has both a positive and negative impact on the quality of the life of people. The positive side includes all the processes of civilisation. On the negative impact, the combustion at high temperature and the incomplete combustion of fossil fuels in the engines of automobiles lead to the emission of gases which are pollutants responsible for global warming and other health risks. Inside the combustion cylinder of an automobile, the direct combination of nitrogen and oxygen takes place at a higher temperature to form nitric oxide. Nitric oxide when it comes in contact with atmospheric oxygen is readily oxidized to nitrogen dioxide. Nitrogen dioxide catalyses the formation of ozone which is one of the primary components of photochemical smog. Formation of ozone by the oxidation of oxygen leads to the decrease in the oxygen level in the lower atmosphere. The presence of ozone in the lower atmosphere is hazardous to human health.

6.1 Name TWO gases that are responsible for global warming? (2)

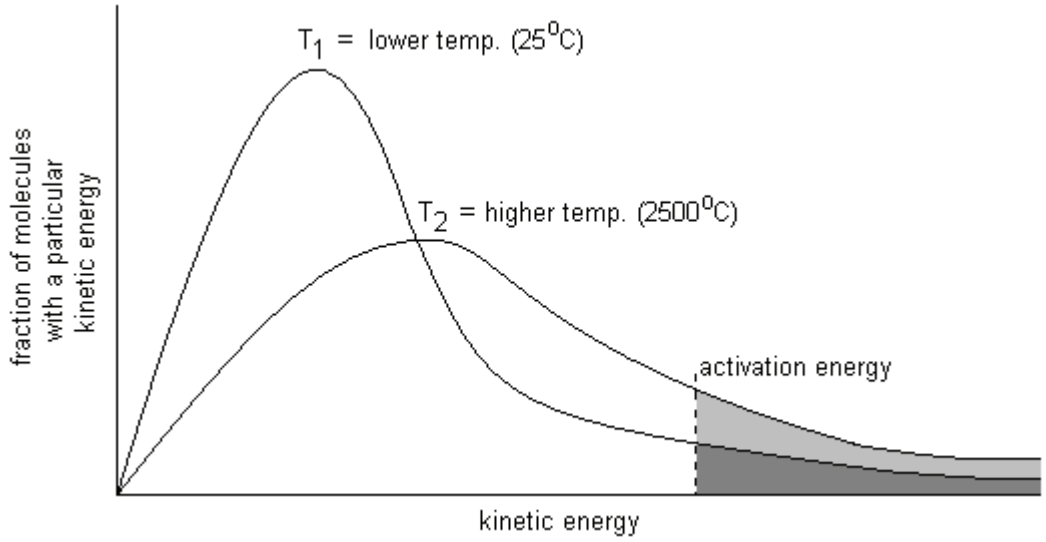
6.2 Ethanol is a renewable fuel and fossil fuels are non-renewable fuels. Briefly explain why ethanol is a renewable fuel? (2)

6.3 Write a balanced chemical equation for the formation of nitrogen dioxide from nitric oxide and oxygen. (3)

6.4 Suggest TWO ways in which formation of smog in urban areas can be prevented. (2)

6.5 Mention TWO diseases caused by the high level of smog and air pollution. (2)

6.6 The graph below shows the Maxwell-Boltzmann energy distribution curve for the reaction of a mixture of nitrogen and oxygen at two different temperatures to form nitric oxide.



6.6.1 Is the formation of nitric oxide from nitrogen and oxygen an exothermic or endothermic reaction? (1)

6.6.2 Define activation energy in words. (2)

6.6.3 Using the collision theory, explain why the rate of formation of nitric oxide increases, with an increase in temperature? (3)

[17]

QUESTION 7: (Start on a new page.)

In order to investigate the effect of a catalyst on the rate of a chemical reaction a learner performs the following experiment. A small quantity of granular manganese dioxide(MnO_2) is added to 20 g of potassium chlorate ($KClO_3$) taken in a hard glass test tube. The test tube with the content is heated at a constant temperature and the oxygen gas produced is collected by the downward displacement of water in an inverted burette. The reaction and stopwatch are started at the same time. The reaction equation is as follows:

$$2\ KClO_{3(s)} \xrightarrow[\Delta]{MnO_2} 2\ KCl_{(s)} + 3\ O_{2(g)}$$

The volume of oxygen gas produced is recorded every 20 s and recorded in a tabular column as shown below.

$Time_{(s)}$	0	20	40	60	80	100	120	140
Volume of $O_{2(g)}$ (cm^3)	0	12	18	22	24	25	25	25

7.1 State the investigative question for this investigation. (2)

7.2 Which quantity **time** or **volume of oxygen gas formed** is the dependant variable? (1)

7.3 Plot a graph of volume of oxygen gas produced versus time on the graph paper provided using the values given in the tabular column. (3)

7.4 The experiment is repeated for the same investigation by the learner <u>without using a catalyst.</u> On the same set of axes in the graph for QUESTION 7.3 sketch the shape of the graph that will be obtained. (Label the new sketch as **X.**) (2)

7.5 Why is the shape of the graph a straight line after 100 s? (2)

[10]

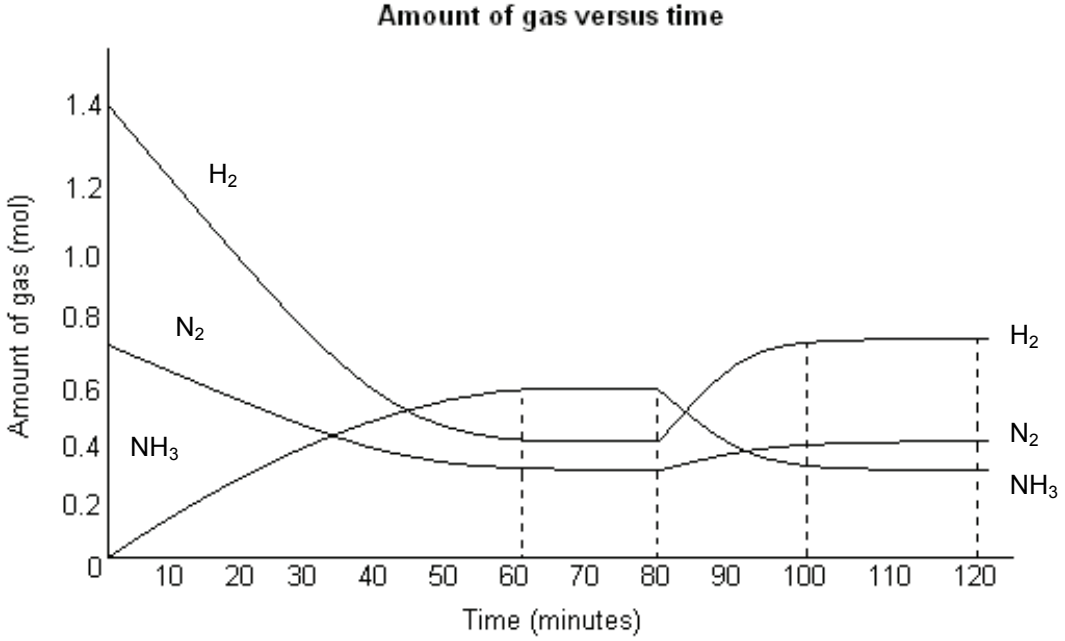
QUESTION 8: (Start on a new page.)

In 1912 the German scientist Fritz Haber produced ammonia gas by the direct combination of nitrogen gas from air and hydrogen gas from natural gas. The reaction equation is as follows.

$$N_{2(g)} + 3\ H_{2(g)} \rightleftharpoons 2\ NH_{3(g)} \quad \Delta H = -92kJ$$

In the research laboratory of ammonia, manufacturing plant chemists carried out the following investigations to study how the equilibrium amount of reactants and products change when a change is made to the temperature of the reaction system. 1,4 mol of hydrogen gas and 0,7 mol of nitrogen gas were allowed to react in a sealed container of volume 5 dm^3 until equilibrium was established at 350°C.

A mini sensor kept inside the sealed container recorded the amount of nitrogen, hydrogen and ammonia gas present in the system every 10 minute intervals. The chemists are able to predict the yield of ammonia based on their investigation by plotting a graph. The graph of amount of gas versus time plotted using the recorded values are given below.



8.1 Write down a possible hypothesis for this investigation. (1)

8.2 How is nitrogen gas used for the manufacture of ammonia obtained from air? (1)

8.3 What do the horizontal lines between 60 s and 80 s represent? (1)

8.4 After 80 s the temperature of the system is increased to 450°C.

8.4.1 Explain using Le-Chatliers principle how this change in temperature will affect the equilibrium of the system? (3)

8.4.2 What happens to the value of the equilibrium constant (K_c) at 450°C? (INCREASES, DECREASES, REMAINS THE SAME) (1)

8.5 Another investigation carried out by the chemists based on the reversible reaction

$$N_{2(g)} + 3\ H_{2(g)} \rightleftharpoons 2\ NH_{3(g)} \quad \Delta H = -92kJ$$

reached equilibrium in the closed container of volume 5 dm^3 at 500°C. The value of equilibrium constant (K_c) for this reaction is 6. When a certain amount of nitrogen and hydrogen gas is placed in the 5 dm^3 sealed container at 500°C a reaction takes place. When the equilibrium was established, it is found that the equilibrium concentration of both hydrogen gas and ammonia gas is 0,48 $mol.dm^{-3}$. Calculate the initial amount (in mol) of nitrogen and hydrogen placed in the container by the chemists. (8)

[15]

QUESTION 9: (Start on a new page.)

Grade 12 Physical Sciences learners in a school were asked to do investigations to find out which electro chemical cell(galvanic/voltaic cell) constructed by them produces better cell potential under standard conditions. The learners were divided into three groups and each group is provided with the necessary apparatus and chemicals. A salt bridge is also provided to each group. They have to prepare the required quantity of electrolytes of concentrations required for standard conditions to use in the anode and cathode compartments.
The investigative project given to the learners involved a planning and designing stage. During planning and designing stage, they have to answer certain questions based on the construction and processes involved. Each group of learners constructed their electrochemical cells using the different electrodes and electrolytes and the salt bridge. The electrodes and electrolytes of anode and cathode compartments and the standard cell potential of the electrochemical cell of each group are tabulated as shown below.

	Anode compartment	**Cathode compartment**	**E^0_{cell}**
Electrochemical cell-1	$Pb_{(s)}$ metal rod in $Pb^{2+}_{(aq)}$ solution	$Mg_{(s)}$ metal strip in $Mg^{2+}_{(aq)}$ solution	2,23 V
Electrochemical cell-2	$Al_{(s)}$ metal rod in $Al^{3+}_{(aq)}$ solution	$Fe_{(s)}$ metal rod in $Fe^{2+}_{(aq)}$ solution	1,22 V
Electrochemical cell-3	$Cu_{(s)}$ metal rod in $Cu^{2+}_{(aq)}$ solution	$Ag_{(s)}$ metal rod in $Ag^{+}_{(aq)}$ solution	0,46 V

9.1 What are the TWO standard conditions necessary for a voltaic cell to operate? (2)

9.2 Name TWO functions of a salt bridge. (2)

9.3 Using the reduction potential table 4A or 4B write down the strongest oxidizing agent among the electrolytes given in the anode and cathode compartment columns. (Choose from Pb^{2+}, Al^{3+}, Cu^{2+}, Mg^{2+}, Fe^{2+}, Ag^{+}) (1)

9.4 In the tabular column given above the particulars for anode and cathode compartment for one of the electrochemical cells is entered **incorrectly** by the group of learners. Is it electrochemical cell-1, electrochemical cell-2 or electrochemical cell-3? (2)

9.5 Write down the half cell reaction taking place at the anode of electrochemical cell-2. (2)

9.6 Which electrode Cu or Ag in electrochemical cell-3 undergo a decrease in mass when the cell is in operation? Give a reason for your answer. (3)

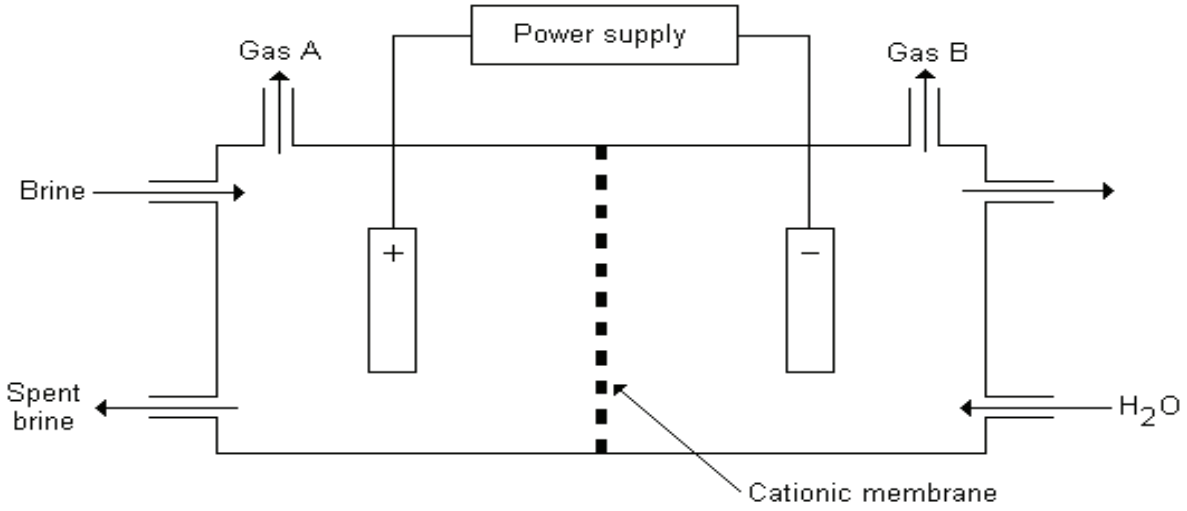
9.7 Do the necessary calculations to show that the emf of the electrochemical cell-2 is 1,22 V. (3)

9.8 Write down the nett cell reaction for electrochemical cell-3. (3)

[18]

QUESTION 10: (Start on a new page.)

The chlor-alkali industry is one of the largest electrochemical technologies in the world that makes use of electrolysis of brine (a concentrated solution of NaCl) to manufacture chlorine and caustic soda. A simplified diagram of a particular electrolytic cell used in the Chlor-alkali industry is given below.



10.1 Name the type of electrolytic cell represented in the above diagram. (1)

10.2 What type of energy conversion does take place in an electrolytic cell? (2)

10.3 Is chlorine gas formed at the anode or cathode of the electrolytic cell? (1)

10.4 Write down the equation for the reaction that takes place at the cathode. (2)

10.5 Apart from hydrogen and chlorine gas, caustic soda is also obtained as a product during the electrolysis of brine.

10.5.1 Write the chemical NAME of caustic soda. (1)

10.5.2 Write down the FORMULA of the ion that passes through the membrane from the anode compartment to the cathode compartment to maintain electric neutrality in the two compartments. (1)

10.5.3 Write down the ionic equation to show the formation of caustic soda. (2)

10.6 Mention ONE industrial use each of hydrogen, chlorine and caustic soda. (3)

10.7 Write down TWO advantages of using the electrolytic cell given in this question compared to other electrolytic cells that were used in the chlor-alkali industry. (2)

[15]

QUESTION 11: (Start on a new page.)

A bag of fertilizer bought by a farmer from a nursery to use in his tomato farm contains some information printed on the cover of the bag regarding the contents. The picture of the fertilizer bag with the information on it is given below.

11.1 What information is represented by the numbers 3 : 2 : 5 printed on the fertilizer bag? (2)

11.2 How much percentage of the total mass of fertilizer in the bag does the combined mass of the mixture of nitrogen, phosphorous and potassium make up? (1)

11.3 Calculate the percentage composition of nitrogen in the fertilizer bag. (2)

11.4 The specification on the fertilizer bag indicates that the chemical substances present in the bag are ammonium sulphate, ammonium phosphate, potassium chloride and fillers such as lime and gypsum.

11.4.1 Write down the balanced equation for the production of ammonium sulphate by the reaction between ammonia and sulphuric acid. (3)

11.4.2 Name the process that creates dead zones in dams and lakes due to the excess use of nitrogenous and phosphate fertilizers. (1)

[9]

SECTION B: 125

GRAND TOTAL: 150

NASIONALE SENIOR SERTIFIKAAT
NATIONAL SENIOR CERTIFICATE

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 2 (CHEMIE)

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)

TABEL 1: FISIESE KONSTANTES/*TABLE 1: PHYSICAL CONSTANTS*

NAAM/*NAME*	SIMBOOL/*SYMBOL*	WAARDE/*VALUE*
Standaarddruk Standard pressure	p^θ	1,013 x 10^5 Pa
Molêre gasvolume by STD Molar gas volume at STP	V_m	22,4 $dm^3 \cdot mol^{-1}$
Standaardtemperatuur Standard temperature	T^θ	273 K

TABEL 2: FORMULES/*TABLE 2: FORMULAE*

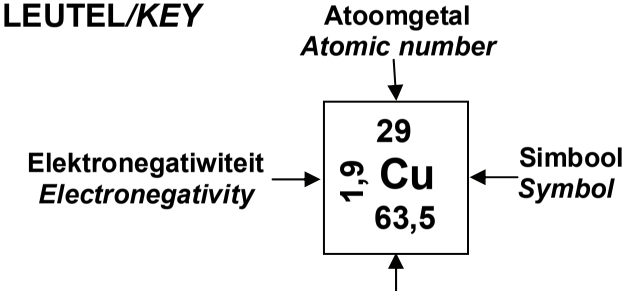
$n = \frac{m}{M}$	$c = \frac{n}{V}$ or / of $c = \frac{m}{MV}$
$q = I\Delta t$	$E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$ / $E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ $E^\theta_{sel} = E^\theta_{reduksie} - E^\theta_{oksidasie}$ / $E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$
$W = Vq$	$E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$ / $E^\theta_{cell} = E^\theta_{oxidising\ agent} - E^\theta_{reducing\ agent}$

TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE / *TABLE 3: THE PERIODIC TABLE OF ELEMENTS*

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 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

SLEUTEL/*KEY*



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

Halfreaksies / *Half-reactions*			E^{θ} (V)
$F_2(g) + 2e^-$	$\rightleftharpoons$	$2F^-$	+ 2,87
$Co^{3+} + e^-$	$\rightleftharpoons$	Co^{2+}	+ 1,81
$H_2O_2 + 2H^+ + 2e^-$	$\rightleftharpoons$	$2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons$	$Mn^{2+} + 4H_2O$	+ 1,51
$C\ell_2(g) + 2e^-$	$\rightleftharpoons$	$2C\ell^-$	+ 1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	$\rightleftharpoons$	$2Cr^{3+} + 7H_2O$	+ 1,33
$O_2(g) + 4H^+ + 4e^-$	$\rightleftharpoons$	$2H_2O$	+ 1,23
$MnO_2 + 4H^+ + 2e^-$	$\rightleftharpoons$	$Mn^{2+} + 2H_2O$	+ 1,23
$Pt^{2+} + 2e^-$	$\rightleftharpoons$	Pt	+ 1,20
$Br_2(\ell) + 2e^-$	$\rightleftharpoons$	$2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^-$	$\rightleftharpoons$	$NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^-$	$\rightleftharpoons$	$Hg(\ell)$	+ 0,85
$Ag^+ + e^-$	$\rightleftharpoons$	Ag	+ 0,80
$NO_3^- + 2H^+ + e^-$	$\rightleftharpoons$	$NO_2(g) + H_2O$	+ 0,80
$Fe^{3+} + e^-$	$\rightleftharpoons$	Fe^{2+}	+ 0,77
$O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons$	H_2O_2	+ 0,68
$I_2 + 2e^-$	$\rightleftharpoons$	$2I^-$	+ 0,54
$Cu^+ + e^-$	$\rightleftharpoons$	Cu	+ 0,52
$SO_2 + 4H^+ + 4e^-$	$\rightleftharpoons$	$S + 2H_2O$	+ 0,45
$2H_2O + O_2 + 4e^-$	$\rightleftharpoons$	$4OH^-$	+ 0,40
$Cu^{2+} + 2e^-$	$\rightleftharpoons$	Cu	+ 0,34
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons$	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + e^-$	$\rightleftharpoons$	Cu^+	+ 0,16
$Sn^{4+} + 2e^-$	$\rightleftharpoons$	Sn^{2+}	+ 0,15
$S + 2H^+ + 2e^-$	$\rightleftharpoons$	$H_2S(g)$	+ 0,14
$2H^+ + 2e^-$	**$\rightleftharpoons$**	**$H_2(g)$**	**0,00**
$Fe^{3+} + 3e^-$	$\rightleftharpoons$	Fe	– 0,06
$Pb^{2+} + 2e^-$	$\rightleftharpoons$	Pb	– 0,13
$Sn^{2+} + 2e^-$	$\rightleftharpoons$	Sn	– 0,14
$Ni^{2+} + 2e^-$	$\rightleftharpoons$	Ni	– 0,27
$Co^{2+} + 2e^-$	$\rightleftharpoons$	Co	– 0,28
$Cd^{2+} + 2e^-$	$\rightleftharpoons$	Cd	– 0,40
$Cr^{3+} + e^-$	$\rightleftharpoons$	Cr^{2+}	– 0,41
$Fe^{2+} + 2e^-$	$\rightleftharpoons$	Fe	– 0,44
$Cr^{3+} + 3e^-$	$\rightleftharpoons$	Cr	– 0,74
$Zn^{2+} + 2e^-$	$\rightleftharpoons$	Zn	– 0,76
$2H_2O + 2e^-$	$\rightleftharpoons$	$H_2(g) + 2OH^-$	– 0,83
$Cr^{2+} + 2e^-$	$\rightleftharpoons$	Cr	– 0,91
$Mn^{2+} + 2e^-$	$\rightleftharpoons$	Mn	– 1,18
$A\ell^{3+} + 3e^-$	$\rightleftharpoons$	$A\ell$	– 1,66
$Mg^{2+} + 2e^-$	$\rightleftharpoons$	Mg	– 2,36
$Na^+ + e^-$	$\rightleftharpoons$	Na	– 2,71
$Ca^{2+} + 2e^-$	$\rightleftharpoons$	Ca	– 2,87
$Sr^{2+} + 2e^-$	$\rightleftharpoons$	Sr	– 2,89
$Ba^{2+} + 2e^-$	$\rightleftharpoons$	Ba	– 2,90
$Cs^+ + e^-$	$\rightleftharpoons$	Cs	- 2,92
$K^+ + e^-$	$\rightleftharpoons$	K	– 2,93
$Li^+ + e^-$	$\rightleftharpoons$	Li	– 3,05

Toenemende oksiderende vermoë/Increasing oxidising ability ↑

Toenemende reduserende vermoë/Increasing reducing ability ↓

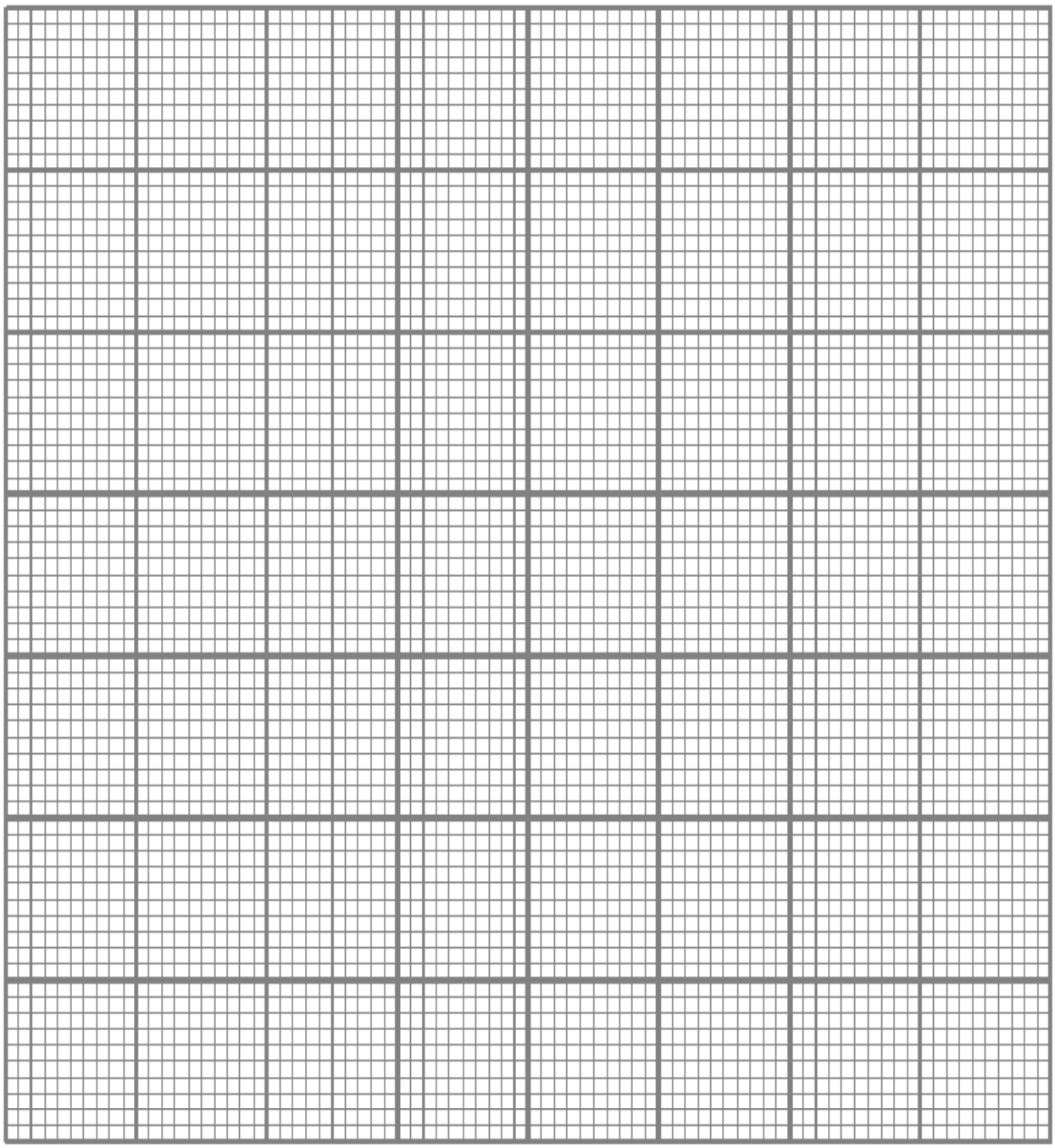
TABEL 4B: STANDAARD REDUKSIEPOTENSIALE
TABLE 4B: STANDARD REDUCTION POTENTIALS

Halfreaksies/*Half-reactions*			E^{θ} (V)
$Li^+ + e^-$	$\rightleftharpoons$	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	− 2,36
$A\ell^{3+} + 3e^-$	$\rightleftharpoons$	$A\ell$	− 1,66
$Mn^{2+} + 2e^-$	$\rightleftharpoons$	Mn	− 1,18
$Cr^{2+} + 2e^-$	$\rightleftharpoons$	Cr	− 0,91
$2H_2O + 2e^-$	$\rightleftharpoons$	$H_2(g) + 2OH^-$	− 0,83
$Zn^{2+} + 2e^-$	$\rightleftharpoons$	Zn	− 0,76
$Cr^{3+} + 3e^-$	$\rightleftharpoons$	Cr	− 0,74
$Fe^{2+} + 2e^-$	$\rightleftharpoons$	Fe	− 0,44
$Cr^{3+} + e^-$	$\rightleftharpoons$	Cr^{2+}	− 0,41
$Cd^{2+} + 2e^-$	$\rightleftharpoons$	Cd	− 0,40
$Co^{2+} + 2e^-$	$\rightleftharpoons$	Co	− 0,28
$Ni^{2+} + 2e^-$	$\rightleftharpoons$	Ni	− 0,27
$Sn^{2+} + 2e^-$	$\rightleftharpoons$	Sn	− 0,14
$Pb^{2+} + 2e^-$	$\rightleftharpoons$	Pb	− 0,13
$Fe^{3+} + 3e^-$	$\rightleftharpoons$	Fe	− 0,06
$2H^+ + 2e^-$	**$\rightleftharpoons$**	**$H_2(g)$**	**0,00**
$S + 2H^+ + 2e^-$	$\rightleftharpoons$	$H_2S(g)$	+ 0,14
$Sn^{4+} + 2e^-$	$\rightleftharpoons$	Sn^{2+}	+ 0,15
$Cu^{2+} + e^-$	$\rightleftharpoons$	Cu^+	+ 0,16
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons$	$SO_2(g) + 2H_2O$	+ 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
$Cu^+ + e^-$	$\rightleftharpoons$	Cu	+ 0,52
$I_2 + 2e^-$	$\rightleftharpoons$	$2I^-$	+ 0,54
$O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons$	H_2O_2	+ 0,68
$Fe^{3+} + e^-$	$\rightleftharpoons$	Fe^{2+}	+ 0,77
$NO_3^- + 2H^+ + e^-$	$\rightleftharpoons$	$NO_2(g) + H_2O$	+ 0,80
$Ag^+ + e^-$	$\rightleftharpoons$	Ag	+ 0,80
$Hg^{2+} + 2e^-$	$\rightleftharpoons$	$Hg(\ell)$	+ 0,85
$NO_3^- + 4H^+ + 3e^-$	$\rightleftharpoons$	$NO(g) + 2H_2O$	+ 0,96
$Br_2(\ell) + 2e^-$	$\rightleftharpoons$	$2Br^-$	+ 1,07
$Pt^{2+} + 2e^-$	$\rightleftharpoons$	Pt	+ 1,20
$MnO_2 + 4H^+ + 2e^-$	$\rightleftharpoons$	$Mn^{2+} + 2H_2O$	+ 1,23
$O_2(g) + 4H^+ + 4e^-$	$\rightleftharpoons$	$2H_2O$	+ 1,23
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	$\rightleftharpoons$	$2Cr^{3+} + 7H_2O$	+ 1,33
$C\ell_2(g) + 2e^-$	$\rightleftharpoons$	$2C\ell^-$	+ 1,36
$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons$	$Mn^{2+} + 4H_2O$	+ 1,51
$H_2O_2 + 2H^+ + 2e^-$	$\rightleftharpoons$	$2H_2O$	+1,77
$Co^{3+} + e^-$	$\rightleftharpoons$	Co^{2+}	+ 1,81
$F_2(g) + 2e^-$	$\rightleftharpoons$	$2F^-$	+ 2,87

Toenemende oksiderende vermoë/*Increasing oxidising ability*

Toenemende reduserende vermoë/*Increasing reducing ability*

QUESTION 7.3



SEPTEMBER 2010

PHYSICAL SCIENCES – PAPER 2
FISIESE WETENSKAPPE – VRAESTEL 2

ANSWER SHEET / ANTWOORDBLAD

NAME / NAAM: ……

SECTION A / AFDELING A

QUESTION 1: ONE WORD ITEMS / VRAAG 1: EENWOORD-ITEMS

1.1 …… (1)

1.2 …… (1)

1.3 …… (1)

1.4 …… (1)

1.5 …… (1)
[5]

QUESTION 2: MULTIPLE CHOICE QUESTIONS/
VRAAG 2: MEERVOUDIGE-KEUSEVRAE

2.1	A	B	C	D
2.2	A	B	C	D
2.3	A	B	C	D
2.4	A	B	C	D
2.5	A	B	C	D
2.6	A	B	C	D
2.7	A	B	C	D
2.8	A	B	C	D
2.9	A	B	C	D
2.10	A	B	C	D

(10 x 2) **[20]**

TOTAL SECTION A / TOTAAL AFDELING A: 25