education

MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

FURTHER EDUCATION AND TRAINING

GRADE 10

PHYSICAL SCIENCES P2

JUNE 2025

MARKS: 100

TIME: 2 HOURS

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

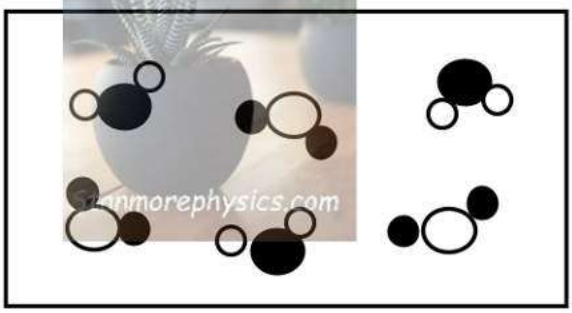
INSTRUCTIONS AND INFORMATION

1. Write your name and class (for example 10 A) in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 7 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, 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 SHEET.
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

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1–1.10) in the ANSWER BOOK, for example 1.11 E.

1.1 The following diagram represents …



A a pure substance

B two different elements

C two different compounds

D a mixture of an element and compound (2)

1.2 The chemical name of $Ca_3(PO_4)_2$?

A Potassium phosphate

B Calcium phosphate

C Carbon phosphate

D Calcium phosphite (2)

1.3 The gas in hairspray is commonly made up of a hydrocarbon compound. The boiling point of this compound is -6°C and its melting point is -121°C. What will the phase of matter of this compound be at 25°C?

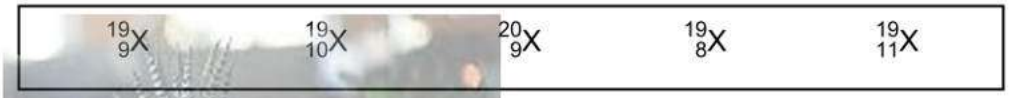
A Gas

B Liquid

C Solid

D Condensation (2)

1.4 Identify the two isotopes from the following atomic symbols.



A $^{19}_{9}X$ and $^{19}_{10}X$

B $^{19}_{11}X$ and $^{19}_{8}X$

C $^{19}_{10}X$ and $^{19}_{11}X$

D $^{19}_{9}X$ and $^{20}_{9}X$ (2)

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

A Electronegativity

B Electron affinity

C Ionization energy

D Atomic radius (2)

1.6 The number of valence electrons the alkali earth metals have.

A 1

B 12

C 2

D 11 (2)

1.7 The atoms of a substance can glide over one another to stretch even though they are tightly bound.

A Good conductor of heat

B Ductile

C Metallic lustre

D Melting point (2)

1.8 The elements A, B and C has atomic numbers between 10 and 18. Atom A has one less electron than a noble gas. Atom B has one more electron than a noble gas. Which type of bond will be formed between atoms A and B.

A Ionic bond

B Covalent bond

C Metallic bond

D Single covalent bond (2)

1.9 Which one of the following represents a physical change?

A Decomposition of hydrogen peroxide

B Combustion of butane

C Heating of hydrogen oxide

D Synthesis of sodium chloride (2)

1.10 A 100 g sample of Magnesium reacts with Oxygen to produce 166 g Magnesium oxide. A second sample Magnesium with a mass of 144 g also reacts with Oxygen. How much Magnesium oxide will be formed in the second sample?

A 86,75 g

B 239,04 g

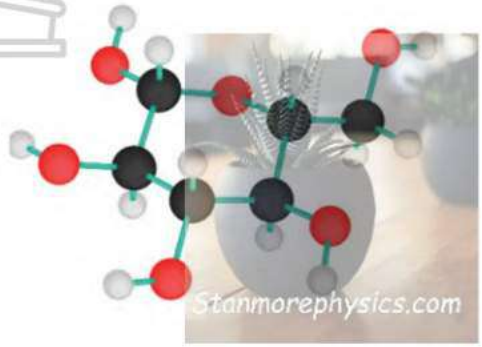
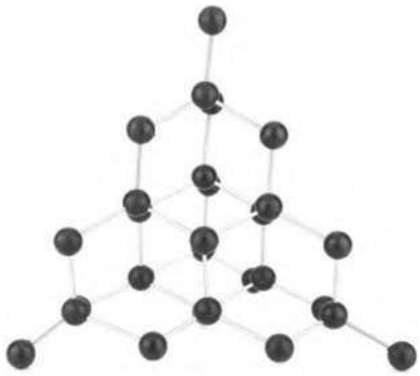
C 115,28 g

D 144 g (2)

[10]

QUESTION 2

2.1 Study the diagrams below and answer the questions.

Substance A	Substance B
	

2.1.1 Define the term *element*. (2)

2.1.2 Classify substance A as an element, compound or mixture. (1)

2.1.3 Classify substance B as an element, compound or mixture. (1)

2.1.4 How many different atoms are present in substance A? (1)

2.1.5 Write the formula of a molecule of substance A by making use of any alphabet letters. (1)

2.2 Four types of materials are shown below.

Metals	Glass
	
Metalloids	**Plastics**
	

Choose the material that would be explained by each of the following descriptions. Write down only the type of material next to the question numbers (2.2.1-2.2.4).

2.2.1 Malleable, melts easily, can be formed but does not conduct electricity. (1)

2.2.2 Strong, hard and is a good conductor of electricity. (1)

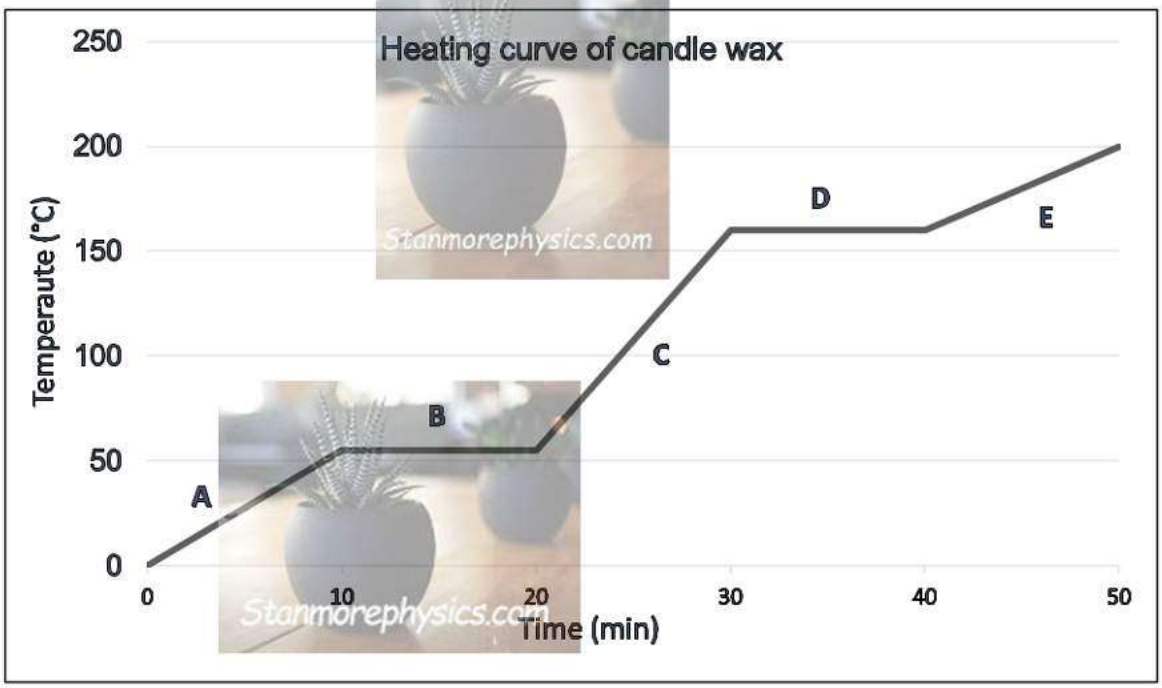
2.2.3 Hard, brittle, strong when compressed but weak when stretched. (1)

2.2.4 Weak conductor of electricity when cold, can be shiny or dull. (1)

[10]

QUESTION 3

A practical investigation was done by some learners to investigate the heating curve of candle wax. Learners heated 100 g of grated candle wax with a Bunsen burner. They used a thermometer to measure the change in temperature over time. Study the graph given below and answer the questions.



3.1 Write down an investigative question for this investigation. (2)

3.2 Write down the dependent variable. (1)

3.3 Write down one controlled variable. (1)

3.4 Write down the phase of candle wax at 100°C. (1)

3.5 State a precaution that must be followed when completing this investigation. (1)

3.6 Indicate the section of the graph that represents the following by making use of the letters A, B, C, D or E.

3.6.1 Melting point (1)

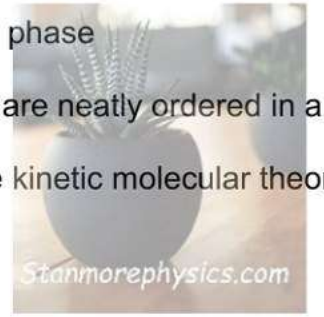
3.6.2 Latent heat (1)

3.6.3 Gaseous phase (1)

3.6.4 Particles are neatly ordered in a fixed pattern (1)

3.7 Explain, using the kinetic molecular theory, what is happening in section B. (3)

[13]



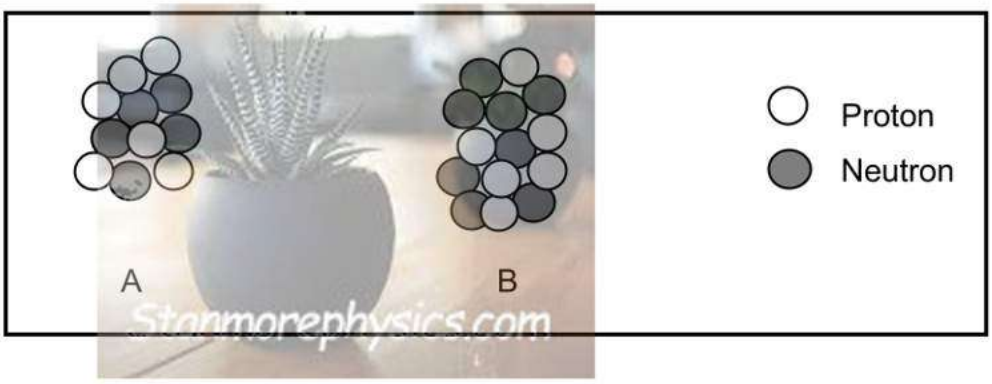
QUESTION 4

4.1 Complete the following table by only writing down the question number (4.1.1–4.1.6) and the answer.

Atom/ Ion	Symbol	Atomic nr	Nucleons	Number of Protons	Number of neutrons	Number of electrons
Sulphur ion	**4.1.1**	16	**4.1.2**	16	16	18
Iron ion	Fe^{3+}	26	56	**4.1.3**	30	**4.1.4**
4.1.5	As	33	75	33	**4.1.6**	32

(6)

4.2 The following diagram shows the nucleus of 2 atoms.



4.2.1 Atoms A and B are the same element. Write down the NAME of this element. (1)

4.2.2 Which term is used to describe different atoms of the same element as represented by atoms A and B? (1)

[8]

QUESTION 5

5.1 Elements on the periodic table is used to the advantage of human beings. Some are more special than others. Study the pictures of some of these elements. Use the pictures and the periodic table to answer the following questions.

5.1.1 To which group of elements does hydrogen belong? Choose between alkali-metal or non-metal. (1)

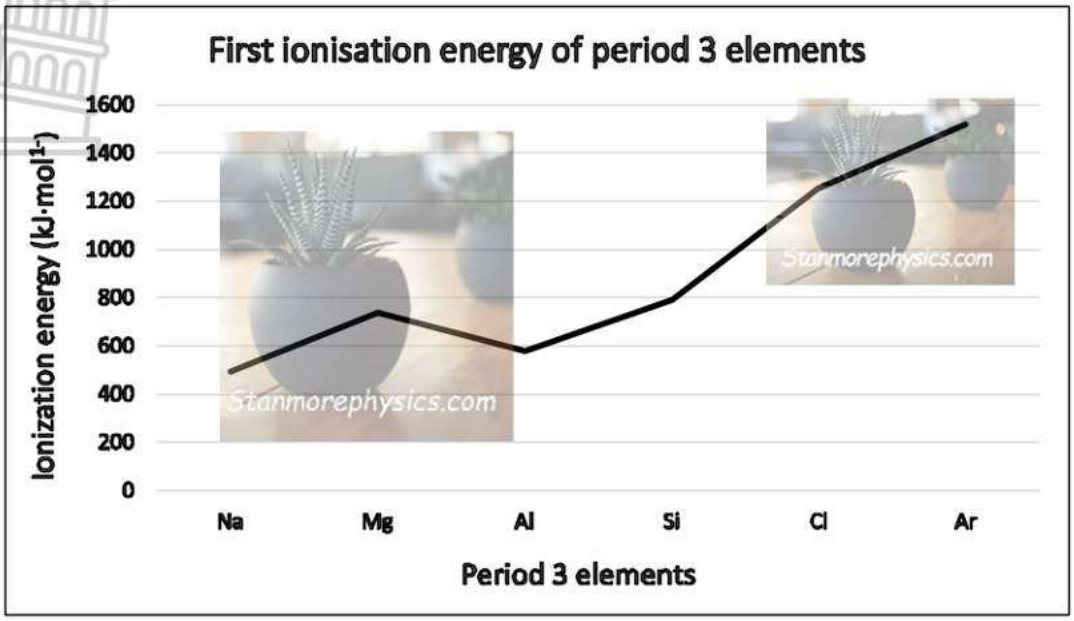
5.1.2 Name any two elements from the pictures that belong to the same period of the periodic table. (2)

5.1.3 When the iron is mixed with a small amount of carbon, an alloy will be formed. Will this alloy be magnetic or non-magnetic? (1)

5.1.4 There are seven elements that exist between the metals and non-metals on the periodic table. What are these elements called? (1)

5.1.5 Name one physical property of this group of elements. (1)

5.2 Study the graph of the ionization energies of elements from period 3 of the periodic table and answer the questions that follow.



5.2.1 Explain why the first ionization energies generally increase from Na to Ar. (2)

5.2.2 Which of these period 3 elements from the graph have the biggest atomic radius? (1)

5.2.3 Write down the NAME of the group on the periodic table which contains the elements that are the most reactive? (1)

5.2.4 Define the term *electronegativity*. (2)

5.2.5 Which of these elements from period 3 from the graph has the highest electronegativity? (1)

5.2.6 Why does Ar have an electron affinity of 0? (2)

[16]

QUESTION 6

6.1 Consider a Magnesium and fluorine atom.

6.1.1 How many valence electrons does fluorine have? (1)

6.1.2 Name the type of bond that you would expect between these two elements. (1)

6.1.3 Which noble gas electron structure does magnesium obtain during this bond? (1)

6.1.4 Which forces are acting to keep the particles in this bond close? (1)

6.1.5 Draw the Aufbau diagram of an anion of fluorine. (2)

6.1.6 Make use of Lewis diagrams to show the formation of the bond that forms between magnesium and fluorine. (3)

6.1.7 What type of bond would form between magnesium atoms? (1)

6.2 Ammonia is an inorganic chemical compound of nitrogen and hydrogen with the formula of NH_3.

6.2.1 What type of bond is formed between nitrogen and hydrogen? (1)

6.2.2 Draw the Lewis diagram for ammonia. (2)

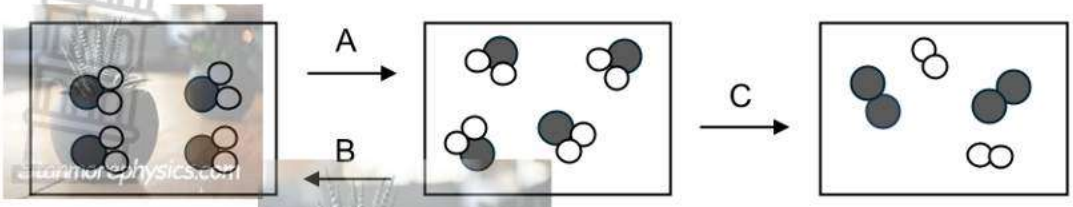
6.2.3 How many shared electron pairs are represented by this molecule? (1)

6.2.4 Calculate the relative molecular mass of ammonia. (2)

[16]

QUESTION 7

7.1 Study the illustration below and answer the questions.



7.1.1 Name the type of change illustrated by process A. (1)

7.1.2 Give a reason for the answer in question 7.1.1. (1)

7.1.3 Name the process illustrated by B. (1)

7.1.4 Is energy released or absorbed during process B? (1)

7.1.5 Name the type of change illustrated by process C. (1)

7.1.6 Give a reason for the answer in question 7.1.5. (1)

7.2 An Alka-Seltzer tablet mainly consists of bicarbonate of soda. The balanced chemical reaction between an Alka-Seltzer tablet and water is as follows:

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

When this experiment is conducted a delivery tube is connected to a balloon that inflates with time.

7.2.1 What is the chemical name for bicarbonate of soda? (1)

7.2.2 Give the meaning of the symbol (ℓ). (1)

7.2.3 What is the function of the balloon in the experiment? (1)

7.2.4 Show that the law of conservation of mass is applicable for this reaction. (3)

7.3 Write a balanced chemical equation for the following word equation. Phosphorous (V) chloride reacts with water to form hydrogen phosphate and hydrochloric acid. (5)

[17]

GRAND TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 10

CHEMISTRY

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10

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* $c=\frac{m}{MV}$

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

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FURTHER EDUCATION AND TRAINING/
VERDERE ONDERWYS EN OPLEIDING

GRADE/GRAAD 10

PHYSICAL SCIENCES/FISIESE WETENSKAPPE

JUNE/JUNIE 2025

MARKING GUIDELINE/MERKRIGLYNE

MARKS/PUNTE: 100

This marking guideline consists of 7 pages.

Hierdie merkriglyne bestaan uit 7 bladsye

QUESTION/VRAAG 1

1.1 C ✓✓

1.2 B ✓✓

1.3 A ✓✓

1.4 D ✓✓

1.5 B ✓✓

1.6 C ✓✓

1.7 B ✓✓

1.8 A ✓✓

1.9 C ✓✓

1.10 B ✓✓

[20]

QUESTION /VRAAG 2

2.1.1 A pure substance that cannot be broken down into simpler substances by chemical means. ✓✓
'n Suiwer stof wat nie afgebreek kan word in eenvoudiger stowwe deur chemiese metodes nie. (2)

2.1.2 Compound / Verbinding ✓ (1)

2.1.3 Element ✓ (1)

2.1.4 Three / Drie ✓ (1)

2.1.5 $A_6B_{12}C_6$ ✓ (1)

2.2.1 Plastics / Plastiek ✓ (1)

2.2.2 Metals / Metale ✓ (1)

2.2.3 Glass / Glas ✓ (1)

2.2.4 Metalloids / Metalloïde ✓ (1)

[10]

QUESTION/VRAAG 3

3.1 What is the relationship between the temperature of heating candle wax

and time in which heat is supplied? ✓✓
Wat is die verhouding tussen die temperatuur van die verwarming van kerswas en die tyd waarin die hitte verskaf word? (2)

3.2 Temperature / Temperatuur ✓ (1)

3.3 Mass/volume of water being heated/heating rate/type of heating source ✓
Massa/volume van water verhit/verwarmingstempo/tipe hittebron (1)

3.4 Liquid / Vloeistof ✓ (1)

3.5 Handle hot materials with care/wear eye protection and a lab coat ✓
Hanteer warm materiale met sorg/dra oogbeskerming en 'n labjas (1)

3.6.1 B ✓ (1)

3.6.2 B or/of D ✓ (1)

3.6.3 E ✓ (1)

3.6.4 A ✓ (1)

3.7 Temperature stays constant. Energy absorbed is used to weaken the intermolecular forces between the molecules. ✓ The molecules move further away from one another and glide over one another. ✓ Phase changes from solid to liquid (melting). ✓
Temperatuur bly konstant. Energie geabsorbeer word gebruik om die intermolekulêre kragte tussen die molekules te verswak. Die molekules beweeg verder weg vanaf mekaar en gly oor mekaar. Fase verander vanaf vastestof na vloeistof (smelt). (1)

[13]

QUESTION/VRAAG 4

4.1.1 S^{2-} ✓ (1)

4.1.2 32 ✓ (1)

4.1.3 26 ✓ (1)

4.1.4 23 ✓ (1)

4.1.5 Arsenic / Arseen ✓ (1)

4.1.6 42 ✓ (1)

4.2.1 Carbon / Koolstof ✓ (1)

4.2.2 Isotopes / Isotope ✓ (1)

[8]

QUESTION/VRAAG 5

5.1.1 Alkali metals / Alkali-metale ✓ (1)

5.1.2 Iron and germanium / Fe and Ge ✓
Yster en germanium / Fe en Ge ✓ (1)

5.1.3 Magnetic / Magneties ✓ (1)

5.1.4 Metalloids / Metalloïde ✓ (1)

5.1.5
- Good conductors of electricity when warm. ✓
- Poor conductors of electricity when cold.
- Solids at room temperature.
- Have a metallic lustre.
- Are brittle.

Any correct answer

- Goeie geleiers van elektrisiteit wanneer warm
- Swak geleiers van elektrisiteit wanneer koud
- Vastestowwe by kamertemperatuur
- Het 'n metaalglans
- Is bros

Enige ander korrekte antwoorde. (1)

5.1.6 Si ✓ (1)

5.2.1 From Na across the period to Ar the elements have increasing numbers of protons. It causes a greater attraction between the nucleus and the electrons. ✓✓

Vanaf Na regoor die periode tot by Ar het die elemente toenemende getalle protone. Dit veroorsaak 'n groter aantrekking tusssen die kern en die elektrone. (2)

5.2.2 Sodium / Natrium / Na ✓ (1)

5.2.3 Alkali metals / Alkali-metale ✓ (1)

5.2.4 A measure of the tendency of an atom to attract the shared pair of electrons. ✓✓

'n Maatstaf van die geneigdheid van 'n atoom om die gedeelde elektronpaar aan te trek. (2)

5.2.5 Chlorine / Cℓ ✓ (1)

5.2.6 Ar has a filled outer energy level (complete octet) ✓ which makes it stable. ✓ **OR** A lot of energy would be needed to remove an electron from the octet which is strongly held by the positive nucleus. **OR** The loss of an electron would make element X unstable with an incomplete octet.

Ar het 'n gevulde buitenste energievlak (volledige oktet) wat dit stabiel maak. **OF** Baie energie word benodig om 'n elektron vanaf die oktet te verwyder wat baie sterk deur die positiewe kern aangetrek word. **OF** Die verlies aan 'n elektron sal element X onstabiel maak met 'n onvolledige oktet. (2)

5.2.7 Element X has an extra energy level since it is in period 3 and is therefore bigger due to the extra electrons. ✓

Element X het 'n ekstra energievlak aangesien dit in periode 3 is en daarom groter is as gevolg van die ekstra elektrone. (1)

[16]

QUESTION/VRAAG 6

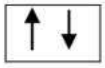
6.1.1 7 ✓ (1)

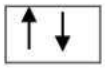
6.1.2 Ionic bond / Ioniese binding ✓ (1)

6.1.3 Neon ✓ (1)

6.1.4 Forces of attraction / Aantrekkingskragte ✓ (1)

6.1.5 2p  ✓

2s 

1s  ✓

Marking criteria/Merkriglyne:

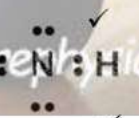
- Core electrons/Kern electrone ✓
- Valence electrons/Valenselektrone ✓

(2)

6.1.6  ✓ ✓ ✓Balancing/Balansering (3)

6.1.7 Metallic bond / Metaalbinding ✓ (1)

6.2.1 Covalent bond / Kovalente binding ✓ (1)

6.2.2  ✓ ✓

Marking criteria/Merkriglyne:

- Bonded hydrogens/Gebinde waterstowwe ✓
- Lone pair of electrons/Alleenpare elektrone ✓

(2)

6.2.3 Three / Drie / 3 ✓ (1)

6.2.4 M_r (NH_3) = 14 + 3(1) ✓

= 17 g·mol^{1-} ✓ (2)

[16]

QUESTION/VRAAG 7

7.1.1 Physical change / Fisiese verandering ✓ (1)

7.1.2 No new compounds were formed. ✓ **OR** The phase of the substance changed.
Geen nuwe verbindings was gevorm. **OF** Die fase van die stof het verander. (1)

7.1.3 Freezing / Vries ✓ (1)

7.1.4 Released / Vrygestel ✓ (1)

7.1.5 Chemical change / Chemiese verandering ✓ (1)

7.1.6 Reactants are rearranged to form new products with new properties. ✓ **OR** New chemical bonds are formed. **OR** The new product formed cannot be separated by physical means.
Reaktante word herrangskik om nuwe produkte met nuwe eienskappe te vorm. **OF** Nuwe chemiese bindings vorm. **OF** Die nuwe produk gevorm kan nie deur fisiese metodes geskei word nie. (1)

7.2.1 Sodium hydrogen carbonate / Natrium waterstof karbonaat ✓ (1)

7.2.2 Liquid / Vloeistof ✓ (1)

7.2.3 The balloon inflates as carbon dioxide / gas collects inside it. ✓
Die ballon blaas op soos koolstofdioksied / gas binne versamel. (1)

7.2.4 $NaHCO_3 + H_2O \rightarrow NaOH + H_2O + CO_2$

$23+1+12+(3)16 + (2)1+16$ ✓ $\rightarrow 23+16+1 + (2)1+16 + 12+(2)12$ ✓

$102\ g \rightarrow 102\ g$ ✓ (3)

7.2 PCl_5 ✓ $+ 4H_2O$ ✓ $\rightarrow H_3PO_4$ ✓ $+ 5HCl$ ✓ ✓Balancing/Balansering (5)

Marking criteria/Merkriglyne:

- Each compound correctly written / Elke verbinding korrek geskryf ✓
- Correct balancing / Korrekte balansering ✓

[17]

GRAND TOTAL/GROOTTOTAAL 100