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KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES P2

PROVINCIAL STANDARDISED ASSESSMENT

NOVEMBER 2026

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MARKS: 100

DURATION: 2 hours

This question paper consists of 10 pages and 2 data sheets.

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INSTRUCTIONS AND INFORMATION

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

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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 (1.1–1.7) in the ANSWER BOOK, for example 1.8 E.

1.1 Which ONE of the following is a mixture?

A KCl(s)

B NaCl(aq)

C $H_2O(l)$

D $CO_2(g)$ (2)

1.2 When atom Y of an element in Group 17 (VII) forms the ion Y^-, the…

A Mass number of Y increases

B Atomic number of Y decreases

C Number of protons decreases

D Number of electrons increases (2)

1.3 The energy released when an electron is attached to an atom or molecule to form a negative ion is…

A Electron affinity

B Electronegativity

C Ionisation energy

D First ionisation energy (2)

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1.4 Which ONE of the following contains the largest number of atoms?

A 18 g of H_2O

B 22g of CO_2

C 32g of O_2

D 17g of NH_3 (2)

1.5 Consider the following statements regarding evaporation:

(i) Evaporation occurs only at the surface of a liquid.
(ii) Evaporation can occur at temperatures below the boiling point.
(iii) The temperature of the remaining liquid decreases during evaporation. downloaded from Stanmorephysics.com

Which of the above statement(s) is/are TRUE?

A (i) only.

B (i) and (ii) only.

C (ii) and (iii) only.

D (i), (ii) and (iii). (2)

1.6 Consider the unbalanced chemical equation below:

$$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$$

Which ONE of the sets of coefficients will balance the equation?

A 2, 6, 4, 6

B 2, 7, 4, 6

C 4, 7, 4, 6

D 1, 4, 2, 3 (2)

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1.7 Consider the balanced chemical equation for the reaction below:

$$CH_4\,(g) + H_2O(g) \longrightarrow CO(g) + 3H_2\,(g)$$

The number of H_2O molecules required to form $44{,}8dm^3$ of H_2 at STP is…

A $\frac{1}{2} \times 6{,}02 \times 10^{23}$

B $\frac{1}{3} \times 6{,}02 \times 10^{23}$

C $\frac{2}{3} \times 6{,}02 \times 10^{23}$

D $2 \times 6{,}02 \times 10^{23}$

(2)

[14]

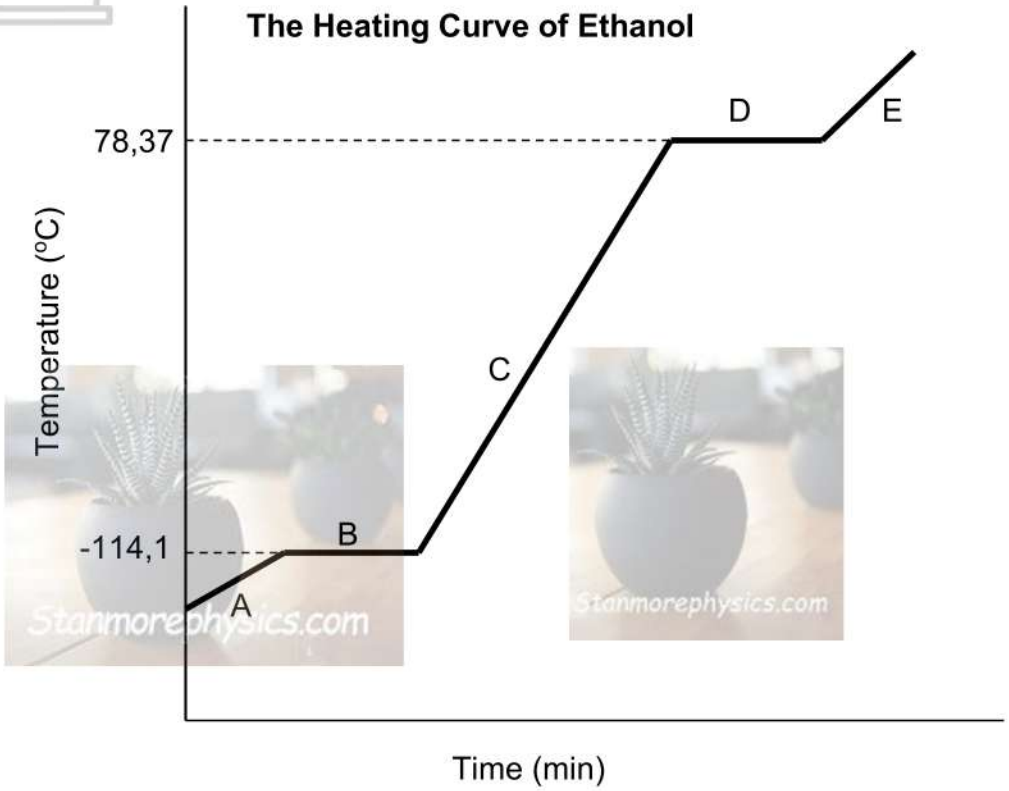
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QUESTION 2 (Start on a new page.)

Grade 10 learners investigated the effect of increasing temperature on a sample of ethanol at standard atmospheric pressure. The temperature of the ethanol was recorded at regular time intervals and the results were used to construct the heating curve shown below.



2.1 Define the term *melting point*. (2)

2.2 Write down the:

2.2.1 value of the standard atmospheric pressure (1)

2.2.2 phase of ethanol at 0 °C (1)

2.3 Consider sections **D and E** of the graph.

2.3.1 State whether the change occurring during section D is a PHYSICAL CHANGE or CHEMICAL CHANGE.
Give a reason for your answer. (2)

2.3.2 Explain why the temperature remains constant during section D but increases during section E, even though the ethanol is continuously heated. (4)

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2.4 In which region, **A**, **C** or **E**, are the forces between ethanol particles the strongest? (1)

2.5 A gaseous mixture of **ethanol and water** is cooled at standard atmospheric pressure. The aim is to separate the two substances by cooling.

2.5.1 The mixture is initially at 110 °C.
Select a suitable temperature from the following values to cause the water vapour to change into a liquid while the ethanol remains a gas: **50 °C, 75 °C, 90 °C or 105 °C.**
Give a reason for your choice. (2)

2.5.2 Name the phase change that occurs when the water vapour changes into a liquid. downloaded from stanmorephysics.com (1)

2.6 How does the average kinetic energy of the water particles compare to ethanol particles at 50 °C?
Choose from GREATER THAN, LESS THAN or EQUAL TO. (1)

[15]

QUESTION 3 (Start on a new page.)

3.1 A scientist analyses a **1 000 g sample of seawater** and obtains the following results:

Substance	**Mass (g)**
Water (H_2O)	965
Sodium chloride (NaCl)	27
Magnesium chloride ($MgCl_2$)	3
Magnesium sulphate	2
Other substances	3

Note: The "Other substances" indicated in the table above, DO NOT contain any chloride ions (Cl^-).

3.1.1 Is seawater a MIXTURE or a PURE SUBSTANCE?
Give a reason for the answer? (2)

3.1.2 Write down the chemical formula for magnesium sulphate. (1)

3.1.3 Draw the Lewis structure for magnesium chloride ($MgCl_2$). (2)

3.1.4 Determine the number of chloride ions (Cl^-) in the 1000 g seawater sample. (7)

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3.2 Use the balanced chemical equation below to prove the law of conservation of mass.

$$MgCl_2\ (aq) + 2NaOH(aq) \rightarrow Mg(OH)_2(s) + 2NaCl(aq)$$ (3)

3.3 When aluminium hydroxide is heated, aluminium oxide and water are formed.

3.3.1 Write a balanced chemical equation for the above reaction. (3)

3.3.2 Is the above reaction an example of a SYNTHESIS or DECOMPOSITION reaction?
Explain your answer. (2)

[20]

QUESTION 4 (Start on a new page.)

4.1 A 200 g sample of chromium (Cr) contains four naturally occurring isotopes. The masses of three of the isotopes in the sample are shown below.

Isotope	Mass (g)
Cr - 50	8,7
Cr - 52	167,58
Cr - 53	Unknown
Cr - 54	7,42

4.1.1 Define the term *isotope*. (2)

4.1.2 Write down the number of neutrons in the most abundant isotope of chromium. downloaded from Stanmorephysics.com (1)

4.1.3 Determine the relative atomic mass of chromium. (4)

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4.2 W, X, Y and Z represent four elements on the periodic table.

- W has three occupied energy levels and two valence electrons.
- X has the same electronic configuration as the W^{2+} ion.
- Y has two valence electrons and is found in the same period as X on the periodic table.
- Z has one less proton than W.

4.2.1 Write down the:

(a) NAME of element **W**. (1)

(b) Electronic configuration (s-p notation) of the W^{2+} ion. (1)

(c) Letter that represents a noble gas element. (1)

4.2.2 Draw the Aufbau diagram for element Z. (2)

4.2.3 Arrange elements W, X, Y and Z in order of increasing atomic radius.
Explain your answer by referring to the **atomic structure** of the elements. (5)

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[17]

QUESTION 5 (Start on a new page.)

5.1 A compound is made up of Carbon (C), Hydrogen (H) and Oxygen (O) only. A 0,5 kg sample of this compound consists of 230,77 g Carbon (C) and 38,46 g Hydrogen (H).

5.1.1 Define the term *empirical formula* in words. (2)

5.1.2 Calculate the mass of oxygen (O), in the sample. (1)

5.1.3 Determine the empirical formula of this compound. (5)

5.2 A hydrated salt has the formula $Na_2S_2O_3 \cdot \mathbf{x}H_2O$. The salt contains 36,29% water by mass.
Determine the number of moles of water of crystallisation ,***x***, in the formula of the salt. (4)

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[12]

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QUESTION 6 (Start on a new page.)

Potassium chlorate ($KClO_3$) reacts with hydrochloric acid (HCl) according to the balanced equation below:

$$KClO_3\,(s) + 6HCl(aq) \rightarrow KCl(aq) + 3Cl_2(g) + 3H_2O(l)$$

In one such reaction a learner completely reacts 34,25 g potassium chlorate ($KClO_3$) with excess hydrochloric acid (HCl) at standard temperature and pressure (STP).

6.1 Calculate the number of moles of $KClO_3$ that reacted. (3)

6.2 Determine the number of H_2O molecules formed. (4)

15,68 dm^3 of chlorine gas (Cl_2) is formed at STP.

6.3 Determine the percentage yield of Cl_2. (5)

[12]

QUESTION 7 (Start on a new page.)

Aluminium is heated in excess oxygen, until all the aluminium has reacted, to produce aluminium oxide (Al_2O_3). The aluminium oxide is then reacted completely with hydrochloric acid (HCl).

The reactions are represented by the following balanced equations:

Reaction 1:

$$4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$$

Reaction 2:

$$Al_2O_3(s) + 6HCl(aq) \rightarrow 2AlCl_3(aq) + 3H_2O(l)$$

The aluminium oxide (Al_2O_3) produced from a sample of aluminium is reacted completely with 150 cm^3 of 2 $mol \cdot dm^{-3}$ hydrochloric acid.

7.1 Define the term *concentration* in words. (2)

7.2 Calculate the:

7.2.1 Number of moles of HCl that reacted. (3)

7.2.2 Mass of aluminium in the original sample. (5)

[10]

TOTAL: 100

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DATA FOR PHYSICAL SCIENCES GRADE 10

CHEMISTRY

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Standard pressure	p^{θ}	$1,013 \times 10^5$ Pa
Molar gas volume at STP	V_m	22,4 $dm^3 \cdot mol^{-1}$
Standard temperature	T^{θ}	273 K
Avogadro's constant	N_A	$6,02 \times 10^{23}$ mol^{-1}

TABLE 2: FORMULAE

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ or $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$

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TABLE 3: THE PERIODIC TABLE OF ELEMENTS

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 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	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/*SLEUTEL*

- **Atomic number** / ***Atoomgetal***
- **Electronegativity** / ***Elektronegatiwiteit***
- **Symbol** / ***Simbool***
- **Approximate relative atomic mass** / ***Benaderde relatiewe atoommassa***

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GRADE 10

PHYSICAL SCIENCES P2

FINAL EXAMINATION MARKING MEMORANDUM

NOVEMBER 2026

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QUESTION 1

1.1 B ✓✓ (2)
1.2 D ✓✓ (2)
1.3 A ✓✓ (2)
1.4 D ✓✓ (2)
1.5 D ✓✓ (2)
1.6 B ✓✓ (2)
1.7 C ✓✓ (2)
[14]

QUESTION 2

2.1 The temperature at which a solid, given sufficient heat, becomes a liquid. ✓✓ (2)

2.2.1 1,013 x 10^5 Pa / 101,3 kPa✓ (1)

2.2.2 Liquid ✓ (1)

2.3.1 Physical (change). ✓
No new substance is formed. OR No chemical reaction took place. ✓ (2)

2.3.2 In section D, phase change occurs/ Energy is used to weaken the forces between particles. ✓ The average kinetic energy of the particles remain constant ✓
In section E, the particles move faster✓, therefore the average kinetic energy of the particles increase. ✓ (4)

2.4 A ✓ (1)

2.5.1 90°C ✓
The temperature is between the boiling points of ethanol and water. OR
The temperature is between 78,37 °C and 100 °C ✓ (2)

2.5.2 Condensation ✓ (1)

2.6 Equal to ✓ (1)

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QUESTION 3

3.1.1 Mixture. ✓

It consists of different substances that are not chemically combined. ✓ (2)

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3.1.2 $MgSO_4$ ✓ (1)

3.1.3

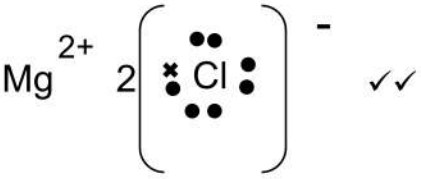
OPTION 1



✓✓

OR

OPTION 2



✓✓

(2)

3.1.4

$$n(NaCl) = \frac{m}{M}$$

$$= \frac{27}{58,5} \checkmark$$

$$= 0,46 \text{ mol}$$

$$n(NaCl) = \frac{N}{N_A}$$

$$0,46 = \frac{N}{6,02 \times 10^{23}} \checkmark$$

$N(NaCl) = 2,77 \times 10^{23}$ formula units

$N(Cl^-) = 2,77 \times 10^{23}$ ions

$$n(MgCl_2) = \frac{m}{M}$$

$$= \frac{3}{95} \checkmark$$

$$= 0,0316 \text{ mol}$$

$$n(MgCl_2) = \frac{N}{N_A}$$

$$0,0316 = \frac{N}{6,02 \times 10^{23}} \checkmark$$

$N(MgCl_2) = 1,902 \times 10^{22}$ formula units

$N(Cl^-) = \underline{2 \times} \checkmark 1,902 \times 10^{22}$

$= 3,804 \times 10^{22}$ ions

$N(Cl^-)_{total} = 2,77 \times 10^{23} + \checkmark 3,804 \times 10^{22}$

$= 3,15 \times 10^{23}$ (ions)✓ (7)

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3.2 Mass of reactants = [24 + 35,5x2] + 2[23 +16+1] ✓ = 175 g.mol^{-1}
Mass of products = [24 + 2(16 + 1)] + 2[23+35,5] ✓ = 175 g.mol^{-1}
Mass of reactants is equal to the mass of products. Therefore mass is conserved. ✓ (3)

3.3.1 $2Al(OH)_3 \rightarrow Al_2O_3 + 3H_2O$ LHS ✓
RHS ✓
Balancing ✓ (3)

3.3.2 Decomposition ✓
Aluminium hydroxide/ a molecule is breaking down into two molecules (in the presence of heat) ✓ (2)

[20]

QUESTION 4

4.1.1 Atoms of the same element having the same number of protons, but different number of neutrons. ✓✓ (2)

4.1.2 28 ✓ (1)

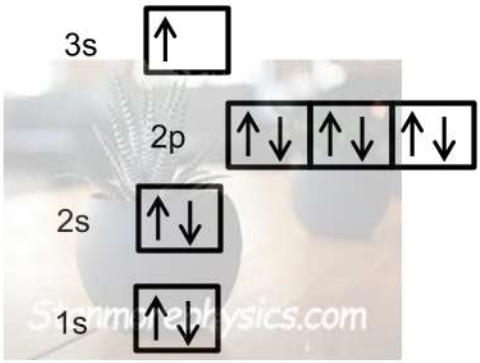
4.1.3 $RAM = 50 \times \frac{8,7}{200} + 52 \times \frac{167,58}{200} + 53 \times \frac{16,3✓}{200} + 54 \times \frac{7,42}{200}$ ✓✓ *(2 Marks awarded for addition in no particular order)*
= 52,07 AMU✓ (4)

4.2.1.a Magnesium ✓ (Accept Tungsten) (1)

4.2.1.b $1s^2\ 2s^2\ 2p^6$ ✓ (1)

4.2.1.c X ✓ (1)

4.2.2 (2)



✓ ✓

(Accept if orbitals are drawn as circles and circles are touching for the P orbital)

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4.2.3 X, Y, W, Z / Ne, Be, Mg, Na ✓

- Across a period, the increase in nuclear charge results in a stronger force of attraction between the nucleus and outer orbital.

OR

Across a period, an additional valence electron is added to the outer orbital, and an additional proton is added to the nucleus, resulting in a stronger force of attraction between the nucleus and outer orbital. ✓

- Therefore Y/Be is larger the X/Ne and Z/Na is larger than W/Mg. ✓
- Period 3 elements have an additional energy level. ✓
- Therefore W/Mg is larger than Y/Be. ✓ (5)

[17]

QUESTION 5

5.1.1 The simplest whole-number ratio of atoms in a compound. ✓✓ (2)

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5.1.2 m(O) = 500 – (230,77 + 38,46)
= 230,77 g✓ (1)

5.1.3

Marking criteria: POSITIVE MARKING FROM 5.1.2

- Calculate the number of moles of each element (3 x 1 = 3) ✓✓✓
- Determine the simplest ratio of all elements ✓
- Final answer: $C_4H_8O_3$ ✓

Element	mass (g)	$n = \frac{m}{M}$	Simplest Ratio			
C	230,77	$\frac{230,77}{12} = 19,23$ ✓	$\frac{19,23}{14,42} = 1,33$	✓	x 3	4
H	38,46	$\frac{38,46}{1} = 38,46$ ✓	$\frac{38,46}{14,42} = 2,67$			8
O	230,77	$\frac{230,77}{16} = 14,42$ ✓	$\frac{14,42}{14,42} = 1$			3

Empirical Formula: $C_4H_8O_3$ ✓ (5)

5.2 $\%\ H_2O = \frac{x \times M(H_2O)}{M(Na_2S_2O_3.xH_2O)} \times 100$

$36,29 = \frac{18x\checkmark}{158 + 18x\ \checkmark} \times 100$ ✓

$x = 5$ ✓ (4)

[12]

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QUESTION 6

6.1 $n(KClO_3) = \frac{m}{M}$ ✓

$= \frac{34,25}{122,5}$ ✓

$= 0,28$ mol ✓ (3)

6.2 **POSITIVE MARKING FROM 6.1**

$KClO_3 : H_2O$

1 : 3

0,28 : 0,84 ✓

$n(H_2O) = \frac{N}{N_A}$ ✓

$0,84 = \frac{N}{6,02 \times 10^{23}}$ ✓

$N(H_2O) = 5,06 \times 10^{23}$ (molecules) ✓ (4)

6.3 **POSITIVE MARKING FROM 6.1**

$KClO_3 : Cl_2$

1 : 3

0,28 : 0,84 ✓

OR

$H_2O : Cl_2$

3 : 3 (or 1:1)

0,84 : 0,84 ✓

$n(Cl_2) = \frac{V}{V_m}$ ✓

$0,84 = \frac{V}{22,4}$ ✓

$V(Cl_2) = 18,816\ dm^3$

$\%\ yield = \frac{actual\ yield}{theoretical\ yield} \times 100$

$= \frac{15,68}{18,816} \times 100$ ✓

$= 83,33\ \%$ ✓ (5)

[12]

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QUESTION 7

7.1 The number of moles of solute per cubic decimetre of solution. ✓✓ (2)

7.2.1 $c(HCl) = \frac{n}{V}$ ✓

$2 = \frac{n}{0,15}$ ✓

$n(HCl) = 0,3$ mol✓ (3)

7.2.2 **POSITIVE MARKING FROM 7.2.1**

$HCl : Al_2O_3$

6 : 1

0,3 : 0,05 mol✓

$Al_2O_3 : Al$

1 : 2 (OR 2:4)

0,05 : 0,1 mol✓

$n(Al) = \frac{m}{M}$ ✓

$0,1 = \frac{m}{27}$ ✓

$m(Al) = 2,7g$ ✓ (5)

[10]

TOTAL: 100

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