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education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 10

PHYSICAL SCIENCES: CHEMISTRY (P2)
NOVEMBER 2024

MARKS: 100

TIME: 2 hours

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

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of EIGHT questions. Answer ALL the questions in the ANSWER BOOK.
2. Start the answers to EACH question at the top of a NEW page.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub-questions, e.g., between QUESTION 2.1 and QUESTION 2.2
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show ALL formulae and substitutions in ALL questions.
8. Round off your FINAL numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. You are advised to use the 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 1.7) in the ANSWER BOOK, e.g. 1.8 E.

1.1 The process when a solid substance change directly to gaseous phase is called …

A evaporation.

B condensation.

C sublimation.

D boiling. (2)

1.2 Which ONE of the following substances is a pure substance?

A Steel

B Sulphur

C Juice

D Salt water (2)

1.3 Which ONE of the following represents the electronic structure of Phosphorus (P).

A $1s^2 2s^2 2p^6 3s^2$

B $1s^2 2s^2 2p^6 3s^2 3p^3$

C $1s^2 2s^2 2p^6 3s^2 3p^5$

D $1s^2 2s^2 2p^6 3s^2 3p^6$ (2)

1.4 In which ONE of the following compounds do covalent bond occur between elementary particles?

A Sodium chloride

B Mercury

C Ammonia

D Carbon (2)

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1.5 What is the percentage of hydrogen in a molecule of hydrogen peroxide with molar mass of 34 g.mol^{-1}, if one mole of hydrogen reacts with one mole of oxygen?

A 72,72 %

B 94,12 %

C 11,11 %

D 5,88 % (2)

1.6 If 30 g of reactant A reacts completely with 25 g of reactant B, which ONE of the following statements is CORRECT?

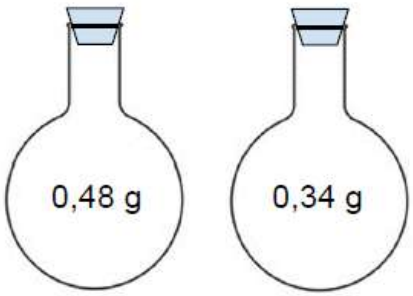
A The total mass of the products will be equal to 55 g.

B The total mass of products for any unreacted reactants will be less than 55 g.

C The total mass of products for any unreacted reactants will be greater than 55 g.

D The total mass of products for any unreacted reactants will be 55 g. (2)

1.7 Two identical flasks are filled with different gasses at the same temperature and pressure. One flask contains ozone (O_3) and the other an unknown gas X.



The mass of the ozone gas in the flask is 0,48 g and the mass of gas X in the flask is 0,34 g. Gas X is:

A O_2

B SO_2

C H_2S

D NH_3 (2)

[14]

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QUESTION 2

2.1 In the table below are different substances. Use the following substances to answer the questions that follow.

	SUBSTANCES
A	Cobalt
B	Gold
C	Phosphorus
D	Silicon
E	Air
F	Ammonium nitrate

2.1.1 Identify the ELEMENT that has a dull surface and cannot conduct electricity. (1)

2.1.2 Identify ONE substance that is ductile. (1)

2.1.3 Which element has magnetic properties? (1)

2.1.4 Identify the element that is a metalloid. (1)

2.1.5 Write down the chemical formula for substance F (Ammonium nitrate). (2)

2.2 The base of a frying pan is made from aluminium while the handle is made of hard plastic.

2.2.1 What benefit does the base of the pan, made from aluminium, have? (1)

2.2.2 Why would the handle of the pan be made of plastic? (1)
[8]

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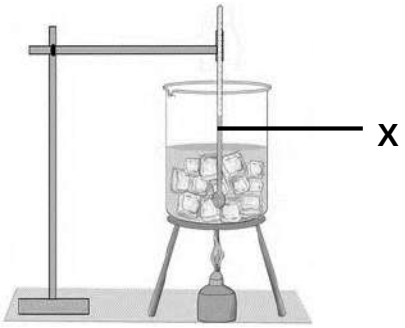
QUESTION 3

Grade 10 learners conducted an experiment to determine the heating curve of water by using ice cubes. The experiment was set up as shown below.

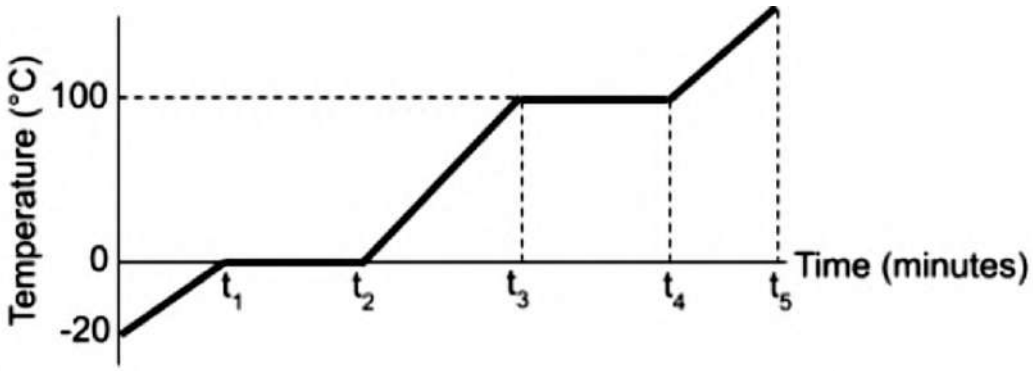


3.1 Define the term *temperature*. (2)

3.2 Name the apparatus labelled X. (1)

3.3 Why is it important to continuously stir the melting ice with a glass rod? (1)

3.4 The graph below shows the results of the experiment.



3.4.1 Name the process taking place between t_1 and t_2. (1)

3.4.2 Will the water particles move SLOWER or FASTER between t_2 and t_3 when compared to the movement of the particles between 0 and t_1? Give a reason for your answer. (2)

3.4.3 Will the potential energy between t_3 and t_4 INCREASE, DECREASE or REMAIN THE SAME? (1)

3.4.4 Can the particles be compressed between t_4 and t_5? Answer YES or NO only. (1)

3.4.5 The forces between particles of ethanol are weaker than those in water. Will the boiling point for ethanol be GREATER THAN or LESS THAN 100 °C under the same standard conditions? (1)

[10]

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QUESTION 4

4.1 Naturally occurring oxygen consists of three isotopes indicated below:

ISOTOPE	PERCENTAGE ABUNDANCE (%)
O-16	99,76
O-17	0,04
O-18	X

4.1.1 Define *isotopes*. (2)

4.1.2 What percentage abundance does O-18 occupy? (2)

4.1.3 Calculate the relative atomic mass of oxygen. (4)

4.2 Aluminium is a metal and a good conductor of electricity.

4.2.1 Name the type of bonding between the aluminium atom that makes it a good conductor of electricity. (1)

4.2.2 State AND explain another one property of aluminium that can be attributed to the type of bond identified. (2)

Aluminium reacts with nitrogen according to the following reaction equation:

$$A\ell + N_2 \rightarrow A\ell N$$

4.2.3 Name the product that forms. (2)

4.2.4 Use Lewis diagrams to show how the product is formed. (4)
[17]

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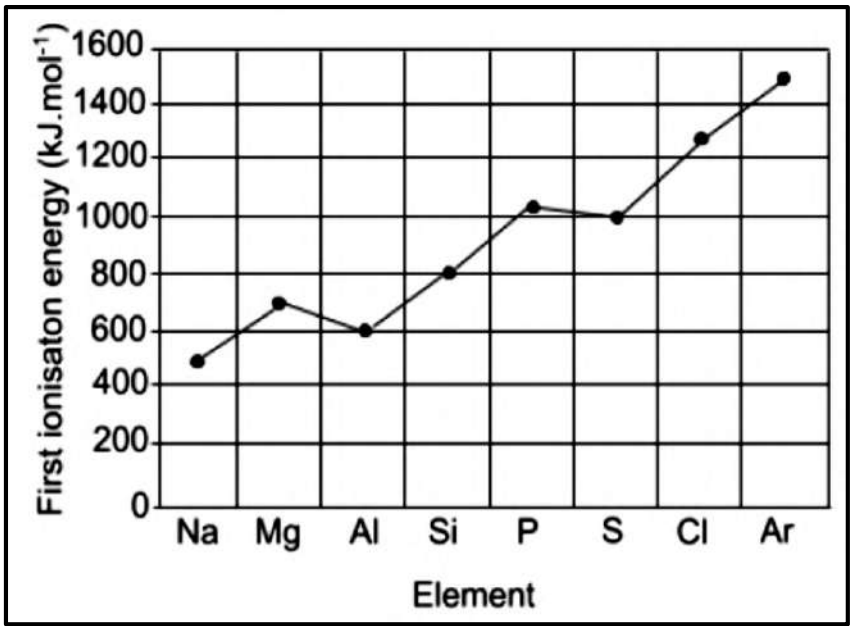
QUESTION 5

The graph below shows the first ionisation energies of the elements of period 3 in the periodic table.



5.1 Define *ionisation energy*. (2)

5.2 Describe the general trend in the first ionisation energies from sodium to argon. (1)

5.3 Explain the difference in the first ionisation energies of magnesium and chlorine. (4)

5.4 How will the SECOND ionisation energy of sodium compare to its FIRST ionisation energy? Choose from GREATER THAN, EQUAL TO or LESS THAN. Explain your answer. (4)
[11]

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QUESTION 6

6.1 Classify the following as a PHYSICAL or CHEMICAL change.

6.1.1 Iron metal is melted. Explain your answer. (2)

6.1.2 Grey hair is dyed to a red colour. (1)

6.1.3 A car rusts. (1)

6.2 The balanced equation for the reaction is:

$$2\ Pb(NO_3)_2(s) \rightarrow 2\ PbO(s) + 4\ NO_2(g) + O_2(g)$$

6.2.1 What type of reaction is shown above? (1)

6.2.2 By use of a calculation prove that the law of conservation of mass is TRUE for this reaction. (5)

6.2.3 When 6,62 g of lead nitrate [$Pb(NO_3)_2$] is heated, 4,46 g of solid is produced. What is the mass of gas that will be produced? (2)

6.3 Balance the following reaction equation:

$$NH_3(g) + O_2(g) \rightarrow NO(g) + H_2O(\ell)$$ (2)

[14]

QUESTION 7

7.1 Calculate the concentration of a solution prepared by dissolving 5,85 g of sodium chloride in enough water to make a 500 cm^3 solution. (4)

7.2 Explain the concept of water of crystallisation and give the formula of a common hydrated salt. (3)

7.3 A learner heats 5 g of a hydrated salt until all the water of crystallisation has evaporated, leaving 3 g of the anhydrous salt. Determine the percentage of water of crystallisation in the hydrated salt. (2)

[9]

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QUESTION 8

There are several steps in the production of fertelisers. In the third step, nitrogen dioxide is absorbed by water to produce nitric acid. Nitric acid and ammonia can react together in an acid-base process to form the salt, ammonium nitrate, which is soluble in water.

$$3\ NO_2(g) + H_2O(\ell) \rightarrow 2\ HNO_3(aq) + NO(g)$$

$$NH_3(\ell) + HNO_3(\ell) \rightarrow NH_4NO_3(s)$$

8.1 Define *mole*. (2)

8.2 Give the scientific name of nitric acid. (1)

8.3 Calculate the:

8.3.1 molecular mass of ammonium nitrate. (2)

8.3.2 number of moles of ammonium nitrate if 15 g of it was formed. (3)

8.3.3 volulme of 12 g of nitrogen oxide at STP. (5)

8.3.4 number of nitrogen atoms present in 2 moles of ammonium nitrate. (4)

[17]

TOTAL: 100

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DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 2 (CHEMISTRY)

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

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

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

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

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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)
1 2,1 H 1																	2 He 4
3 1,0 Li 7	4 1,5 Be 9											5 2,0 B 11	6 2,5 C 12	7 3,0 N 14	8 3,5 O 16	9 4,0 F 19	10 Ne 20
11 0,9 Na 23	12 1,2 Mg 24											13 1,5 Aℓ 27	14 1,8 Si 28	15 2,1 P 31	16 2,5 S 32	17 3,0 Cℓ 35,5	18 Ar 40
19 0,8 K 39	20 1,0 Ca 40	21 1,3 Sc 45	22 1,5 Ti 48	23 1,6 V 51	24 1,6 Cr 52	25 1,5 Mn 55	26 1,8 Fe 56	27 1,8 Co 59	28 1,8 Ni 59	29 1,9 Cu 63,5	30 1,6 Zn 65	31 1,6 Ga 70	32 1,8 Ge 73	33 2,0 As 75	34 2,4 Se 79	35 2,8 Br 80	36 Kr 84
37 0,8 Rb 86	38 1,0 Sr 88	39 1,2 Y 89	40 1,4 Zr 91	41 Nb 92	42 1,8 Mo 96	43 1,9 Tc	44 2,2 Ru 101	45 2,2 Rh 103	46 2,2 Pd 106	47 1,9 Ag 108	48 1,7 Cd 112	49 1,7 In 115	50 1,8 Sn 119	51 1,9 Sb 122	52 2,1 Te 128	53 2,5 I 127	54 Xe 131
55 0,7 Cs 133	56 0,9 Ba 137	57 La 139	72 1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 1,8 Tℓ 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po	85 2,5 At	86 Rn
87 0,7 Fr	88 0,9 Ra 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29
1,9 Cu 63,5

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT/
PROVINSIALE ASSESSERING

GRADE/*GRAAD* 10

PHYSICAL SCIENCES: CHEMISTRY (P2)

FISIESE WETENSKAPPE: CHEMIE (V2)

NOVEMBER 2024

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 100

These marking guidelines consists of 6 pages and the cognitive grid.
Hierdie nasienriglyne bestaan uit 6 bladsye en 'n kognitiewe rooster.

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QUESTION/*VRAAG* 1

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

QUESTION/*VRAAG* 2

2.1 2.1.1 C/Phosphorus/*fosfor* ✓ (1)

2.1.2 A/Cobalt/*Kobalt* ✓ **OR** B/Gold/*Goud* ✓ (1)

2.1.3 A/Cobalt/*Kobalt* ✓ (1)

2.1.4 D/Silicon/*Silikon* ✓ (1)

2.1.5 NH_4NO_3 ✓✓ (2)

2.2 2.2.1 Aluminium is a metal that is a thermal conductor./*Aluminium is a metaal wat 'n termiese geleier is.* ✓
OR/*OF*
Aluminium allows heat to pass through easily/*Aluminium laat toe dat hitte maklik deur dit gaan.* ✓ (1)

2.2.2 Plastic is a thermal insulator./*Plastiek is nie 'n termiese geleier nie.* ✓
OR/OF
Plastic does not allow heat to pass through it/*Plastiek laat nie toe dat hitte deur dit gaan nie.* ✓ (1)
[8]

QUESTION/*VRAAG* 3

3.1 Measure of the average kinetic energy of the particles./*Die gemiddelde kinetiese energie van deeltjies.* ✓✓ (2)

3.2 Thermometer/*Termometer* ✓ (1)

3.3 To distribute the heat evenly in the beaker./*Om te verseker dat die hitte eweredelik versprei word.* ✓
OR/*OF*
To keep uniform temperature throughout./*Om univormige deurgans te behou.* ✓ (1)

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3.4 3.4.1 Melting/*Smelt* ✓ (1)

3.4.2 FASTER/*VINNIGER* ✓
The water now exists in the liquid phase./*Die water is nou in die vloeistof fase.* ✓ OR/*OF*
Particles have more kinetice energy./*Deeltjies het meer kinetiese energie.* ✓ (2)

3.4.3 Increase/*Toeneem* ✓ (1)

3.4.4 Yes/*Ja* ✓ (1)

3.4.5 Less than/*Minder as* ✓ (1)
[10]

QUESTION/*VRAAG* 4

4.1 4.1.1 Atoms from the same element with the same atomic number but different mass number due to the difference in the number of neutrons. ✓✓ (2 or 0)/
Atome van dieselfde element met dieselfde atoomgetal maar verskillende massagetal as gevolg van 'n verskil in die aantal neutrone. ✓✓ *(2 of 0)* (2)

4.1.2 % abundance of/ O-18 = 100 – (99,76 + 0,04) ✓
% *oorvloed van* = 0,2 ✓ (2)

4.1.3 Relative atomic mass/*Relatiewe atoommassa*
$= \frac{(99{,}76 \times 16) \checkmark + (0{,}04 \times 17) \checkmark + (0{,}2 \times 18) \checkmark}{100}$
= 16,0044 ✓ (Accept/*Aanvaar:* 16,00) (4)

4.2 4.2.1 Metallic bond/*Metaal binding* ✓ (1)

4.2.2 Aluminium is ductile ✓ as aluminium has an ability to be stretched into a wire. ✓
OR
Aluminium is malleable ✓ as aluminium has an ability to be hammered into shape without breaking. ✓/
Aluminium is rekbaar ✓ *omdat aluminium die vermoë het om in lang drade gestrek te word.* ✓
OF
Aluminium is smeerbaar ✓ *omdat aluminium die vermoë het om in verskillende vorms gehammer te word.* ✓ (2)

4.2.3 Aluminium nitride/*Aluminium nitried* ✓ (2)

4.2.4

(4)
[17]

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QUESTION 5

5.1 The (minimum) energy per mole required to remove an electron from an atom in the gaseous phase. ✓✓ (2 or 0)/
Die (minimum) energy per mol benodig om 'n elektron van 'n atoom in die gasfase te verwyder. ✓✓ (2 *of* 0) (2)

5.2 Ionisasion energy will increase from sodium to argon (Na to Ar).
/ *Ionisasie energie sal toeneem van natrium tot argon (Na na Ar)* ✓ (1)

5.3
- Chlorine has a greater first ionisation energy than magnesium. ✓/
  Chloor het 'n groter eerste ionisasie energie in vergelyking met magnesium. ✓
- Chlorine and magnesium have the same number of energy levels but chlorine has more protons and electrons than magnesium. ✓/
  Chloor en magnesium het dieselfde aantal energie vlakke maar chloor het meer protone en elektrone as magnesium. ✓
- Therefore the chlorine nucleus attracts the valence electrons more strongly ✓ than the magnesium nucleus./
  Gevolglik sal die chloor nukleus die valens elektrone sterker aantrek ✓ *as die magnesium nukleus.*
- More energy is needed in magnesium than in chlorine to overcome the (strong) attractive electrostatic force. ✓/
  Meer energie word benodig in magnesium as in chloor om die (sterk) elektrostatiese aantrekkings kragte te oorkom. ✓ (4)

5.4 GREATER THAN/*GROTER AS* ✓
- The sodium ion has a completely filled outer most energy level ✓ and therefore does not want to lose anymore electrons. / This represents a state of greater stability.
- The second electron to be removed is closer to the nucleus and will experience a greater force of attraction with the nucleus. ✓ Hence more energy will be needed to overcome/break that force./
- *Die natrium ioon het 'n gevulde mees buitenste energie vlak* ✓ *en daarom wil dit nie enige elektrone meer verloor nie. / Dit dui 'n meer stabiele staat aan.*
- *Die tweede elektron wat verwyder moet word is nader aan die nukleus en ondervind 'n groter aantrekkings krag met die nukleus.* ✓ *Gevolglik sal meer energie benodig word om die krag te verswak.breek.* ✓ (4)

[11]

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QUESTION 6

6.1 6.1.1 Physical ✓ A phase/state change takes place ✓ the chemical composition of the metal remains the same./
Fisiese ✓ 'n Fase verandering vind plaas. ✓ die chemise samestelling van die metaal bly dieselfde. (2)

6.1.2 Physical/*Fisiese* ✓ (1)

6.1.3 Chemical/*Chemiese* ✓ (1)

6.2 6.2.1 Decomposition/*Ontbinding* ✓ (1)

6.2.2 2 [207+2(14)+3(16)] ✓=2(207+16)✓+4[14+2(16)] ✓+(2x16)✓
2(207 + 124) = 446 + 184 + 32
662 = 662 ✓ (5)

6.2.3 6,62 g – 4,46 g ✓ = 2,16 g ✓ (2)

6.3 $4\ NH_3(g) + 5\ O_2(g)$ ✓ → $4\ NO(g) + 6\ H_2O(\ell)$ ✓ (2)
[14]

QUESTION 7

7.1

OPTION 1		**OPTION 2**	
n(NaCℓ)	$= \frac{m}{M}$	c(NaCℓ)	$= \frac{m}{MV}$ ✓
	$= \frac{5,85}{58,5}$ ✓		$= \frac{0,1\ ✓}{58,5(0,5)\ ✓}$
	= 0,1 mol		= 0,2 mol.dm^{-3} ✓
c(NaCℓ)	$= \frac{n}{V}$ ✓		
	$= \frac{0,1}{0,5}$ ✓		
	= 0,2 mol.dm^{-3} ✓		

(4)

7.2
- Water of crystallisation refers to the water molecules that are chemically bonded within the crystal structure of a salt./*Kristalwater verwys na die water molekules wat chemies verbind is aan die kristal struktuur van 'n sout.* ✓✓
- $CuSO_4.5H_2O$ ✓ (Accept any other correct forumula/*Aanvaar enige ander korrekte formule*) (3)

7.3 $m(H_2O) = 5 – 3 = 2$ g ✓

$$\%H_2O = \frac{mass\ of\ water\ /\ massa\ water}{mass\ of\ hydrated\ salt\ /\ massa\ van\ die\ gehidriseerde\ sout} \times 100$$

$$= \frac{2}{5} \times 100$$

= 40 % ✓ (2)
[9]

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QUESTION 8

8.1 The number of particles of a substances that is the same as there are atoms in 12 g of carbon-12. ✓✓ (2 or 0)/
Die aantal deeltjies van 'n stof wat dieselfde is as die hoeveelheid atome in 12 g of koolstof-12. ✓✓ (2 *of* 0) (2)

8.2 Hydrogen nitrate/*Waterstof nitraat* ✓ (1)

8.3

8.3.1 $M(NH_4NO_3)$ = 14 + 4(1) + 14 + 3(16) ✓
= 80 g.mol^{-1} ✓ (2)

8.3.2 $n(NH_4NO_3) = \frac{m}{M}$ ✓
$= \frac{15}{80}$ ✓
= 0,19 mol ✓ (3)

8.3.3 M(NO) = 14 + 16
= 30 g.mol^{-1} ✓
$n(NO) = \frac{m}{M}$
$= \frac{12}{30}$ ✓
= 0,4 mol
V(NO) = nV_m ✓
= (0,4)(22,4) ✓
= 8,96 dm^3 ✓ (5)

8.3.4 $N(N_2) = nN_A$ ✓
= 2(6,02 x 10^{23}) ✓ (2) ✓
= 2,41 x 10^{24} nitrogen atoms/*stikstof atome* ✓ (4)
[17]

TOTAL: 100

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