basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES: CHEMISTRY (P2)

NOVEMBER 2016

MARKS: 150

TIME: 3 hours

This question paper consists of 12 pages, 4 data sheets and 1 answer sheet.

L8P2

GAUTENG

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INSTRUCTIONS AND INFORMATION

1. Write your name and class (for example 11A) in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of 10 questions. Answer ALL the questions in the ANSWER BOOK except QUESTIONS 4.1.2, 4.1.3 and 4.1.6, which have to be answered on the attached ANSWER SHEET. The ANSWER SHEET has to be handed in together with 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 subquestions, 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 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 number (1.1–1.10) in the ANSWER BOOK, for example 1.11 E.

1.1 The type of bond formed between a H^+ ion and H_2O is called a/an …

A hydrogen bond.

B dative covalent bond.

C ionic bond.

D covalent bond. (2)

1.2 The shape of the molecule in which the central atom is surrounded by two lone pairs and two bonding pairs is …

A linear.

B trigonal planar.

C tetrahedral.

D bent. (2)

1.3 The intermolecular forces in dry ice (CO_2) are …

A ion-induced dipole forces.

B hydrogen bonding.

C ion-dipole forces.

D London forces. (2)

1.4 The bond energy of a C–Cℓ bond is 338 $kJ.mol^{-1}$ whereas the bond energy of a C–I bond is 238 $kJ.mol^{-1}$. The difference in bond energy exists because …

A the bond length of the C–Cℓ bond is greater than that of the C–I bond.

B chlorine is more electronegative than iodine.

C the bond length of the C–I bond is greater than that of the C–Cℓ bond.

D the chlorine atom is bigger than the iodine atom. (2)

1.5 A gas of volume V is at a temperature T_1 and pressure P_1 in a gas syringe. If the pressure on the gas is doubled and the temperature halved, then the volume that the gas will occupy is …

A ¼ V

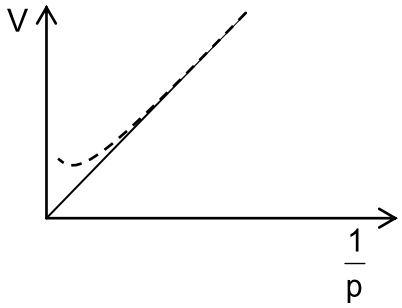
B ½ V

C V

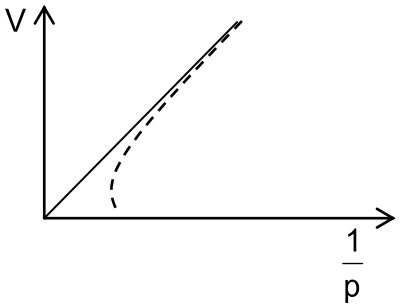
D 2 V (2)

1.6 Which ONE of the graphs below CORRECTLY represents the deviation of a real gas from ideal gas behaviour at very high pressures? The dotted line represents the graph of the real gas.

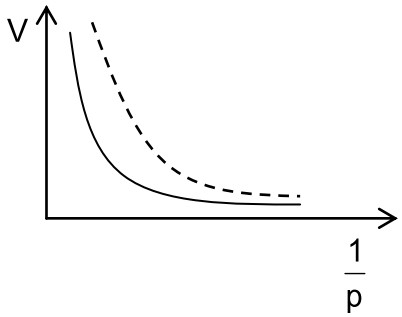
A



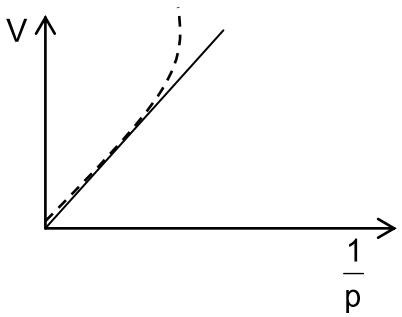
B



C



D



(2)

1.7 The flowers of hydrangeas are natural indicators of soil pH. A natural indicator is made in a laboratory by using hydrangea flowers. NaOH and HCℓ are added to the indicator and the colour change is recorded in the table below.

INDICATOR	NATURAL COLOUR	NaOH	HCℓ
Hydrangea flowers	Blue	Purple	Pink

If orange juice is added to the indicator above, the observed colour may be …

A brown.

B pink.

C purple.

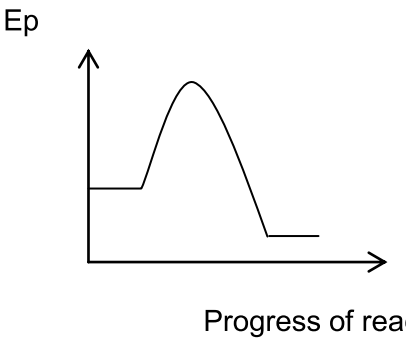
D blue. (2)

1.8 Cellular respiration occurs inside the cells of all living organisms. Oxygen reacts with glucose in cellular respiration to produce the following compounds according to the balanced equation below:

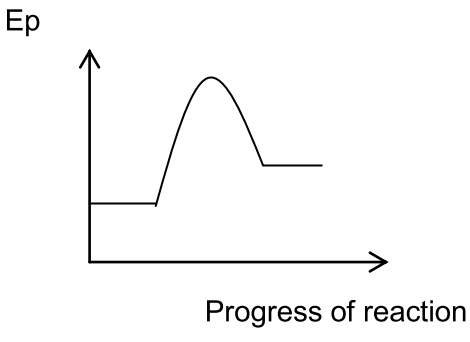
$$C_6H_{12}O_6(aq) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(\ell) \quad \Delta H = -2\,830 \text{ kJ}$$

The potential energy versus progress of reaction diagram for this reaction is …

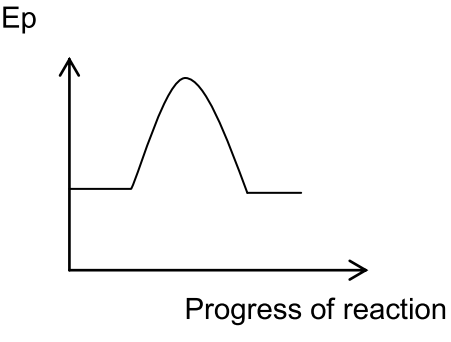
A



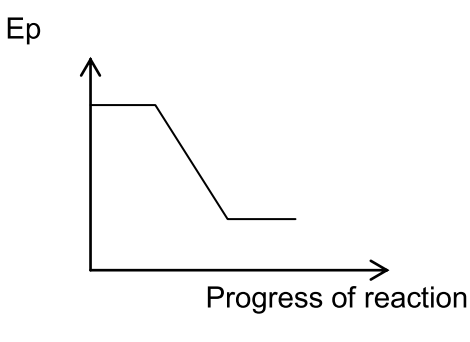
B



C



D



(2)

1.9 The oxidation number of phosphorus in H_3PO_4 is …

A +3

B -2

C +2

D +5 (2)

1.10 During the processing of gold ore, zinc is added to the gold cyanide solution to produce gold according to the balanced equation below:

$$Zn(s) + 2NaAu(CN)_2(aq) \rightarrow 2Au(s) + Zn(CN)_2(aq) + 2NaCN(aq)$$

The reducing agent in this reaction is …

A Na^+

B Au^+

C Zn

D CN^- (2)

[20]

QUESTION 2 (Start on a new page.)

Electronegativity of atoms may be used to explain the polarity of bonds.

2.1 Define the term *electronegativity.* (2)

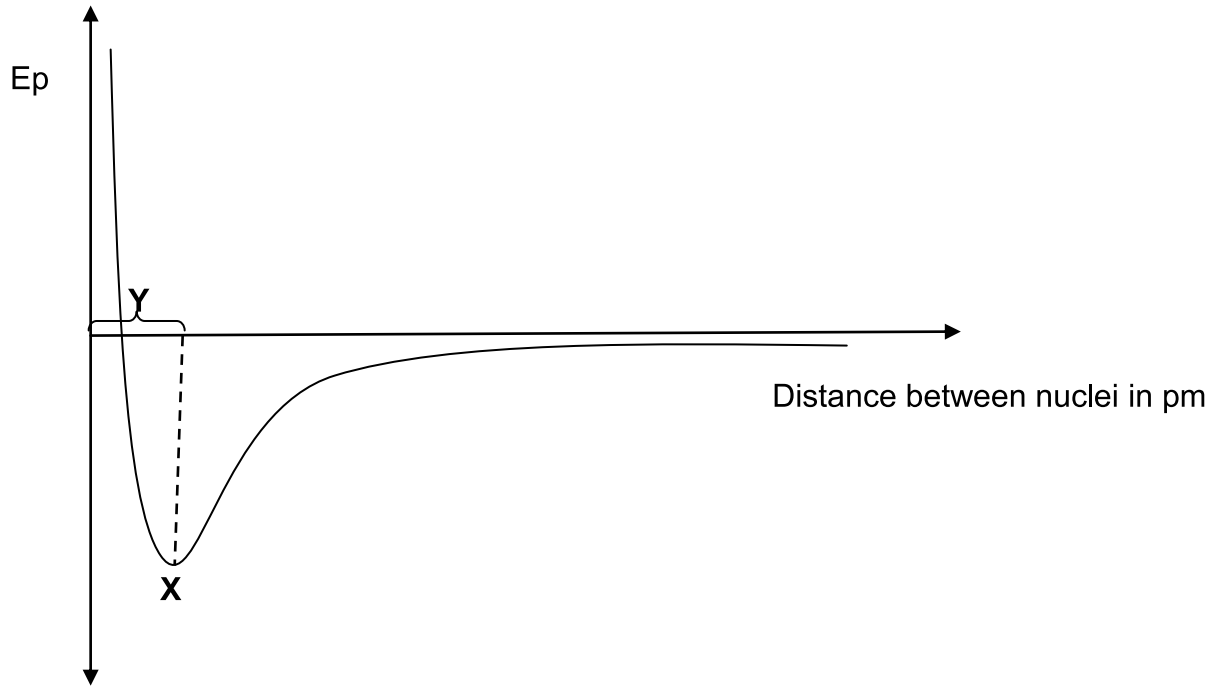
2.2 Draw the Lewis diagram of an oxygen difluoride molecule. (2)

2.3 Calculate the electronegativity difference between O and F in oxygen difluoride and predict the polarity of the bond. (2)

2.4 A polar bond does not always lead to a polar molecule.

Explain the statement by referring to OF_2 and CO_2 molecules. In your explanation, include the polarity of the bonds and the shape of the molecules. (4)

2.5 The diagram below shows the energy change that takes place when two atoms move towards each other.



2.5.1 What does **X** and **Y** represent? (2)

2.5.2 Define the concept represented by **X**. (2)

2.5.3 Explain the relationship between bond order, bond length and bond energy. (3)

[17]

QUESTION 3 (Start on a new page.)

Learners conduct an experiment to investigate the effects of intermolecular forces on boiling points. They use 20 mℓ of each of the following compounds in their investigation: water, sunflower oil, nail polish remover, glycerine and methylated spirits. The results are shown in the table below:

NAME OF COMPOUND	BOILING POINT (°C)
water	93
sunflower oil	230
nail polish remover	56
glycerine	290
methylated spirits	62

3.1 Define the term *boiling point.* (2)

3.2 Formulate an investigative question for this experiment. (2)

3.3 In which compound in the table above will the strongest intermolecular forces occur? Give a reason for the answer. (2)

3.4 The learners now use 40 mℓ of each of the compounds above in the experiment. Will it affect the boiling points? Choose YES or NO. Give a reason for the answer. (2)

3.5 Methylated spirits is highly flammable. State TWO safety precautions that should be taken when using methylated spirits in the laboratory. (2)

3.6 Which compound in the table above will have the highest rate of evaporation? Give a reason for the answer. (2)

3.7 Sunflower oil is a non-polar compound with induced dipole forces between the molecules, while water is a polar molecule with hydrogen bonds between its molecules. Explain why the boiling point of sunflower oil is higher than the boiling point of water. (2)

[14]

QUESTION 4 (Start on a new page.)

4.1 Charles' Law describes the relationship between the volume and temperature of an enclosed mass of gas at constant pressure. The volumes of a gas at different temperatures at constant pressure are given in the table below.

VOLUME (cm^3)	TEMPERATURE (ºC)
114	0
124	25
134	50
145	75
155	100

4.1.1 Explain Charles' Law in terms of the kinetic molecular theory of gases. (2)

4.1.2 Draw a graph of volume versus temperature at constant pressure on the attached graph paper. (4)

4.1.3 Extrapolate the graph (extend the graph) and state at what temperature the graph intersects the x-axis. (1)

4.1.4 What is significant about this temperature? (2)

4.1.5 Calculate the volume that this gas will occupy at 120 °C at constant pressure. (3)

4.1.6 The experiment is now conducted at a lower constant pressure. On the graph drawn for QUESTION 4.1.2, sketch the graph that will be obtained at a lower pressure. Label this graph P. (2)

4.2 An unknown gas with a mass of 0,77 g occupies a volume of 0,32 dm^3 at a temperature of 27 °C and a pressure of 96 kPa. Assume that the gas behaves as an ideal gas.

4.2.1 Calculate the molar mass of the gas. (5)

4.2.2 Write down the MOLECULAR FORMULA or NAME of the gas named in QUESTION 4.2.1. (2)

[21]

QUESTION 5 (Start on a new page.)

5.1 Define the term *concentration.* (2)

5.2 Eight (8) grams of $Na_2S_2O_3$ is dissolved in water to prepare 500 cm^3 of solution. Calculate the concentration of the $Na_2S_2O_3$ solution. (3)

5.3 A 10 g sample of a compound contains 2,66 g of potassium, 3,54 g of chromium and 3,81 g of oxygen.

5.3.1 Define the term *empirical formula*. (2)

5.3.2 Determine the empirical formula of this compound. (7)
[14]

QUESTION 6 (Start on a new page.)

Learners made a mini volcano in a science laboratory by adding sodium bicarbonate to ethanoic acid. They added 100 mℓ of a 0,2 $mol \cdot dm^{-3}$ ethanoic acid solution to 10 g of $NaHCO_3$ to start the reaction of the volcano.

The balanced equation for this reaction is:

$$CH_3COOH(aq) + NaHCO_3(s) \rightarrow CH_3COONa(aq) + H_2O(\ell) + CO_2(g)$$

6.1 Define the term *limiting reagent.* (2)

6.2 Determine the limiting reagent in this reaction. (6)

6.3 Calculate the mass of the other substance in excess. (3)

6.4 Calculate the volume of CO_2 produced at STP. (4)
[15]

QUESTION 7 (Start on a new page.)

Methane is used as an alternative fuel. The combustion of methane releases carbon dioxide and water. The balanced equation for this reaction is:

$$CH_4(g) + O_2(g) \rightarrow CO_2(g) + 2H_2O(g) + 891\ kJ{\cdot}mol^{-1}$$

The activation energy for this reaction is 172 $kJ{\cdot}mol^{-1}$.

7.1 Is this reaction ENDOTHERMIC or EXOTHERMIC? Give a reason for the answer. (2)

7.2 Explain why all chemical reactions need activation energy. (2)

7.3 Why is this reaction not considered to be environmentally friendly? (2)
[6]

QUESTION 8 (Start on a new page.)

8.1 Define an *acid* in terms of the Lowry-Brønsted theory. (2)

8.2 Consider the following acid-base reaction:

$$H_2PO_4^- + NH_3 \rightarrow HPO_4^{2-} + NH_4^+$$

8.2.1 Identify the conjugate acid-base pairs in the above reaction. (4)

8.2.2 Define the term *ampholyte*. (1)

8.2.3 Choose an ampholyte in the above reaction. (2)

8.3 Ten grams (10 g) of an impure sample of sodium carbonate is added to 100 cm^3 of a 0,2 $mol.dm^{-3}$ solution of hydrochloric acid. The acid is in excess.

The equation for the reaction is:

$$Na_2CO_3 + HC\ell \rightarrow NaC\ell + H_2O + CO_2$$

8.3.1 Balance the equation above. (1)

8.3.2 Calculate the number of moles of hydrochloric acid. (3)

The excess acid neutralises 20 cm^3 of a solution of 0,1 $mol.dm^{-3}$ of magnesium hydroxide.

$$2HC\ell(aq) + Mg(OH)_2(aq) \rightarrow MgC\ell_2(aq) + H_2O(\ell)$$

8.3.3 Calculate the percentage purity of the sodium carbonate solution. (8)
[21]

QUESTION 9 (Start on a new page.)

A silver Christmas tree can be made by placing copper wire, shaped in the form of a tree, into a silver nitrate solution. The unbalanced equation for the reaction is:

$$Cu(s) + AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + Ag(s)$$

9.1 Define the term *oxidation* in terms of oxidation number. (2)

9.2 Write down the following for the reaction above:

9.2.1 Formula of the reducing agent (2)

9.2.2 Name of the oxidising agent (2)

9.2.3 Oxidation half-reaction (2)

9.2.4 Balanced net ionic equation using the ion-electron method (4)

9.3 Use oxidation numbers to explain your choice of oxidising agent in QUESTION 9.2.2. (2)
[14]

QUESTION 10 (Start on a new page.)

The discovery of gold played a significant role in the economic development of South Africa. In 1970 gold mining in South Africa contributed 68 per cent to global production.

10.1 Which TWO mining methods are used in South Africa? (2)

10.2 Give TWO reasons why mining is important for the South African economy. (2)

10.3 State TWO negative effects of mining, with respect to the environment. (2)

10.4 Most alloys of gold are used in jewellery and dentistry. The gold content in jewellery is expressed in carat. The term indicates the number of parts of gold present in each 24 parts of alloy.

10.4.1 Pure gold, which is 24 carat, is not used to make jewellery. Give ONE reason why, referring to the properties of gold. (1)

10.4.2 Apart from gold being used in jewellery and dentistry, name ONE other use of gold. (1)
[8]

TOTAL: 150

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DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
VRAESTEL 2 (CHEMIE)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Avogadro's constant *Avogadro-konstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$
Molar gas constant *Molêre gaskonstante*	R	$8{,}31\ J{\cdot}K^{-1}{\cdot}mol^{-1}$
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

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$\frac{p_1V_1}{T_1}=\frac{p_2V_2}{T_2}$	$pV=nRT$
$n=\frac{m}{M}$	$n=\frac{N}{N_A}$
$n=\frac{V}{V_m}$	$c=\frac{n}{V}$ OR/*OF* $c=\frac{m}{MV}$

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

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 H 1																	2 He 4
1,0 Li 7	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
0,9 Na 23	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
0,8 K 39	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
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	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
0,7 Cs 133	0,9 Ba 137	La 139	1,6 Hf 179	Ta 181	W 184	Re 186	Os 190	Ir 192	Pt 195	Au 197	Hg 201	1,8 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	Rn
0,7 Fr	0,9 Ra 226	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

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29 Cu 1,9 63,5

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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

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
$K^+ + e^- \rightleftharpoons K$	– 2,93
$Li^+ + e^- \rightleftharpoons Li$	– 3,05

Increasing reducing ability/*Toenemende reduserende vermoë* ↓

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

Increasing oxidising ability/*Toenemende oksiderende 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
$F_2(g) + 2e^- \rightleftharpoons 2F^-$	+ 2,87

Increasing reducing ability/*Toenemende reduserende vermoë* ↑

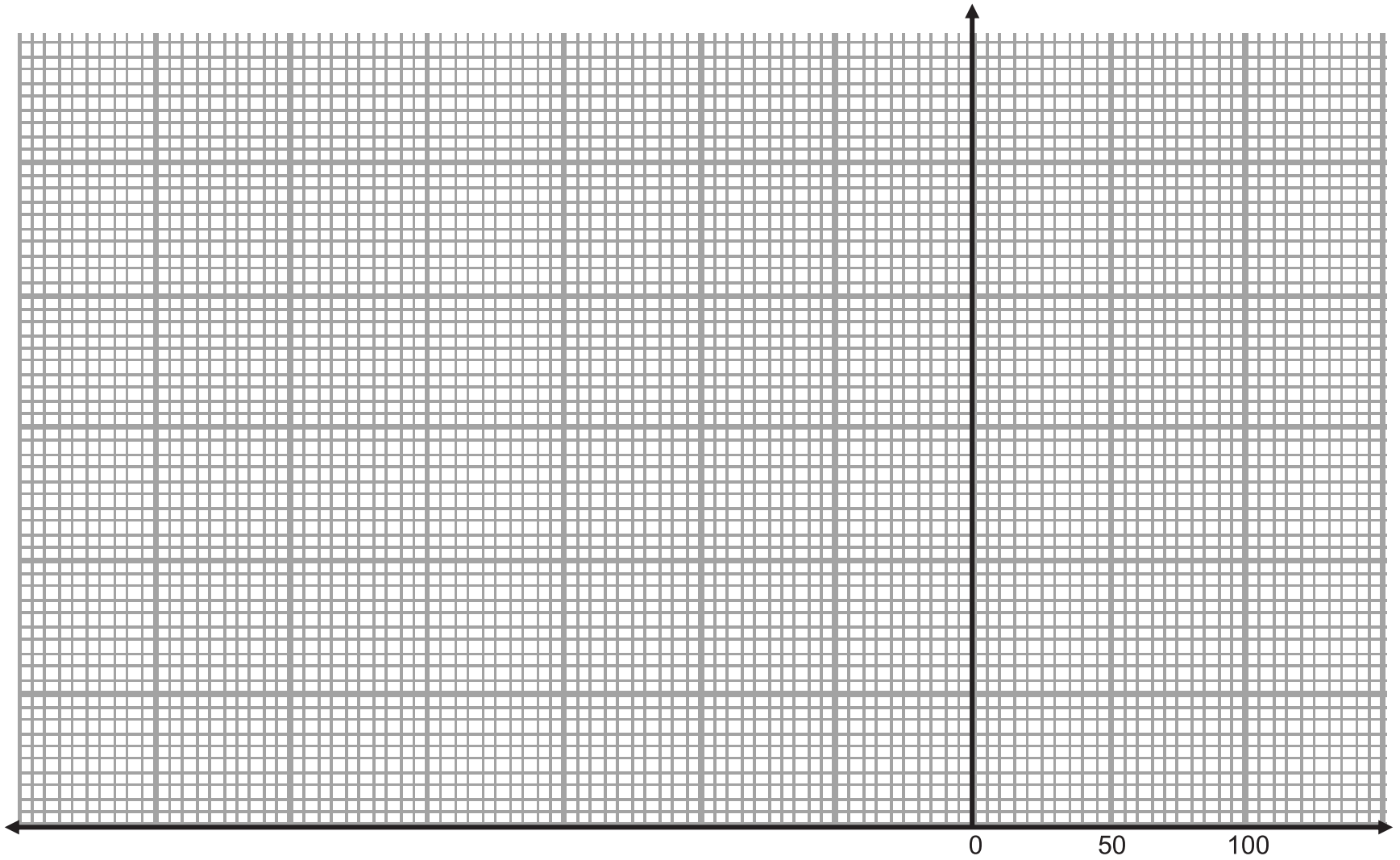
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QUESTIONS 4.1.2, 4.1.3 and 4.1.6

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