GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2026

10842

PHYSICAL SCIENCES: CHEMISTRY

(PAPER 2)

PHYSICAL SCIENCES: Paper 2

10842E

TIME: 3 hours

MARKS: 150

17 pages + 4 data sheets

X10

P.T.O.

INSTRUCTIONS AND INFORMATION

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

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

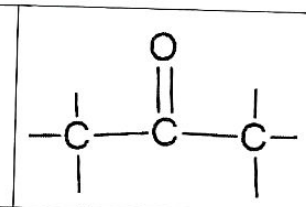
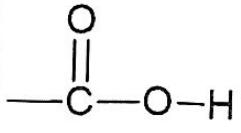
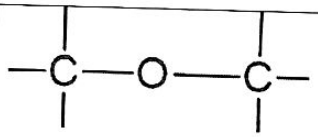
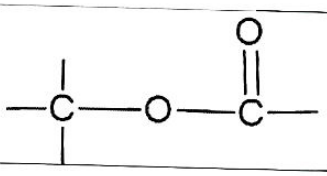
Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A – D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g. 1.11 D.

1.1 A chemical formula that indicates the elements and the number of each type of atom in a molecule, is defined as:

A Structural formula
B Condensed formula
C Molecular formula
D General formula

(2)

1.2 The correct structural formula of the functional group for an ester is:

A 	B 
C 	D 

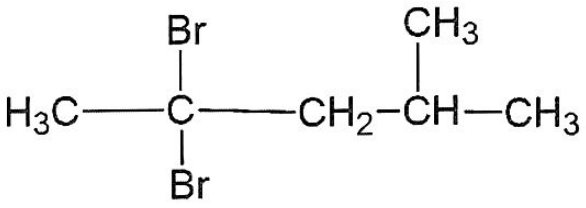
(2)

1.3 Hexyl octanoate is added to water. This ester is insoluble in water because ...

A an ester has only dipole-dipole forces.
B water has hydrogen bonding while an ester has ionic forces.
C an ester has a sweet smell which keeps it afloat.
D an ester has stronger London forces.

(2)

1.4 The correct IUPAC name for the structure below is:



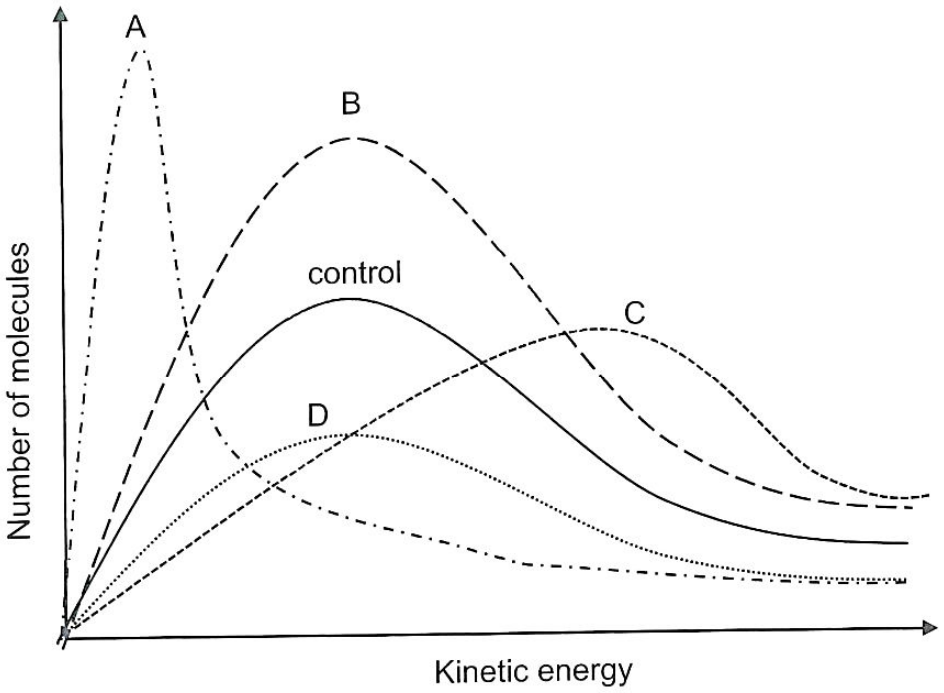
A 2-methyl-4,4-dibromopentane
B 2,2-dibromo-1,1-dimethylbutane
C 2,2-dibromo-4-methylpentane
D dibromo-dimethylbutane

(2)

1.5 The Maxwell-Boltzmann distribution curve for the following reaction is given and indicated as the control in the graph:

$$Zn + 2HC\ell \rightarrow ZnC\ell_2 + H_2 \qquad \Delta H<0$$

In a second experiment the concentration of hydrochloric acid is increased. Which graph best compares with the control graph?

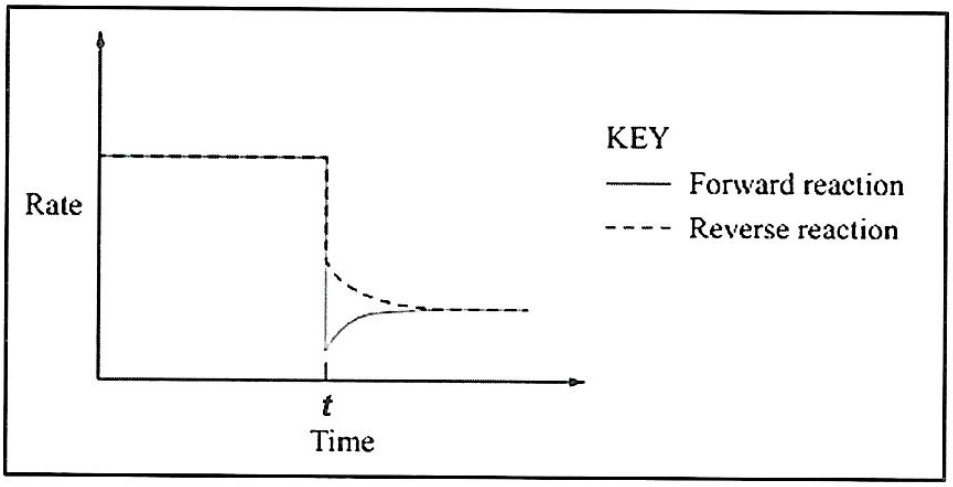


(2)

1.6 Carbon dioxide reacts with hydrogen gas to form carbon monoxide and water vapour in a sealed container, as shown in the chemical equation given below:

$$CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$$

A temperature change was applied to the equilibrium system at time ***t***, and the rates of both the forward and reverse reactions were monitored.



Which statement correctly shows the temperature change that was applied and the nature of the forward reaction at time ***t***?

A Decrease in temperature, endothermic
B Decrease in temperature, exothermic
C Increase in temperature, endothermic
D Increase in temperature, exothermic (2)

1.7 A weak acid solution is diluted by adding acid to water. The temperature is kept constant.

Which of the following best describes the effect on the K_a value and the concentration of hydronium ions in the new diluted weak acid solution?

	K_a VALUE	CONCENTRATION OF HYDRONIUM IONS
A	Decreases	Increases
B	Decreases	Decreases
C	Remains the same	Increases
D	Remains the same	Decreases

(2)

1.8 The pH of a solution changes from 8 to 5.

What happens to the concentration of hydrogen ions during this change in pH? (Assume that the temperature is kept constant.)

A It increases by a factor of 3.
B It decreases by a factor of 3.
C It increases by a factor of 1 000.
D It decreases by a factor of 1 000. (2)

1.9 Magnesium reacts quickly with hot water to form magnesium hydroxide and hydrogen gas, as shown in the equation below:

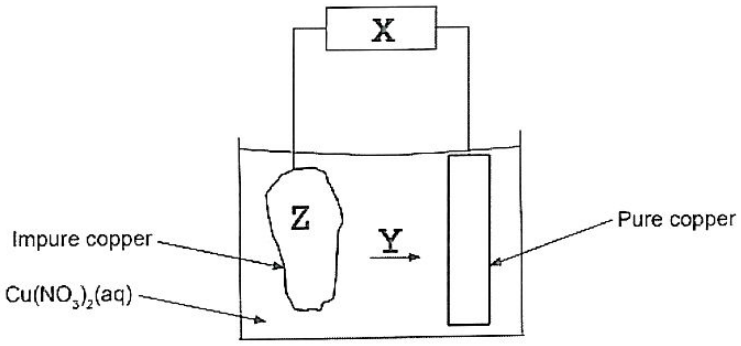
$$Mg(s) + 2H_2O(\ell) \rightarrow Mg(OH)_2(aq) + 2H_2(g)$$

Which of the following correctly identifies the oxidising agent and reducing agent in the above reaction?

	OXIDISING AGENT	REDUCING AGENT
A	H_2O	H_2
B	H_2O	Mg
C	Mg	H_2O
D	$Mg(OH)_2$	Mg

(2)

1.10 The cell below was set up to demonstrate the purification of copper.



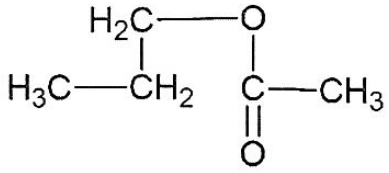
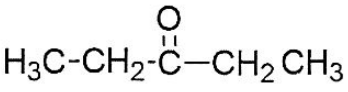
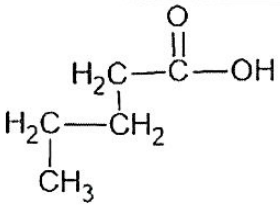
Which of the following is the correct labels for **X**, **Y** and **Z**, as indicated in the diagram above?

	X	Y	Z
A	Voltmeter	Direction of anion flow	Anode
B	Power supply	Direction of cation flow	Anode
C	Voltmeter	Direction of anion flow	Cathode
D	Power supply	Direction of cation flow	Cathode

(2)
[20]

QUESTION 2 (Start on a new page.)

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

A		**B**	$CH_3CHC(CH_3)CH_2CH_3$
C		**D**	$CH_3(CH_2)_2COCH_3$
E		**F**	$CH_3CH_2CH_2CHO$
G	Ethanol	**H**	$CH_2CHCH_2CH_3$

2.1 Define the term *unsaturated compound*. (2)

2.2 Write down the IUPAC name for compound **A**. (2)

2.3 Write down the STRUCTURAL FORMULA of the functional isomer for compound **F**. (2)

2.4 Compound **H** reacts with HBr. Write down the IUPAC name of the major product. (2)

2.5 Write down the STRUCTURAL FORMULA and IUPAC name of compound **B**. (2)

2.6 Write down the symbol of the compound that contains a hydroxyl functional group. (1)

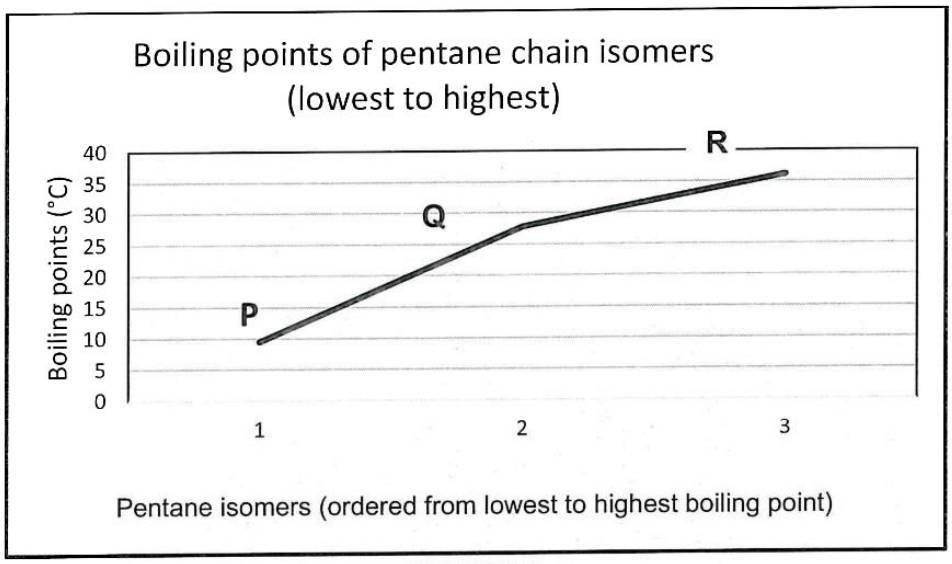
2.7 What is the difference between compound **C** and compound **D**? Give a reason for the answer. (2)

2.8 Write down the general formula of the homologous series to which compound **B** belongs. (1)

[14]

QUESTION 3 (Start on a new page.)

The boiling points of the three chain isomers of pentane are given in the graphs below.



GRAPH A

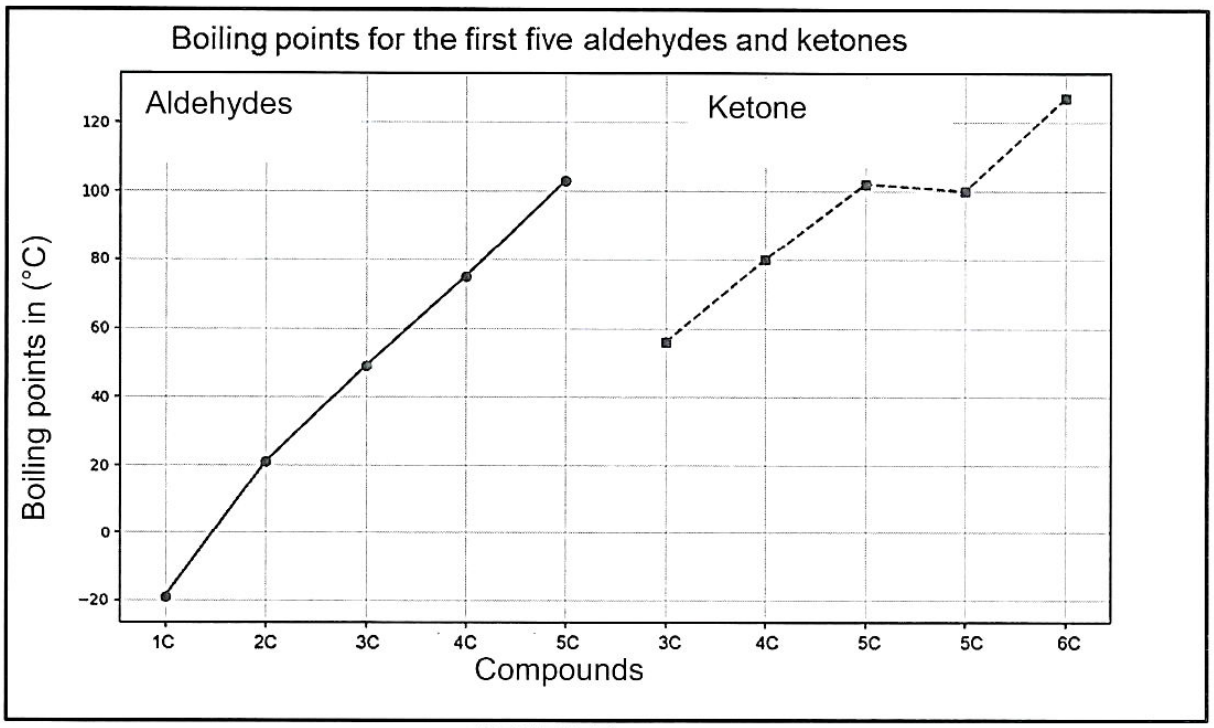
3.1 Define the term *chain isomer*. (1)

3.2 For GRAPH A:

The graph shows three chain isomers for an alkane with the molecular formula C_5H_{12}.

3.2.1 Write down the IUPAC names for compounds **P** and **Q**. (2)

3.2.2 Explain the difference in the boiling points of compounds **P** and **Q**. (3)



GRAPH B

3.3 For GRAPH B:

3.3.1 Give a reason why there are no ketone compounds containing one or two carbon atoms. (1)

3.3.2 Write down the STRUCTURAL FORMULA of the functional group of an aldehyde. (2)

3.3.3 Refer to the aldehydes. Explain the tendency in the boiling points of the first five aldehydes. (3)

3.3.4 Which compound has the higher vapour pressure: propanal or propanone? Explain the answer. (3)
[15]

QUESTION 4 (Start on a new page.)

A primary, a secondary and a tertiary alcohol are used in three different reactions. The flow diagram below represents these reactions.

REACTION I

$C_5H_{12}O$ + Compound A ⟶ $C_5H_{11}OOC_3H_7$ + Compound **B**

REACTION II

$C_5H_{12}O$ —(concentrated strong acid)→ Major product + Compound **B**

Major product —($+ H_2$)→ Compound **C**

REACTION III

$C_5H_{12}O$ + Compound **D** ⟶ $H_3C-C(Cl)(CH_3)-CH_2-CH_3$ + Compound **B**

REACTION IV

4.1 For REACTION I:

4.1.1 Name the type of reaction. (1)

4.1.2 What precautions should be taken during this experiment? Give a reason for the answer. (2)

4.1.3 Use structural formulae to write the complete chemical reaction. (4)

4.1.4 Name the catalyst that is used in this reaction (1)

4.2 For REACTION II: ($C_5H_{12}O$ secondary alcohol)

4.2.1 Name the type of elimination reaction that initially occurs in REACTION II. (1)

4.2.2 Use condensed structural formulae to write down the reaction between the major product and hydrogen. (3)

4.2.3 Use molecular formulae to write down the balanced combustion reaction of compound **C** in sufficient oxygen. (3)

REACTION I

$C_5H_{12}O$ + Compound A ⟶ $C_5H_{11}OOC_3H_7$ + Compound **B**

REACTION II

$C_5H_{12}O$ —concentrated strong acid→ Major product + Compound **B**

Major product —+ H_2→ Compound **C**

REACTION III

$C_5H_{12}O$ + Compound **D** ⇌ $H_3C-C(Cl)(CH_3)-CH_2-CH_3$ + Compound **B**

REACTION IV

4.3 For REACTIONS III and IV:

4.3.1 Is this a PRIMARY, SECONDARY or TERTIARY alcohol? Give a reason for the answer. (2)

4.3.2 State the reaction condition needed for REACTION III. (1)

4.3.3 Name the type of reaction that takes place. (1)

4.3.4 Name compound **D**. (1)

4.3.5 The reaction can be reversed. Name a reaction condition required for the reverse reaction. (REACTION IV) (1)

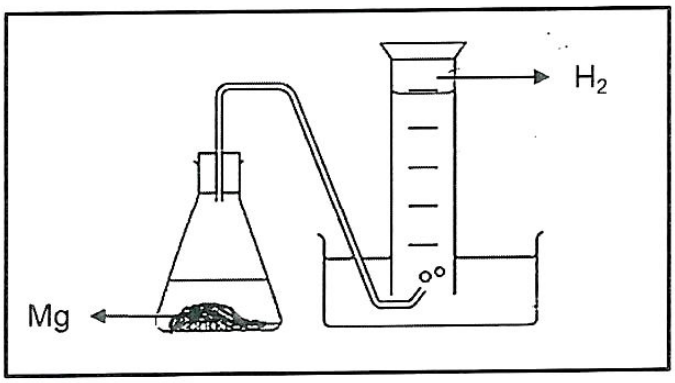
[21]

QUESTION 5 (Start on a new page.)

The rate of reaction between magnesium ribbon and dilute hydrochloric acid at room temperature is investigated. The experiment is conducted in a laboratory at 25°C, at which the molar volume of hydrogen gas is 25,4 $dm^3 \cdot mol^{-1}$.

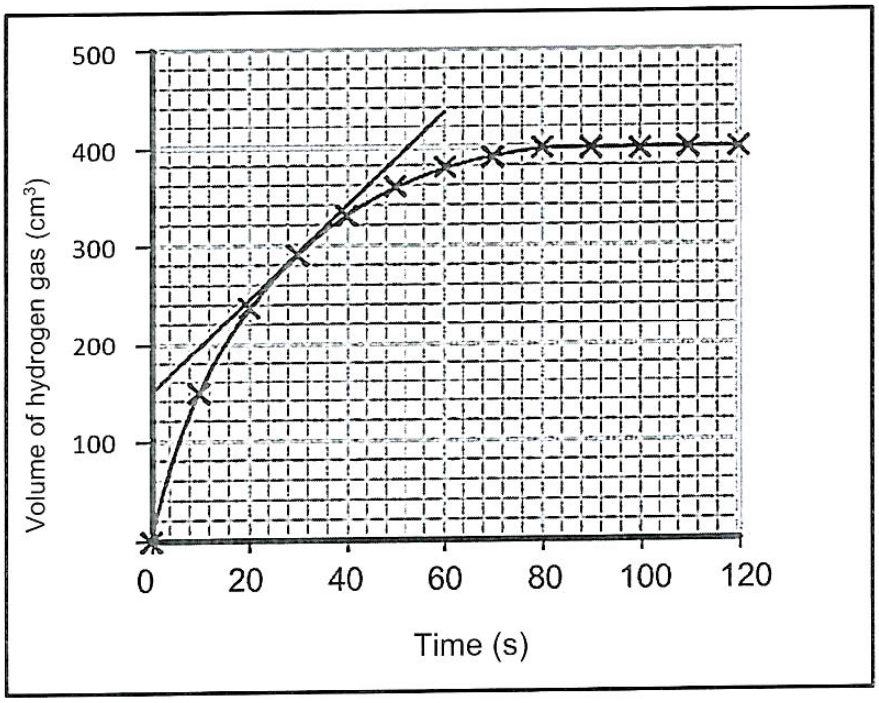
$$Mg(s) + 2HC\ell(aq) \rightarrow MgC\ell_2(aq) + H_2(g)$$

The apparatus used is shown in the diagram below.



The volume of hydrogen gas given off was measured at regular intervals during the reaction.

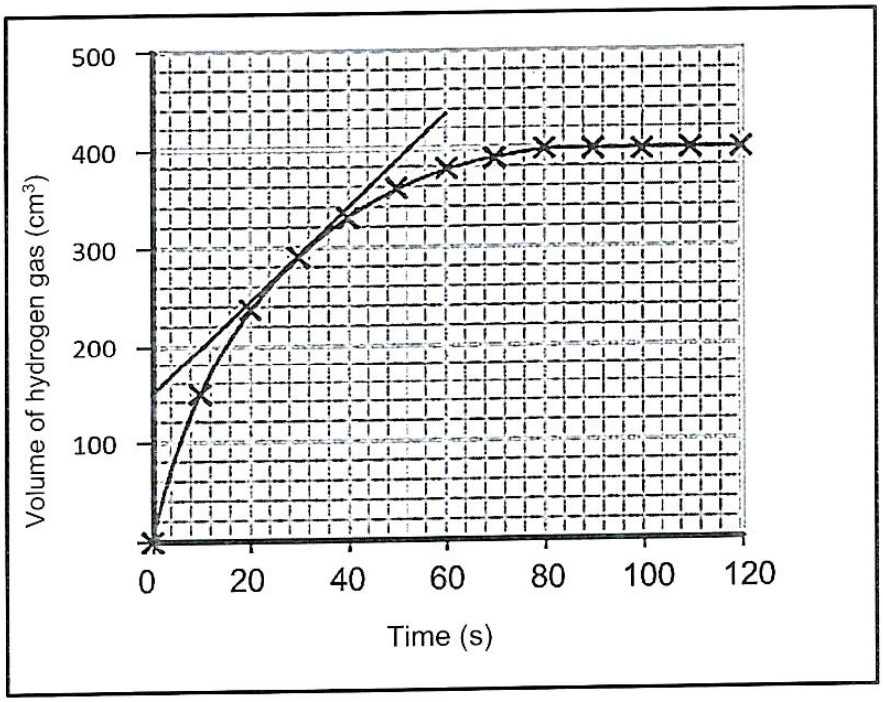
The graph below shows the results of this experiment.



5.1 Define the term *reaction rate*. (2)

5.2 Use the graph to calculate the instantaneous rate of the reaction at 30 s, in $cm^3 \cdot s^{-1}$. (3)

5.3 The volume of hydrochloric acid used in the conical flask was 100 cm^3. If 1 g of magnesium ribbon was used, calculate the percentage purity of the magnesium ribbon. (5)



5.4 In a second experiment, the same mass of magnesium is used, but in powder form. Explain how the graph obtained in this experiment will differ from the graph obtained in the initial experiment. (2)

5.5 In a third experiment, the same mass of magnesium ribbon is used, but this time the concentration of the hydrochloric acid is increased. Explain fully, using the collision theory, the effect of this change on the rate of the reaction. (4)
[16]

QUESTION 6 (Start on a new page.)

An unknown quantity (**X** moles) of hydrogen sulphide is mixed with 0,2 moles of methane in a sealed container with a volume of 3 dm^3. The following chemical equilibrium is established:

$$2H_2S(g) + CH_4(g) \rightleftharpoons CS_2(\ell) + 4H_2(g)$$

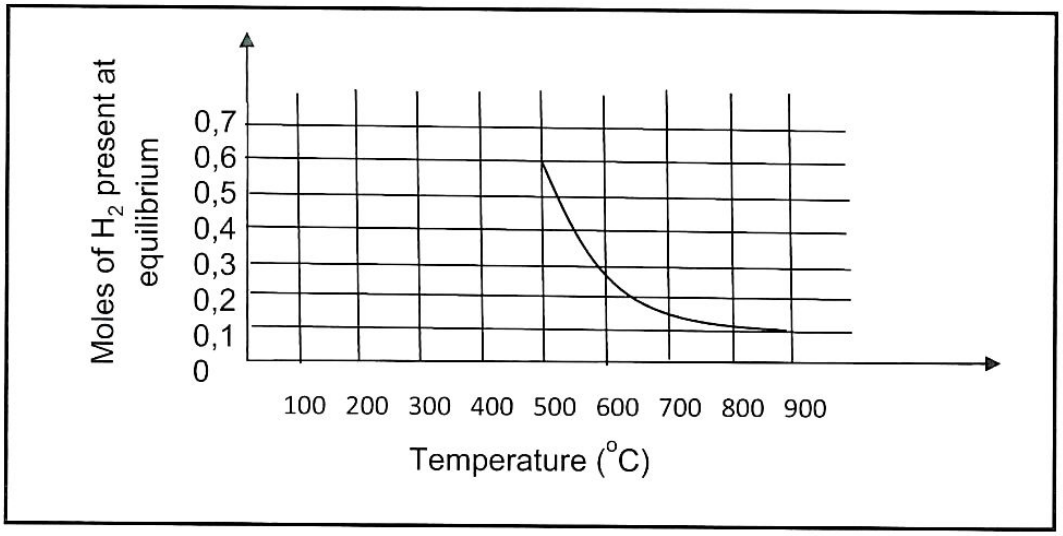
6.1 State *Le Chatelier's principle*. (2)

6.2 Some methane gas was removed from the container.

6.2.1 What effect does this have on the volume of carbon sulphide? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

6.2.2 Explain the answer to QUESTION 6.2.1 by using Le Chatelier's principle. (2)

6.3 The temperature inside the container was increased and the graph shows the number of moles of hydrogen gas present in the system after equilibrium has been established at different temperatures.



The temperature of the equilibrium system was increased from 500 °C to 900 °C.

6.3.1 Is the forward reaction EXOTHERMIC or ENDOTHERMIC? (1)

6.3.2 Explain the answer to QUESTION 6.3.1. (3)

6.3.3 Calculate the value of the unknown quantity, X (the initial number of moles of hydrogen sulphide), in the container at 500 °C. The Kc value measured at this temperature is 2. (9)

[18]

QUESTION 7 (Start on a new page.)

Magnesium carbonate, $MgCO_3(s)$, and a solution of nitric acid, $HNO_3(aq)$, react in a conical flask according to the balanced chemical equation:

$$MgCO_3(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + CO_2(g) + H_2O(\ell)$$

A few drops of methyl orange are added to the final mixture and the mixture turns red.

7.1 Does magnesium carbonate act as a strong base or a weak base? Give a reason for the answer. (2)

7.2 Will the magnesium nitrate solution have a pH ABOVE 7, BELOW 7 or EQUAL TO 7? Give a reason for the answer. (2)

7.3 The following data was obtained from the reaction of 30 cm^3 excess nitric acid solution with a concentration of 0,5 $mol \cdot dm^{-3}$ and magnesium carbonate granules in a conical flask. The volume of gas produced was recorded at a temperature and pressure at which the molar gas volume is 25 $dm^3 \cdot mol^{-1}$.

Time (min.)	0	1	2	3	4	5	6
Volume of gas produced (cm^3)	0	12	18	25	32	33	33

7.3.1 Use the table of results above to draw a sketch graph of the volume of gas produced versus time in the ANSWER BOOK. ALL relevant values and labels must be shown. (4)

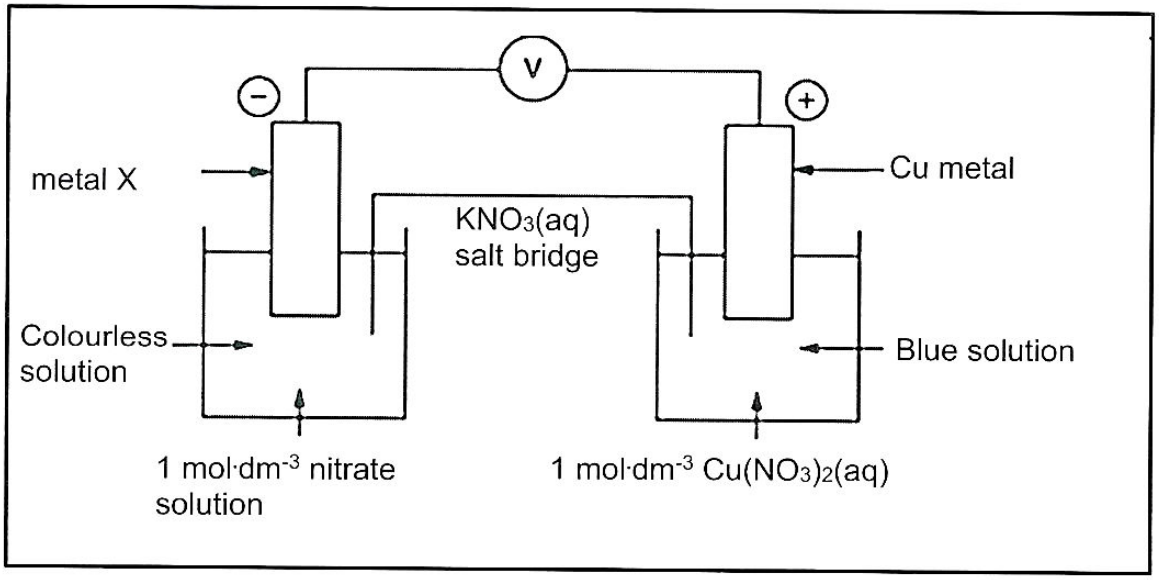
7.3.2 What happens to the reaction after 5 minutes? Explain the answer by referring to the shape of the graph. (3)

7.3.3 Use the table of results to calculate the mass of magnesium carbonate used in this reaction. (3)

7.3.4 Calculate the pH of the final solution in the conical flask. (7)
[21]

QUESTION 8 (Start on a new page.)

Use the galvanic cell shown below to answer the questions that follow. The two electrodes are the metal **X** and copper, each in its respective electrolytic solutions.



8.1 Is metal **X**, the anode or the cathode? Give a reason for the answer. (2)

8.2 Write down the equation for the half-reaction taking place at the copper electrode. (2)

8.3 Use a calculation to identify metal **X** if the electrode potential of this cell is 2 V under standard conditions. (4)

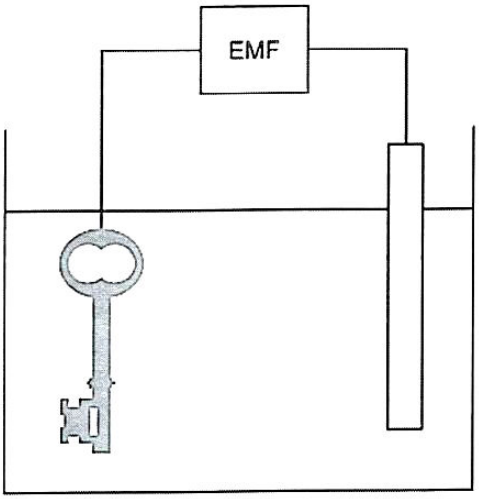
8.4 The mass of one of the electrodes decreases during this reaction. Choose from COPPER or METAL **X** to identify the electrode that undergoes this decrease in mass. Give a reason for the answer. (2)

8.5 The electrode mentioned in QUESTION 8.4 decreases by 1,6 g during the electrochemical reaction, calculate the increase in mass of the other electrode. (4)

[14]

QUESTION 9 (Start on a new page.)

A solution that contains a mixture of silver nitrate, $AgNO_3(aq)$ and potassium cyanide KCN(aq), is used to plate a key with silver, as shown below.



The potassium cyanide increases the electrical conductivity of the electrolyte and keeps the silver ion concentration constant.

9.1 Write down the NAME or FORMULA of the substance that acts as the anode. (1)

9.2 Write down the oxidation half-reaction for the cell. (2)

9.3 If the mass of the key increased by 0,54 g after a time **T**, calculate the number of electrons that moved through the external circuit during this time. (4)

9.4 Why does the silver ion concentration remain constant? (2)

9.5 Should the power source used be a DC source or an AC source? Give a reason for the answer. (2)
[11]

TOTAL: 150

END

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 2 (CHEMIE)

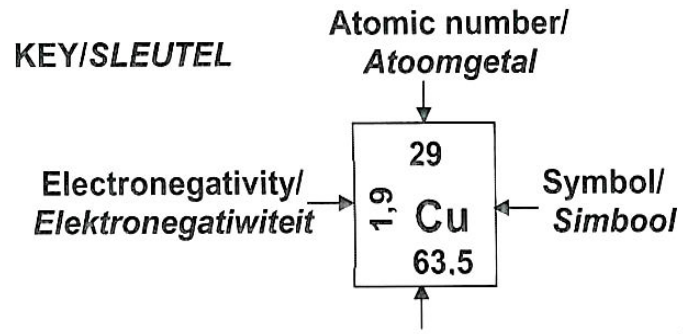
TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

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*	q_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^+]
Kw = [H_3O^+][OH^-] = 1×10^{-14} at/by 298 K	
$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ / $E^{\theta}_{sel} = E^{\theta}_{katode} - E^{\theta}_{anode}$ $E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ / $E^{\theta}_{sel} = E^{\theta}_{reduksie} - E^{\theta}_{oksidasie}$ $E^{\theta}_{cell} = E^{\theta}_{oxidising\ agent} - E^{\theta}_{reducing\ agent}$ / $E^{\theta}_{sel} = E^{\theta}_{oksideermiddel} - E^{\theta}_{reduseermiddel}$	

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



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 He 4
1,5 Be 9											2,0 B 11	2,5 C 12	3,0 N 14	3,5 O 16	4,0 F 19	10 Ne 20
1,2 Mg 24											1,5 Aℓ 27	1,8 Si 28	2,1 P 31	2,5 S 32	3,0 Cℓ 35,5	18 Ar 40
1,0 Ca 40	1,3 Sc 45	1,5 Ti 48	1,6 V 51	1,6 Cr 52	1,5 Mn 55	1,8 Fe 56	1,8 Co 59	1,8 Ni 59	1,9 Cu 63,5	1,6 Zn 65	1,6 Ga 70	1,8 Ge 73	2,0 As 75	2,4 Se 79	2,8 Br 80	36 Kr 84
1,0 Sr 88	1,2 Y 89	1,4 Zr 91	41 Nb 92	1,8 Mo 96	1,9 Tc	2,2 Ru 101	2,2 Rh 103	2,2 Pd 106	1,9 Ag 108	1,7 Cd 112	1,7 In 115	1,8 Sn 119	1,9 Sb 122	2,1 Te 128	2,5 I 127	54 Xe 131
0,9 Ba 137	57 La 139	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	1,8 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	86 Rn
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: STANDAARDREDUKSIEPOTENSIALE

Increasing oxidising ability/*Toenemende oksiderende vermoë* ↑

Half-reactions/*Halfreaksies*	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

Increasing reducing ability/*Toenemende reduserende vermoë* ↓

TABLE 4B: STANDARD REDUCTION POTENTIALS
TABEL 4B: STANDAARDREDUKSIEPOTENSIALE

Increasing oxidising ability/*Toenemende oksiderende vermoë* ↓

Increasing reducing ability/*Toenemende reduserende vermoë* ↑

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
$2H^+ + 2e^- \rightleftharpoons H_2(g)$	**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