Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES P2 (CHEMISTRY)

PREPARATORY EXAMINATIONS

SEPTEMBER 2017

TIME:	**3 hours**
MARKS:	**150**

This question paper consists of 16 pages including 4 data sheets and 1 answer sheet.

INSTRUCTIONS AND INFORMATION

1. Write your centre number and examination number in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of TEN questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your final numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions et cetera where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE CHOICE

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A - D) next to the question number (1.1 – 1.10) in the ANSWER BOOK, for example 1.1 D.

1.1 Which one of the following organic compounds contains a carbonyl group?

A Haloalkanes
B Alkanes
C Alcohols
D Aldehydes (2)

1.2 Which one of the following reaction types represents the conversion of ETHENE to CHLOROETHANE?

A Substitution
B Hydrohalogenation
C Dehydrogenation
D Elimination (2)

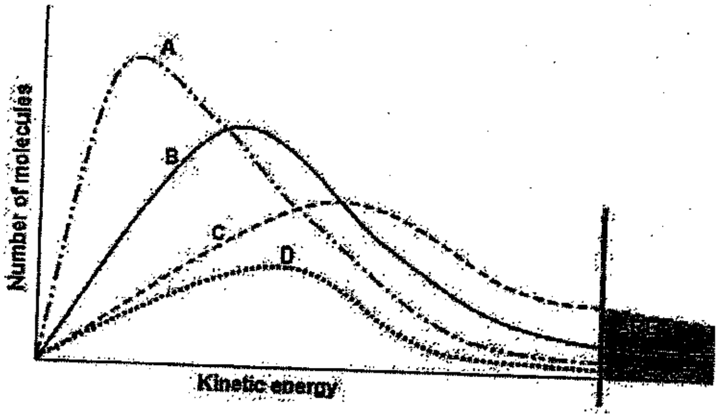
1.3 In which one of the following reaction types is methyl methanoate formed?

A Esterification
B Hydrolysis
C Dehydration
D hydration (2)

1.4 50 cm^3 of a 0,1 $mol.dm^{-3}$ solution of hydrochloric acid is poured on to 5 g of magnesium powder inside a small test tube at room temperature. Which one of the following factors **will increase** the rate of this reaction?

A Using 100 cm^3 of a 0,1 $mol.dm^{-3}$ solution of hydrochloric acid at room temperature.
B Using 5g of magnesium ribbon.
C Decreasing the temperature of the acid solution to 10 °C
D Increasing the temperature of the acid solution to 80 °C (2)

1.5 Graph **B** below represents the Maxwell-Boltzmann energy distribution curve for a reaction mixture at a temperature of 300°C. Area X represents the number of molecules in the mixture that have enough kinetic energy for the reaction to take place.



The temperature of the mixture is now increased to 500 °C.

Which ONE of graphs **A** to **D** represents the distribution curve of the mixture at this higher temperature?

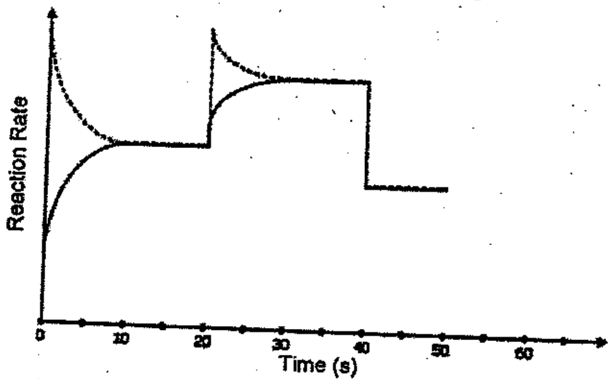
A A
B B
C C
D D

(2)

1.6 A mixture of SO_2 gas and O_2 gas was placed into a closed container at 300°C with a small amount of V_2O_5.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

At certain times, various changes in the physical conditions applicable to the reaction or to the chemicals themselves, were made.
The graph below represents the rate of reaction against time.



Which one of the changes below explains the change in the graph at 20 s?

A Decrease in pressure.
B Increase in pressure.
C Decrease in temperature.
D Addition of a catalyst.

(2)

1.7 Consider the ionisation reaction below:

$$H_2SO_4(aq) + H_2O(l) \rightleftharpoons HSO_4^-(aq) + H_3O^+(aq)$$

A conjugate acid-base pair is:

A H_2SO_4 ; HSO_4^-

B H_2SO_4 ; H_3O^+

C H_2SO_4 ; H_2O

D HSO_4^- ; H_3O^+ (2)

1.8 During the electrolysis of a concentrated sodium chloride solution, water is reduced and not sodium ions because...

A Na^+ is a stronger reducing agent than H_2O.

B $Na^+$is a stronger oxidising agent than H_2O.

C H_2O is a stronger reducing agent than Na^+.

D H_2O is a stronger oxidising agent than Na^+. (2)

1.9 A solution of copper (II) chloride ($CuCl_2$) must be stored in a metal container. Which one of the following metals should be used?

A Ag

B Zn

C Mg

D Fe (2)

1.10 Which one of the following fertilizers provides the least nitrogen per mole of fertilizer?

A Ammonium phosphate

B Ammonium nitrate

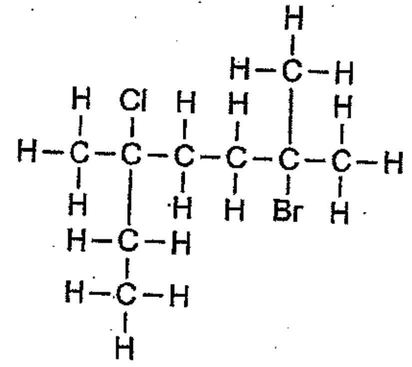
C Potassium nitrate

D Calcium nitrate (2)

[20]

QUESTION 2 (Start on a new page.)

The letters A to F in the table below represent eight organic compounds.

A	
B	$CH_3COCH_2CH_2CH_3$
C	but-2-ene
D	$CHCCH_2CH_3$
E	3-chloro-3-ethylheptane
F	CH_3COOH

2.1 Write down the IUPAC name of compound A. (2)

2.2 Write down the general formula of the homologous series to which compound C belongs. (1)

2.3 Write down the structural formula for compound E. (3)

2.4 Write down the name of the functional group to which compound D belongs. (1)

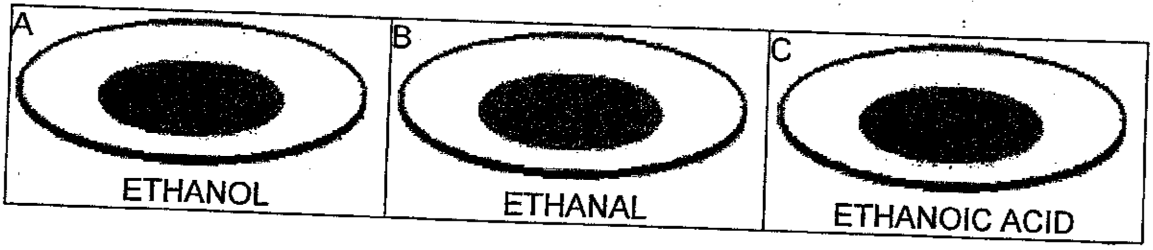
2.5 Draw the structural isomer for compound F (2)

2.6 Write down the name of the homologous series to which compound B belongs. (1)

[10]

QUESTION 3 (Start on a new page.)

Learners investigate the evaporation of ethanol, ethanal and ethanoic acid. They place 2 ml of each of the liquids in a watch glass. They then observe the change in the volume of the liquids.



3.1 Which one of the above liquids would have the largest volume after 10 mins? (1)

3.2 Give an explanation for the answer to QUESTION 3.1. (3)

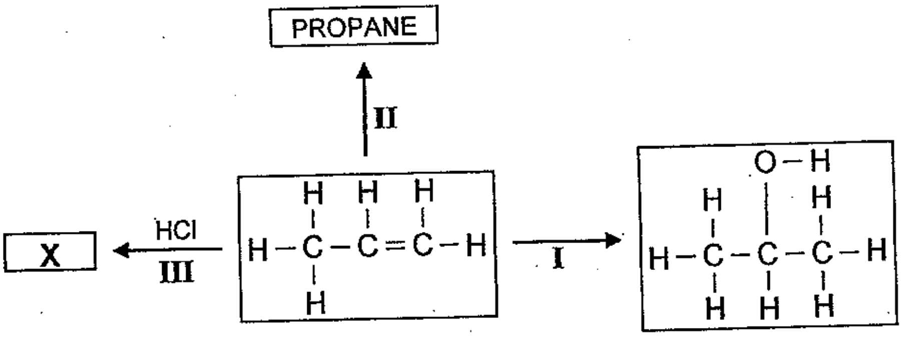
3.3 Which one of the liquids will have the highest vapour pressure after 10 mins.? (1)

3.4 Give an explanation for the answer to QUESTION 3.3. (3)

[8]

QUESTION 4 (Start on a new page.)

The flow diagram below represents various organic reactions. Study the reactions and answer the questions that follow.



4.1 State the reaction condition required for reaction I (1)

4.2 Write down the formula of the catalyst used in reaction II. (1)

4.3 Propane reacts with excess oxygen. Write down a balanced equation for this reaction using molecular formulae. (3)

4.4 Use structural formulae a write a balanced equation for reaction III. (3)

A structural isomer of the product of reaction I is reacted with butanoic acid, to form an ester.

4.5 Write down the name of the catalyst used in this reaction. (1)

4.6 Write down the structural formula of the ester that is formed. (2)

4.7 Name the ester that is formed Question 4.6 (2)

[13]

QUESTION 5 (Start on a new page.)

Ethene is used as a monomer in the preparation of a macromolecule, polyethene.

5.1 Define a macromolecule. (2)

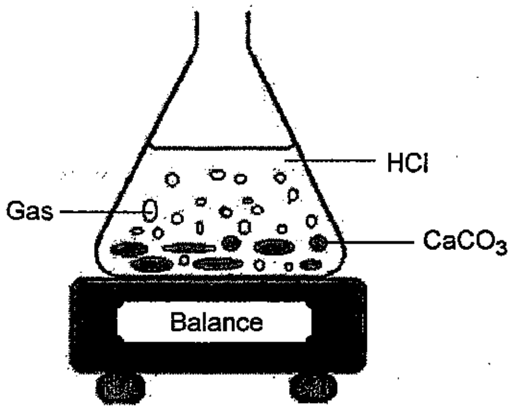
5.2 Name the process by which polyethene is manufactured. (1)

5.3 Write down the structural formula for the monomer used to prepare polyethene. (2)

[5]

QUESTION 6 (Start on a new page.)

In investigating the factors that affect the rate of reaction, some learners react calcium carbonate with excess dilute hydrochloric acid, in a conical flask. The apparatus is setup as shown below.



The change in mass of the conical flask and its contents are recorded every minute. The results for this investigation are shown in the table below.

Time (s)	0	1	2	3	4	5	6	7	8	9
Mass of flask and its contents (g)	178	176,2	174,1	172,7	172,3	172,2	172,1	172,1	172,1	172,1

6.1 Write down an investigative question for this investigation. (2)

6.2 State the independent variable for this investigation. (1)

The above table is re-drawn in the special answer sheet provided.

6.3 Complete the table by filling in the values for the mass of CO_2 produced. (2)

6.4 Plot a graph of mass of CO_2 produced vs time elapsed. (5)

6.5 Give a reason why the mass of the flask and its contents remains constant after 6 s. (1)

6.6 Calculate the total volume of CO_2 (g) produced at room temperature (25 °C). Assume the molar gas volume of CO_2 (g) at this temperature is 24,46 dm^3. (3)

The experiment is now repeated at a higher temperature. The volume and concentration of the HCl and the mass of $CaCO_3$ used are the same as in the original investigation.

6.7 On the same system of axes used to draw the graph in QUESTION 6.4, draw a sketch graph of mass of CO_2 produced vs time elapsed, at the higher temperature. Label this graph as **N**. (2)

6.8 Use the collision theory to explain the difference between the two graphs obtained. (3)

[19]

QUESTION 7 (Start on a new page.)

Ten (10) grams of hydrogen gas and 355 g of chlorine gas are heated together in a sealed 500 cm^3 container. Equilibrium is reached at 450 °C.

$$H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g) \quad ; \quad \Delta H < 0$$

The equilibrium constant for this reaction at 450 °C is 60.

7.1 Calculate the mass of chlorine gas present at equilibrium. (10)

The temperature is now increased to 550 °C while the volume is kept constant. The system reaches a NEW equilibrium.

7.2 State Le Chatelier's principle. (2)

7.3 How will the following be affected in this new equilibrium? Write down only INCREASE, DECREASE or REMAINS THE SAME.

7.3.1 The equilibrium constant. (1)

7.3.2 The volume of H_2 present. (1)

7.4 Use Le Chatelier's principle to explain the answer to QUESTION 7.3.2. (2)

[16]

QUESTION 8 (Start on a new page.)

8.1 Concentrated hydrochloric acid with a concentration of 10 mol·dm^{-3} is diluted to form 500 cm^3 of a 0,25 mol·dm^{-3} solution.

8.1.1 Is the diluted hydrochloric acid a strong acid or a weak acid? (1)

8.1.2 Calculate the volume, in cm^3, of the concentrated hydrochloric acid that must be used. (5)

8.1.3 Calculate the pH of the 0,25 mol·dm^{-3} solution of HCl. (3)

8.2 Calcium carbonate forms a large percentage of sea shells. In order to determine percentage purity of the calcium carbonate in sea shells, learners react 5 g of powered sea shells with the 500 cm^3 of the diluted hydrochloric acid prepared in QUESTION 8.1. The reaction that takes place is represented by the following balanced equation.

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

The excess HCl is then titrated with 140 cm^3 of a 0,2 mol·dm^{-3} solution of sodium hydroxide.

8.2.1 Calculate the mass of $CaCO_3$ present in the sample of sea shells. (8)

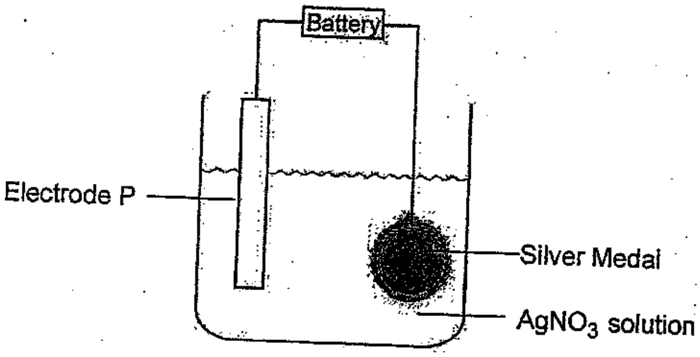
8.2.2 Calculate the percentage purity of the calcium carbonate in the in the sea shells. (3)

[20]

QUESTION 9 (Start on a new page.)

9.1 An 800 m athlete, was recently placed first in an international event after the original winner was disqualified. This athlete was required to return the silver medal and receive a new gold medal. When the silver medal was returned it had scratch marks.

The following apparatus was setup to coat the medal with a thin layer of silver.



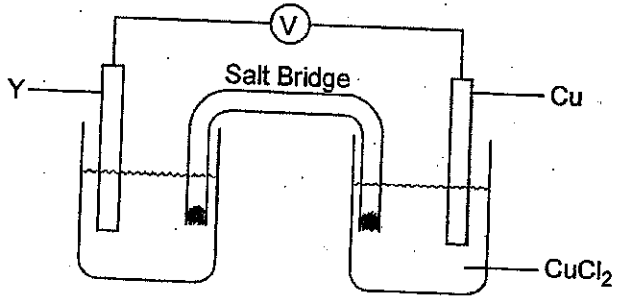
9.1.1 Will the medal be the anode or the cathode? (1)

9.1.2 State the direction in which the current must flow in the external circuit. (State from **silver medal to P** or **P to silver medal**) (1)

9.1.3 The concentration of the electrolyte solution ($AgNO_3$) remains constant during the process. Briefly explain why this happens. (2)

9.1.4 Give the symbol for the metal that must be used as electrode P. (1)

9.2 An electrochemical cell is setup under standard conditions as shown below. Copper (Cu) is used as the cathode and an unknown metal **Y** as the anode of the cell. The voltmeter connected across the two electrodes shows an initial reading of 2,70 V.



9.2.1 State the standard conditions that are applicable to this cell. (2)

9.2.2 State the energy conversion that takes place in this cell. (1)

9.2.3 State two functions of the salt bridge. (2)

9.2.4 Use the information given to identify the metal **Y**. Show all calculations. (5)

9.2.5 Write down the oxidation half reaction. (2)

9.2.6 Write down the cell notation (symbolic notation) of this cell. (3)

Some silver nitrate ($AgNO_3(aq)$) is added to the Cu half-cell.

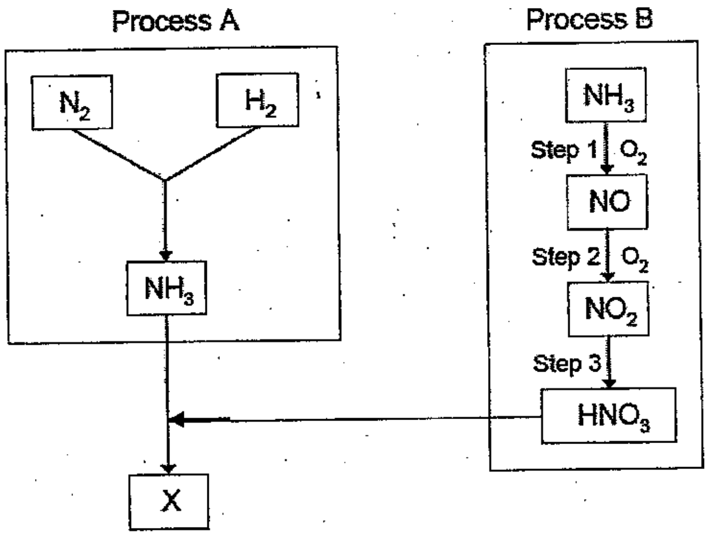
9.2.7 How will the reading on the voltmeter be affected? Write down INCREASE, DECREASE OR REMAIN THE SAME. (1)

9.2.8 Give an explanation for your answer in QUESTION 9.2.7. (3)

[24]

QUESTION 10 (Start on a new page.)

10.1 The flow diagram below shows two industrial processes that result in the production of a fertilizer, **X**.



10.1.1 Write down the name of Process **A**. (1)

10.1.2 Name the method used to obtain the N_2 (g) used in Process **A**. (1)

10.1.3 Write down the name of Process **B**. (1)

10.1.4 Name the catalyst used in Step 1 of Process **B**. (1)

10.1.5 Write down the formula of the other reactant in Step 3 of Process **B**. (1)

10.1.6 State two reasons why it is necessary to manufacture fertilizers on an industrial scale. (2)

10.1.7 Give the name of fertilizer **X** that is produced. (1)

10.2 The following information is found on a 50 kg bag of a fertilizer that you purchase for your lawn.

22 : 10 : 18 (22)

10.2.1 What information can you obtain from these numbers? (2)

10.2.2 Calculate the percentage composition of the nutrients in the bag. (3)

10.2.3 The number 18 in the ratio above represents a particular element. Briefly discuss the role this element plays in the development and growth of plants. (2)

[15]

TOTAL : 150

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 2 (CHEMIE)

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

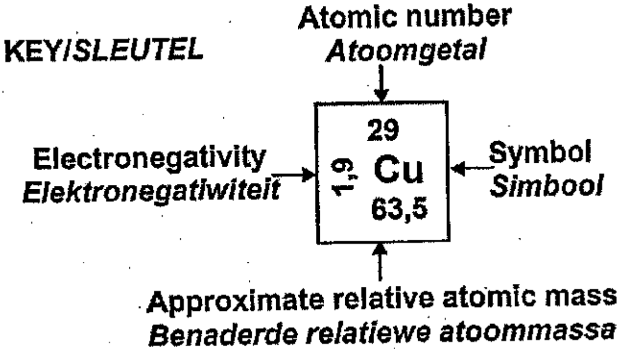
NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Standard pressure *Standaarddruk*	p^θ	$1{,}013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22{,}4\ dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^θ	273 K
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}$ C
Avogadro's constant *Avogadro-konstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at/*by* 298 K	
$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ / $E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$ or/*of* $E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ / $E^\theta_{sel} = E^\theta_{reduksie} - E^\theta_{oksidasie}$ or/*of* $E^\theta_{cell} = E^\theta_{oxidising\ agent} - E^\theta_{reducing\ agent}$ / $E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$	

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKE TABEL VAN ELEMEN

KEY/*SLEUTEL*



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)
1 2,1 H 1																	2 He 4
3 1,0 Li 7	4 1,5 Be 9											5 2,0 B 11	6 2,5 C 12	7 3,0 N 14	8 3,5 O 16	9 4,0 F 19	10 Ne 20
11 0,9 Na 23	12 1,2 Mg 24											13 1,5 Aℓ 27	14 1,8 Si 28	15 2,1 P 31	16 2,5 S 32	17 3,0 Cℓ 35,5	18 Ar 40
19 0,8 K 39	20 1,0 Ca 40	21 1,3 Sc 45	22 1,5 Ti 48	23 1,6 V 51	24 1,6 Cr 52	25 1,5 Mn 55	26 1,8 Fe 56	27 1,8 Co 59	28 1,8 Ni 59	29 1,9 Cu 63,5	30 1,6 Zn 65	31 1,6 Ga 70	32 1,8 Ge 73	33 2,0 As 75	34 2,4 Se 79	35 2,8 Br 80	36 Kr 84
37 0,8 Rb 86	38 1,0 Sr 88	39 1,2 Y 89	40 1,4 Zr 91	41 Nb 92	42 1,8 Mo 96	43 1,9 Tc	44 2,2 Ru 101	45 2,2 Rh 103	46 2,2 Pd 106	47 1,9 Ag 108	48 1,7 Cd 112	49 1,7 In 115	50 1,8 Sn 119	51 1,9 Sb 122	52 2,1 Te 128	53 2,5 I 127	54 Xe 131
55 0,7 Cs 133	56 0,9 Ba 137	57 La 139	72 1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 1,8 Tℓ 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po	85 2,5 At	86 Rn
87 0,7 Fr	88 0,9 Ra 226	89 Ac															
				58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
				90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

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

Increasing oxidising ability/*Toenemende oksiderende vermoë*

Increasing reducing ability/*Toenemende reduserende vermoë*

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

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

Half-reactions/*Halfreaksies*	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
$\mathbf{2H^+ + 2e^-} \rightleftharpoons H_2(g)$	**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

Name: ______________________________

Answer sheet Q6.4 and Q6.7

Time (s)	0	1	2	3	4	5	6	7	8	9
Mass of flask and its contents (g)	178	176,2	174,1	172,7	172,3	172,2	172,1	172,1	172,1	172,1
Mass of CO_2 (g) produced (g)										

PLEASE TEAR ON DOTTED LINE