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education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 11

PHYSICAL SCIENCES: CHEMISTRY (P2)

NOVEMBER 2026

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MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages and 4 data sheets.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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. 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, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your FINAL numerical answer to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc, where required.
10. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various 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. E.

1.1 A pair of electrons in the valence shell of an atom that is NOT shared with another atom is called …

A valence electron.

B lone pair.

C bonding electrons.

D transferred electrons. (2)

1.2 Which ONE of the following substances has the strongest intermolecular forces?

A F_2

B $C\ell_2$

C Br_2

D I_2 (2)



1.3 Which ONE of the following statements CORRECTLY describes an ideal gas?

A It has no intermolecular forces between the particles.

B Collisions between the particles are perfectly inelastic.

C They have strongest intermolecular forces between the particles.

D They occupy a volume of maximum value. (2)

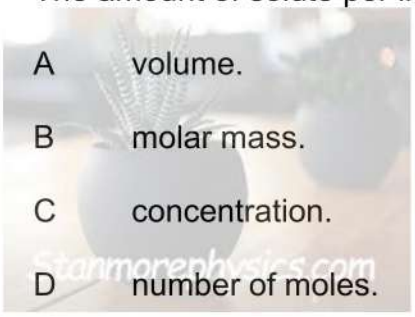
1.4 The amount of solute per litre of solution, is known as the …

A volume.

B molar mass.

C concentration.

D number of moles. (2)



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1.5 How many molecules are there in 1,5 moles of hydrogen sulphide?

A $1{,}51 \times 10^{24}$ molecules

B $9{,}0 \times 10^{23}$ molecules

C $4{,}21 \times 10^{23}$ molecules

D $3{,}01 \times 10^{23}$ molecules (2)

1.6 A catalyst is responsible for …

A increasing the heat of reaction.

B increasing the yield of products.

C decreasing the activation energy.

D decreasing the speed of a reaction. (2)

1.7 Which ONE of the following statements CORRECTLY describe an EXOTHERMIC reaction?

A Heat of the reaction is always positive

B Energy of products is less than the energy of reactants

C A reaction that absorbs heat

D Energy of products and reactants are equal (2)

1.8 A substance that ionises completely in water to form a low concentration of hydronium ions is called …

A a strong base.

B a weak acid.

C a base.

D a strong acid. (2)

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1.9 A solution with the lowest pH value.

A 0,01 mol.dm^{-3} of HCℓ

B 1,2 mol.dm^{-3} of HNO_3

C 0,2 mol.dm^{-3} of KOH

D 0,8 mol.dm^{-3} of NaOH (2)

1.10 Consider the following redox reaction:

$$Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$$

Which ONE of the following substances acts as the oxidising agent?

A Cu

B $AgNO_3$

C Ag

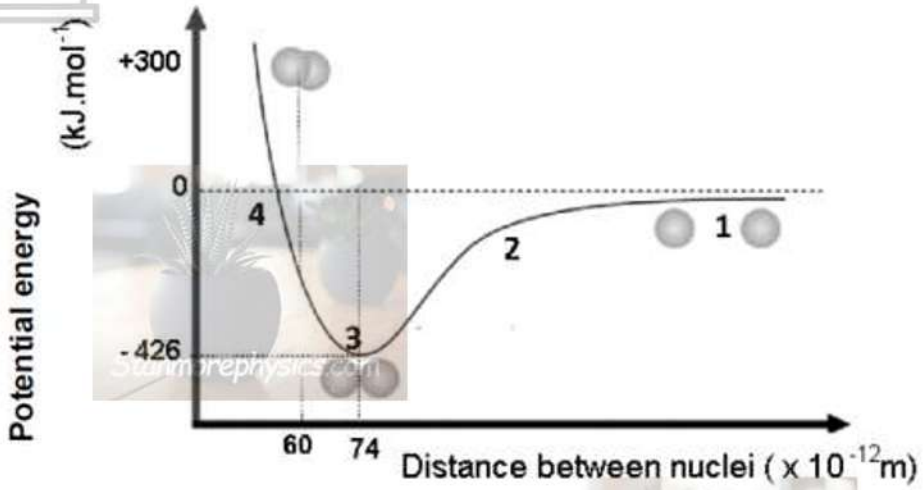
D $Cu(NO_3)_2$ (2)
[20]

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QUESTION 2

The graph below shows how the potential energy of two hydrogen atoms changes as the distance between them changes.



It is possible to find the magnitude of the bond energy for hydrogen and the bond energy of the hydrogen molecule.

2.1 Define the term *bond energy*. (2)

2.2 Use the graph above to answer the following:

2.2.1 Write down the bond energy for hydrogen. (1)

2.2.2 Write down the bond length of hydrogen molecule. (2)

2.3 Fully explain why the molecule is more stable at point 3 than at point 4, as shown on the graph. (3)
[8]

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QUESTION 3

Chemical bonding is primarily driven by the tendency of atoms to achieve a state of maximum stability and minimum energy, by acquiring a stable electron configuration.

3.1 Define the term *chemical bond*. (2)

3.2 Consider the elements Aℓ and S. Use their electronegativity values to explain which ONE is more likely to form a negative ion. (1)

3.3 Calculate the electronegativity difference in EACH of the following compounds and predict the polarity of the bond.

3.3.1 NaCℓ (2)

3.3.2 H_2O (2)

3.3.3 CO_2 (2)

3.4 The Valence Shell Electron Pair repulsion theory (VSEPR) is used to predict the geometrical shape of molecules.

Write down the molecular shape of EACH of the following molecules:

3.4.1 CH_4 (2)

3.4.2 SO_2 (2)

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3.5 Draw the Lewis diagram for the following:

3.5.1 Oxygen atom (2)

3.5.2 HOCℓ (2)

3.5.3 Chlorine ion (2)

3.6 The hydronium ion (H_3O^+), forms when an acid ionises in water.

3.6.1 Name the type of bond found in hydronium ion. (1)

3.6.2 Use Lewis diagrams to show the formation of the hydronium ion. (4)

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QUESTION 4

The table below shows the boiling points of four hydrogen halides.

Hydrogenhalide compounds	**A**	**B**	**C**	**D**
	HF	HCl	HBr	HI
Boiling Points (°C)	19,6	-84	-65	-33,5

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

4.2 Name the type of intermolecular force responsible for the boiling point of HF. (2)

4.3 Which hydrogen halides, **A**, **B**, **C** or **D** in the table above has the …

4.3.1 highest vapour pressure? (1)

4.3.2 strongest intermolecular forces?

Use the information in the table above to explain the answer. (2)

4.4 The boiling points of **A** and **C** are compared.

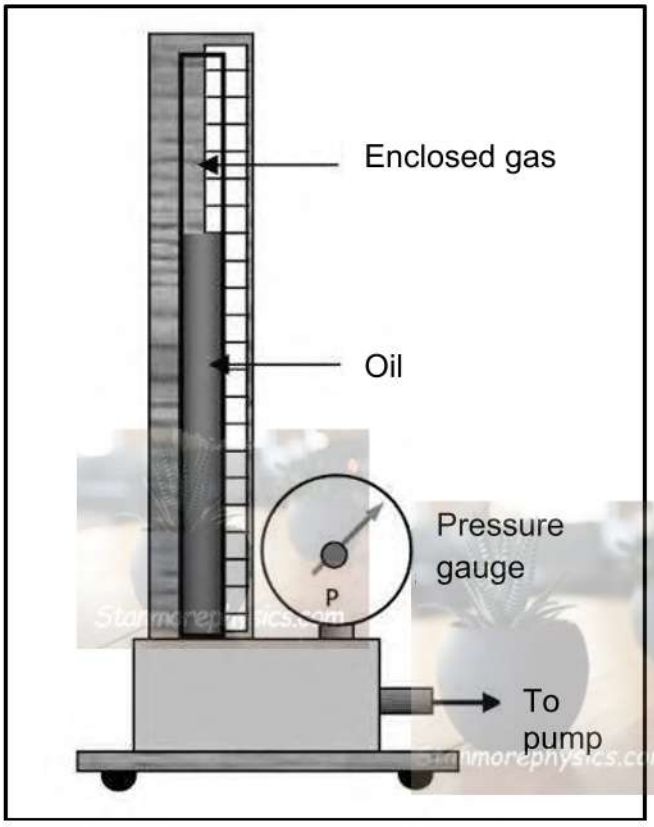
Fully explain the difference in their boiling points by referring to the TYPE and the STRENGTH of these intermolecular forces and the amount of energy required. (4)

[11]

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QUESTION 5

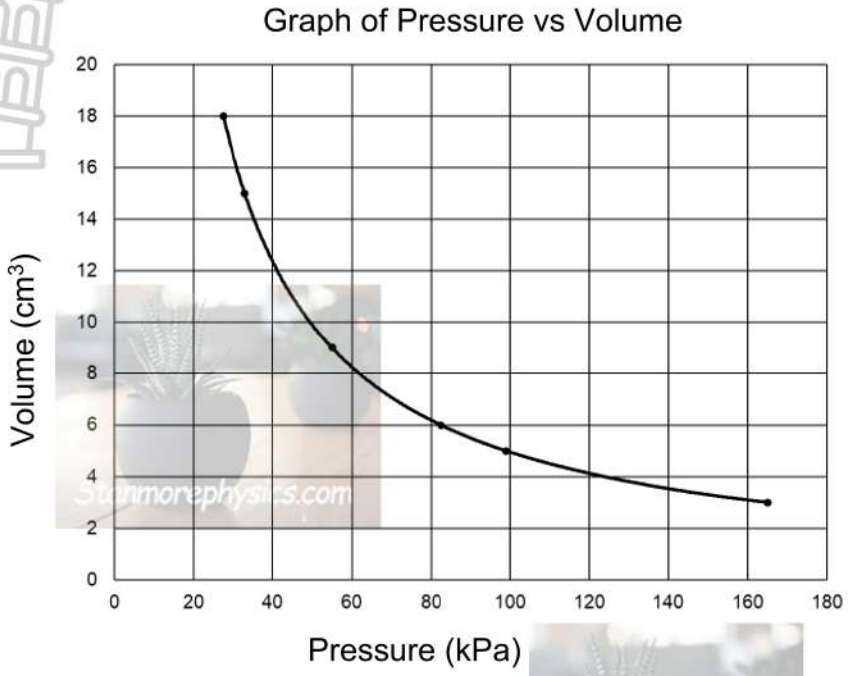
During an investigation to determine the relationship between pressure and volume of a given mass of gas, a group of learners set up the apparatus as shown below.



5.1 Name the apparatus shown above. (2)

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The learners use the pump to change the pressure on the gas. From their results, they obtained the graph shown below.



5.2 State Boyle's law. (2)

5.3 Identify the following variables:

5.3.1 Independent variable (1)

5.3.2 Dependent variable (1)

5.3.3 Controlled variable (1)

5.4 Use the graph and state the pressure of the gas when the volume of the gas is 4 cm^3. (2)

5.5 State TWO conditions under which a real gas to deviate from the behaviour of an ideal gas. (2)
[11]

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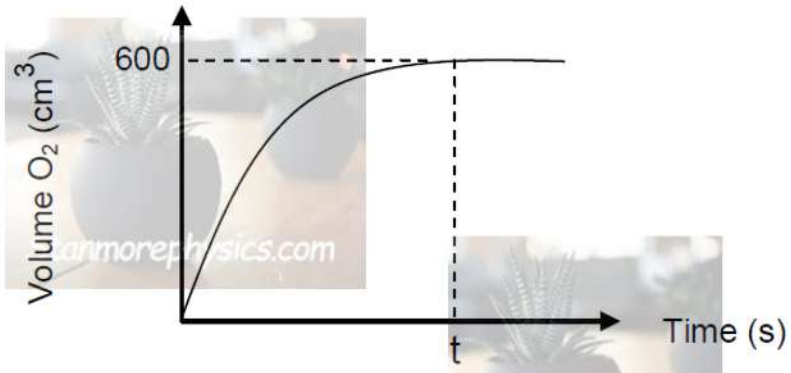
QUESTION 6

6.1 The decomposition of water in the presence of a catalyst under STANDARD CONDITIONS is given according to the unbalanced chemical equation:

$$H_2O(\ell) \rightarrow H_2(g) + O_2(g)$$

The oxygen gas formed is collected using a syringe and the volume is recorded over a period of time. The reaction reaches completion at time **t**.

The results are plotted on a graph of volume of O_2 versus time, as shown below.



Take the molar volume of gases under STANDARD CONDITIONS as 24 dm^3.

6.1.1 Balance the above chemical equation. (2)

6.1.2 How would a catalyst affect the reaction? (2)

6.1.3 Use the information from the graph to calculate the mass of water that decomposed. (7)

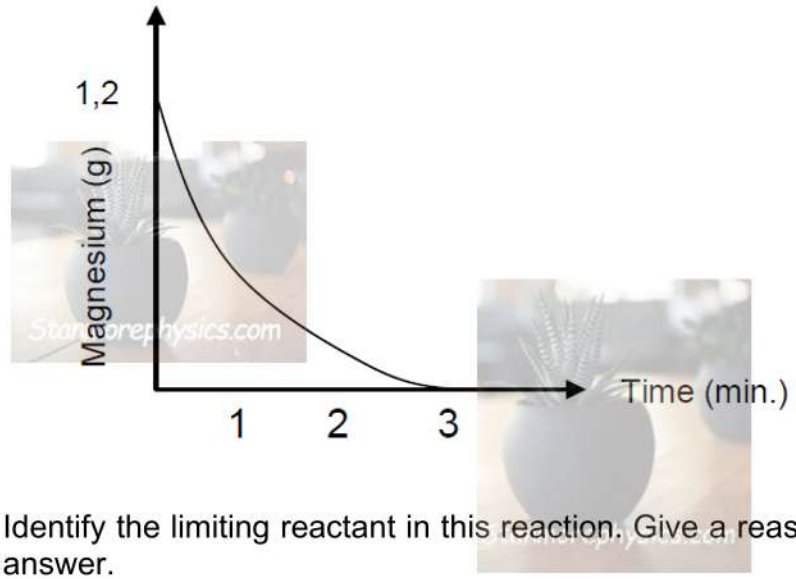
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6.2 In an experiment, a learner adds 550 cm^3 hydrochloric acid (HCℓ), with a concentration of 0,38 $mol.dm^{-3}$, to 1,2 g of magnesium in a test tube. He records the change in mass of magnesium as the reaction proceeds at regular intervals.

The balanced chemical equation for the reaction is:

$$Zn(s) + 2HC\ell(aq) \rightarrow ZnC\ell_2(aq) + H_2(g)$$

The change in the mass of magnesium during the reaction is shown on the graph below.



6.2.1 Identify the limiting reactant in this reaction. Give a reason for the answer. (2)

6.2.2 Calculate the number of moles of UNREACTED hydrochloric acid after 3 minutes. (7)

[20]

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QUESTION 7

7.1 Vinegar is a dilute form of acetic acid. A sample of acetic acid has the following percentage composition: 39,9% carbon, 6,7% hydrogen and 53,4% oxygen.

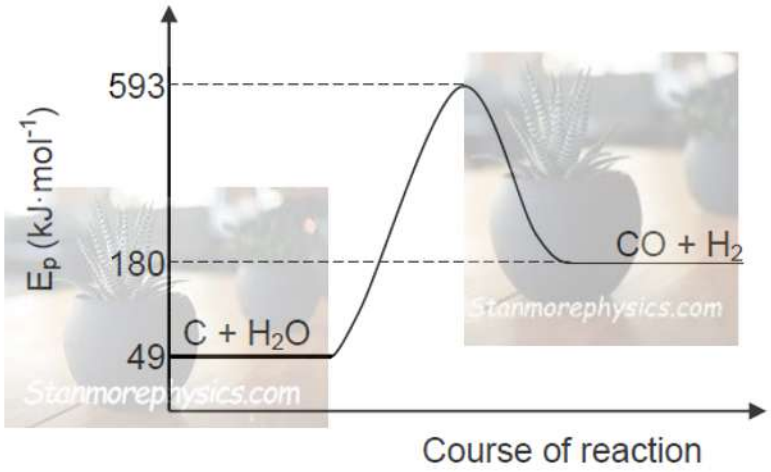
7.1.1 Determine the molecular formula of acetic acid if the molar mass of acetic acid is 60 $g.mol^{-1}$. (6)

7.1.2 Give a reason why acetic acid is regarded as a monoprotic acid. (2)

7.2 The balanced equation for the reaction of carbon with steam is:

$$C(s) + H_2O(g) \rightarrow CO(g) + H_2(g)$$

The graph below, NOT drawn to scale, represents the change in potential energy of the substances during the reaction.



7.2.1 Define the term *heat of reaction*. (2)

7.2.2 Is the reaction ENDOTHERMIC or EXOTHERMIC? Use the information from the graph to give a reason for the answer. (2)

7.2.3 Determine the heat of the reaction. (3)

7.2.4 Redraw the graph for the reaction above. Use BROKEN LINES to indicate the effects of adding a catalyst. (4)

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QUESTION 8

8.1 Consider the balanced equations for the reactions of water with hydrochloric acid and ammonia:

REACTION 1: $HC\ell\,(aq) + H_2O(\ell) \rightarrow H_3O^+(aq) + C\ell^-(aq)$

REACTION 2: $NH_3(aq) + H_2O(\ell) \rightarrow NH_4^+(aq) + OH^-(aq)$

8.1.1 Define an acid according to Lowry-Bronsted theory. (2)

8.1.2 Write down the FORMULA of ONE conjugate acid-base pair in REACTION 2. (2)

8.1.3 Is the solution formed in REACTION 1 ACIDIC or BASIC? Give a reason for the answer. (2)

8.1.4 Define the term *ampholyte*. Give the NAME of a substance that acts as an ampholyte in the reactions above. (3)

8.2 A solution of sodium hydroxide, with concentration of 0,3 $mol.dm^{-3}$ is added to a 100 cm^3 volumetric flask.

8.2.1 Determine the pH of the sodium hydroxide solution. (5)

A sample of nitric acid with volume of 65 cm^3 and unknown concentration is added to the sodium hydroxide solution above.

The excess nitric acid is then neutralised using 15 g of magnesium hydroxide.

The balanced equation for the reactions is:

STEP 1: $HNO_3(aq) + NaOH(aq) \rightarrow NaNO_3(aq) + H_2O(\ell)$

STEP 2: $HNO_3(aq) + Mg(OH)_2(aq) \rightarrow Mg(NO_3)_2(aq) + 2H_2O(\ell)$

8.2.2 Calculate the initial concentration of nitric acid added to the sodium hydroxide solution. (8)

[22]

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QUESTION 9

9.1 Oxidation numbers make it easier to determine whether an element or a substance is oxidised or reduced during a chemical reaction.

9.1.1 Define the term *oxidation* with reference to oxidation numbers. (2)

9.1.2 Calculate the oxidation number of chromium in $Cr_2O_7^{2-}$. (1)

9.1.3 Calculate the oxidation number of oxygen in H_2O. (1)

9.2 The reaction between permanganate ions (MnO_4^-) and hydrogen sulphide (H_2S) is:

$$MnO_4^-(aq) + H^+(aq) + H_2S(g) \rightarrow Mn^{2+}(aq) + S(s) + H_2O(\ell)$$

9.2.1 Define *reduction* in terms of electron transfer. (2)

9.2.2 Write down the FORMULA of the reducing agent. (1)

9.2.3 Explain the answer to QUESTION 9.2.2 in terms of oxidation numbers. (2)

9.2.4 Write down the reduction half-reaction. (2)

9.2.5 Use the ion-electron method and write down the balanced net ionic equation. (4)
[15]

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*
Standard pressure *Standaarddruk*	$p^\ominus$	$1{,}013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	22,4 $dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	$T^\ominus$	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	

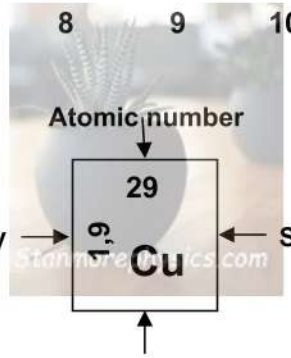
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THE PERIODIC TABLE OF ELEMENTS

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 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	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
0,7 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

KEY



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

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
$Cl_2(g) + 2e^- \rightleftharpoons 2Cl^-$	+ 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
$\mathbf{2H^+ + 2e^- \rightleftharpoons H_2(g)}$	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 oxidising ability/*Toenemende oksiderende vermoë* ↑

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*	$E^{\ominus}$ (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

Increasing reducing ability/*Toenemende reduserende vermoë* ↑

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PROVINCIAL ASSESSMENT /
PROVINSIALE ASSESSERING

GRADE/*GRAAD* 11

PHYSICAL SCIENCES: CHEMISTRY (P2)

FISIESE WETENSKAPPE: CHEMIE (V2)

AMENDED MARKING GUIDELINE 2026

MARKS/PUNTE: 150

These marking guidelines consist of 11 pages.
Hierdie nasienriglyne bestaan uit 11 bladsye.

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QUESTION/*VRAAG* 1

1.1 B ✓✓ (2)

1.2 D ✓✓ (2)

1.3 A ✓✓ (2)

1.4 C ✓✓ (2)

1.5 B ✓✓ (2)

1.6 C ✓✓ (2)

1.7 B ✓✓ (2)

1.8 B/D ✓✓ (2)

1.9 B ✓✓ (2)

1.10 B ✓✓ (2)

[20]

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QUESTION/*VRAAG* 2

2.1 The energy needed to break one mole of its molecule into separate atoms. ✓✓
(2 or/of 0)
Die energie benodig om een mol van sy molecule in aparte atome op te breek. ✓✓ (2)

2.2.1 (-) 426 kJ.mol^{-1} ✓ (1)

2.2.2 74 x 10^{-12} m ✓✓ (2)

2.3 At point 3: the forces of attraction between the nuclei of atoms and the outer most electron shells are equal forces of repulsion ✓ between the electron shells of the atoms, which results in formation of a stable molecule.

At point 4: the forces of repulsion between nuclei of atoms and electron shells become stronger✓ due to atoms moving closer to one another, this results in atoms being unstable due to weak forces of attraction. ✓

By punt 3: die aantrekkingskragte tussen die kerne van atome en die mees uiterste elektronskil is gelyk aan as afstootkragte ✓ tussen die elektronskil van die atome, wat 'n resultaat het op die vorming van 'n stabiele molekuul.

By punt 4: die afstootkragte tussen die kerne van die atome en die elektronskil word sterker ✓ as gevolg van die atome wat nader aan mekaar beweeg, dus veroorsaak dit dat atome onstabiel is weens die swak aantrekkingskragte. (3)
[8]

QUESTION/*VRAAG* 3

3.1 Mutual attraction between two atoms resulting from the simultaneous attraction between their nuclei and outer electrons. **(2 or/of 0)** ✓✓
Wedersydse aantrekking tussen twee atome as gevolg van die gelyktydige aantrekking tussen hulle kerne en die uiterste elektrone. ✓✓ (2)

3.2 S is more electronegative than Aℓ and it is more likely to be the negative ion than Aℓ. ✓
S is meer elekronegatief as Aℓ en het daarom 'n groter moontlikheid om die negatiewe-ioon te vorm as Aℓ. ✓ (1)

3.3.1 ΔEN = 3,0 – 0,9
= 2,1 ✓
The bond is more polar/*Die binding is meer polêr.* ✓ (2)

3.3.2 ΔEN = 3,5 – 2, 1
= 1,4✓

The bond is polar/*Die binding is polêr* ✓ (2)

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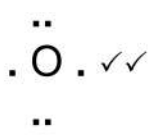
3.3.3 $\Delta EN = 3,5 - 2,5$
$= 1$ ✓

The bond is polar/*Die binding is polêr* ✓ (2)

3.4.1 Tetrahedral/*Tetrahëdries* ✓✓ (2)

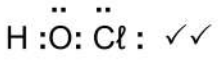
3.4.2 Bent/ angular /*Gebuig / hoekig* ✓✓ (2)

3.5.1



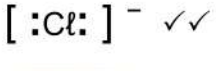
(2)

3.5.2



(2)

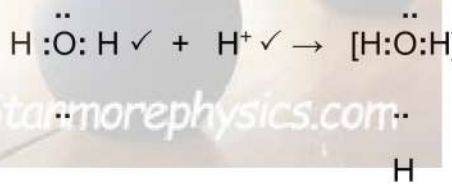
3.5.3



(2)

3.6.1 <u>Dative covalent/Coordinate covalent</u> bond / *Datief-kovalente binding* ✓ (1)

3.6.2



(4)
[24]

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QUESTION/*VRAAG* 4

4.1 The temperature at which vapour pressure of a (substance) equals the atmospheric pressure✓✓ **(2 or/*of* 0)**
Die temperatuur waarby die dampdruk van 'n (vastestof) gelyk is aan die atmosferiese druk. ✓✓ (2)

4.2 Hydrogen bonds/*Waterstofbindings* ✓✓ (2)

4.3.1 B/HCℓ ✓ (1)

4.3.2 A/HF✓ it has the highest boiling point./*dit het die hoogste kookpunt.* ✓ (2)

4.4
- A/HF has hydrogen bonds✓, and C/HBr has dipole-dipole forces. ✓
- A/HF has stronger intermolecular forces than C/HBr. ✓
- A/HF requires more energy to overcome the intermolecular forces than C. **OR** C/HBr requires less energy to overcome intermolecular forces. ✓

- *A/HF het waterstofbindings* ✓, *en C/HBr het dipool-dipool kragte* ✓
- *A/HF het sterker intermolekulêre kragte as C/HBr.* ✓
- *A/HF benodig meer energie om die intermolekulêre kragte te oorkom as C **OF** C/Br benodig minder energie om die intermolekulêre kragte te oorkom.* ✓

(4)
[11]

QUESTION/*VRAAG* 5

5.1 Boyle's (law) apparatus/pressure gauge//*Boyle se (wet) apparat/ druk meter* ✓✓ (2)

5.2 The pressure of an enclosed gas is inversely proportional to the volume it occupies at constant temperature. **(2 or/of 0)**✓✓
Die druk van 'n ingeslote gas is omgekeerd eweredig aan die volume wat dit opneem by konstante temperatuur. ✓✓ (2)

5.3.1 Pressure/*druk* ✓ (1)

5.3.2 Volume ✓ (1)

5.3.3 Temperature/*Temperatuur*/mass of gas/*massa van gas* ✓ (1)

5.4 (120 – 125)✓ kPa ✓

NOTE: (**if only kPa is written without magnitude award 0**)
NOTA: (indien slegs kPa geskryf is sonder 'n waarde ken 0 toe.) (2)

5.5 High pressure/*Hoë druk* ✓ and/*en* low temperature/*lae temperatuur* ✓ (2)
[11]

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QUESTION/*VRAAG* 6

6.1.1 $2H_2O\ (g) \rightarrow 2H_2(g) + O_2(g)$ ✓✓ (2)

6.1.2 It will speed up the rate of reaction✓ by creating an alternative path which will lower the activation energy✓
Dit sal die reaksietempo versnel ✓ deur 'n alternatiewe weg te maak die aktiveringsenergie sal verlaag. ✓ (2)

6.1.3 $n = \frac{V}{V_m}$

$= \frac{0,6}{24}$✓

$= 0,025\ mol$✓ of O_2

mole ratio/*mol verhouding*

$H_2O : O_2$
2 : 1 ✓
$nH_2O = 0,05\ mol$

$n = \frac{m}{M}$ ✓

$0,05$ ✓ $= \frac{m}{18}$ ✓

m = 0,9 g ✓ (7)

6.2.1 Mg/Magnesium/Zn/Zinc/*Sink*✓, it is used completely/*dit word heeltemal opgebruik* ✓ in a reaction/*in die reaksie*. (2)

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6.2.2

Option 1: Magnesium used	**Option 2: Zinc used**
$n = \frac{m}{M}$ ✓ $= \frac{1,2}{24}$ ✓ $= 0,05\ mol$ of Mg Mg : HCl 1 : 2 ✓ n(HCl) = 0,1 mol nHCl = cv = (0,38)(0,55) ✓ = 0,209 mol (initial/*aanvanklik*) nHCl(unreacted/*ongereageer*) =0,209 – 0,1 ✓✓ = 0,109 mol ✓	$n = \frac{m}{M}$ ✓ $= \frac{1,2}{65}$ ✓ $= 0,0185\ mol$ of Zn Zn : HCl 1 : 2 ✓ n(HCl) = 0,037 mol nHCl = cv = (0,38)(0,55) ✓ = 0,209 mol (initial/*aanvanklik*) nHCl(unreacted/*ongereageer*) = 0,209 – 0,037 ✓✓ = 0,172 mol ✓

(7)

[20]

QUESTION 7

7.1.1 n(C) = $\frac{39,9}{12}$ ✓ = 3,33 mol n(H) = $\frac{6,7}{1}$ ✓ = 6,7 mol n(O) = $\frac{53,4}{16}$ ✓ = 3,34 mol

Ratio 1:2:1✓

Empirical formula is/*Empiriese formule is* CH_2O

30 : 60 ✓
1 : 2

Molecular formula is/*Molekulêre formule is* $C_2H_4O_2$ ✓ (6)

7.1.2 It donates one hydrogen ion/ proton ✓✓
Dit skenk een waterstof ioon/proton ✓✓ (2)

7.2.1 Energy absorbed or released per mole✓✓ (in a chemical reaction). **(2 or/*of* 0)**
Energie absorbeer of afgegee per mol ✓✓ *(in 'n chemiese reaksie)* (2)

7.2.2 ENDOTHERMIC ✓ energy of products is higher than energy of reactants/energy of reactants is less than energy of products. ✓
ENDOTERMIESE ✓ *energie van produkte is hoër as die energie van die reaktante/energie van reaktante is laer as energie van produkte.* ✓

(2)

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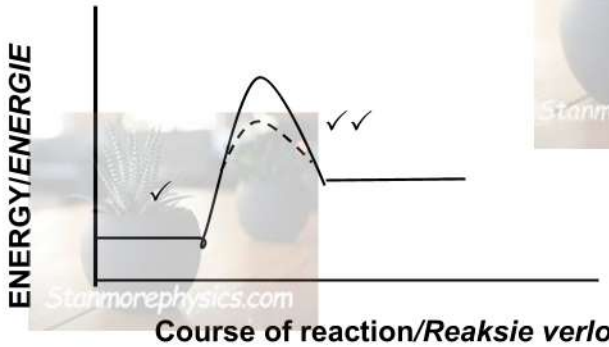
OR

NOTE: If heat of reaction is used for explanation, calculation should be done to award a mark.
NOTA: Indien hitte van reaksie gebruik word as verduideliking, moet berekening gedoen wees om punt toe te ken.

$\Delta H = 180 - 49$
$= + 131 \text{ kJ.mol}^{-1}$
$\therefore \Delta H > 0$ ✓

7.2.3 $\Delta H = H_{products/produkte} - H_{reactants/reaktante}$ ✓
$= 180 - 49$ ✓
$= + 131 \text{ kJ.mol}^{-1}$ ✓ (3)

7.2.4



Course of reaction/*Reaksie verloop* ✓

Marking Criteria/*Nasien kriteria*	
Labelling both X and Y axis/ *Benoeming van die X en Y as*	✓
Indicating broken lines with lower peak/*Stippellyne met laer piek aangedui.*	✓✓
Correct shape of the graph/ *korrekte grafiek vorm*	✓

(4)
[19]

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QUESTION/*VRAAG* 8

8.1.1 A proton donor./*'n Proton skenker* ✓✓ (2)

8.1.2 NH_3 ✓ and/*en* NH_4^+ ✓ **OR** H_2O ✓ and/*en* OH^- ✓ (2)

8.1.3 ACIDIC/*SUUR* ✓ it produces hydronium ions/*dit produseer hydroniumione* ✓ (2)

8.1.4 A substance that acts as an acid or a base./*'n Vastestof was as suur en as basis optree.* ✓✓
Water✓ (3)

8.2.1

Option 1	**Option 2**
$[OH^-] = [NaOH]$ $= 0,3\ mol.dm^{-3}$ $K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ $[H_3O^+](0,3)$ ✓ $= 1 \times 10^{-14}$ ✓ $[H_3O^+] = 3,33 \times 10^{-14}$ $pH = -\log[H_3O^+]$✓ $= -\log(3,33 \times 10^{-14})$✓ $= 13,48$ ✓	$[OH^-] = [NaOH]$ $= 0,3\ mol.dm^{-3}$ $pOH = -\log[OH^-]$✓ $= -\log(0,3)$ ✓ $= 0,52$ $pH = 14$ ✓ $- 0,52$ ✓ $= 13,48$✓

(5)

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8.2.2

Option 1: Ratio 1:2 (HNO_3 and $Mg(OH)_2$)	**Option 2** Ratio 1:1 (HNO_3 and $Mg(OH)_2$)
$n = \frac{m}{M}$ both ✓ $nMg(OH)_2 = \frac{15}{58}$ ✓ $= 0,259$ (mol) $nHNO_3 = \frac{1}{2}n(Mg(OH)_2)$ ✓ $= 0,1295$ mol $c = \frac{n}{V}$ $0,3 = \frac{n}{0,1}$ ✓ $n = 0,03$ mol $nHNO_3 = nNaOH$ $= 0,03$ mol $nHNO_{3\ initial} = \frac{0,03 + 0,1259}{}$ ✓✓ $= 0.156$ mol $c = \frac{n}{V}$ $= \frac{0,156}{0,065}$ ✓ $= 2,46$ mol.dm^{-3} ✓	$n = \frac{m}{M}$ $nMg(OH)_2 = \frac{15}{58}$ ✓ $= 0,259$ (mol) both ✓ $nHNO_3 = (Mg(OH)_2)$ ✓ $= 0,259$ mol $c = \frac{n}{V}$ $0,3 = \frac{n}{0,1}$ ✓ $n = 0,03$ mol $nHNO_3 = nNaOH$ $= 0,03$ mol $nHNO_{3\ initial} = \frac{0,03 + 0,259}{}$ ✓✓ $= 0,289$ mol $c = \frac{n}{V}$ $= \frac{0,289}{0,065}$ ✓ $= 4,446$ mol.dm^{-3} ✓

(8)
[22]

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QUESTION/*VRAAG* 9

9.1.1 Increase in oxidation number./*Laat oksidasiegetal toeneem* ✓✓ (2)

9.1.2 Cr = +6✓ (1)

9.1.3 O = -2 ✓ (1)

9.2.1 Gain of electrons./*Wins in elektrone* ✓✓ (2)

9.2.2 H_2S / S^{2-} ✓ (1)

9.2.3 The oxidation number of S increases✓ from -2 to 0. ✓
Die oksidasiegetal van S neem toe ✓ van -2 na 0. ✓ (2)

9.2.4 $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ ✓✓ (2)

9.2.5 $H_2S \rightarrow S + 2H^+ 2e^-$ ✓
$MnO_4^- + 8H^+ + 5e^- \rightarrow 2Mn^{2+} + 4H_2O$
$2MnO_4^- + 5H_2S + 6H^+$ ✓$\rightarrow 2Mn^{2+} + 5S + 8H_2O$ ✓ balancing/*balansering* ✓ (4)
[15]

TOTAL/*TOTAAL*: 150

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