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education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 10

PHYSICAL SCIENCES: CHEMISTRY (P2)

JUNE 2024

MARKS: 75

TIME: 1½ hours

This question paper consists of 8 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 FIVE 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, 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 calculations.
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 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 1.5) in the ANSWER BOOK, e.g. 1.6 C.

1.1 The process where a solid substance change directly to a gas is called:

A Evaporation

B Condensation

C Sublimation

D Melting (2)

1.2 The number of neutrons of $^{24}_{12}Mg$ is:

A 6

B 24

C 36

D 12 (2)

1.3 In which ONE of the following compounds do metallic bond occur between elementary particles?

A Sodium chloride

B Mercury

C Water

D Sulphur (2)

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1.4 Which ONE of the following is correct regarding a PHYSICAL CHANGE of a substance?

(i) No new substances are formed.
(ii) Intermolecular forces are broken.
(iii) Energy changes are large.
(iv) Number of atoms are conserved.

A (i), (ii) and (iv) only

B (i), (iii) and (iv) only

C (i), (ii) and (iii) only

D (i) and (ii) only (2)

1.5 Which ONE of the following represents 1 mole of a substance?

A 16 g oxygen gas

B 2 g hydrogen gas

C 22,4 dm^3 copper

D 22,4 cm^3 nitrogen gas (2)
[10]

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QUESTION 2 (Start on a new page.)

Study the list below that shows a variety of substances.

glass; bromine; copper wire; table salt; air; sodium chloride

2.1 Define a *pure substance*. (2)

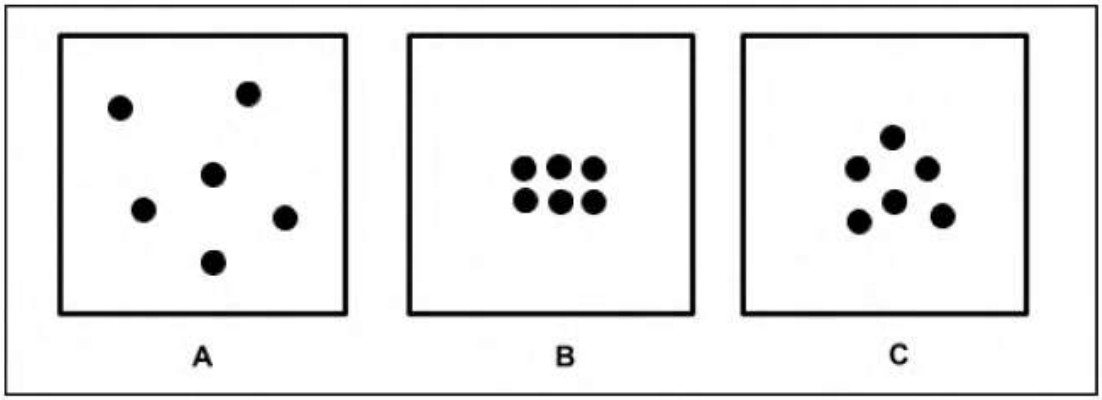
2.2 Use the information above and write down:

2.2.1 ONE substance that is a mixture. (1)

2.2.2 ONE substance that is malleable. (1)

2.2.3 A substance that is a liquid at room temperature. (1)

2.3 The grade 10 learners are investigating the effect of increasing temperature on three different substances (**A**, **B** and **C**).



2.3.1 Organise the diagrams according to the increasing average kinetic energy of the substances. (3)

2.3.2 Identify the phase which substance C is in? (1)
[9]

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QUESTION 3 (Start on a new page.)

Chlorine is a non-metallic element with an atomic number of 17 and can exist as isotopes.

3.1 Define *isotopes*. (2)

3.2 Natural chlorine consists of Cℓ - 35 and Cℓ - 37.

3.2.1 Write down the sp-notation for Cℓ. (2)

3.2.2 Calculate the relative atomic mass of chlorine if 24,23 % of natural chlorine is Cℓ - 37. (3)

3.2.3 Write down the number of valence electron in a chlorine atom. (1)

3.2.4 What period of the Periodic Table does chlorine belong to? (1)

3.3 Calcium reacts with chlorine to form calcium chloride.

3.3.1 Draw the Aufbau (orbital box) diagram for a calcium-ion. (3)

3.3.2 Write down the chemical symbols of the particles found in the calcium chloride crystal (lattice). (2)

Study the table of the first ionisation energies below and answer the questions that follow.

	FIRST IONISATION ENERGY ($kJ.mol^{-1}$)
Li	520
F	1 681

3.4 Define the term ionisation energy. (2)

3.5 Use the information in the table to:

3.5.1 Explain why the first ionisation energy of Lithium is so much lower compared to that of Fluorine. (3)

3.5.2 Choose from the options below if the second ionisation energy of Lithium will be lower than, higher than or equal to.
Write only LOWER THAN, HIGHER THAN or EQUAL TO. (1)

[20]

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QUESTION 4 (Start on a new page.)

Chlorine gas can be prepared in the laboratory by allowing concentrated hydrochloric acid to react with manganese dioxide. Manganese (II) chloride and water also forms from the reaction.

4.1 Define the term *covalent molecule*. (2)

4.2 Classify the reaction between hydrochloric acid and manganese dioxide as a chemical or physical change. (1)

4.3 Write down:

4.3.1 The Lewis structure for the formation of the water molecule. (4)

4.3.2 Name the chemical bond that exist between atoms of a water molecule. (1)

4.3.3 A balanced chemical equation for the reaction between hydrochloric acid (HCℓ) and manganese dioxide (MnO_2). Show all phases of the reactants and products. (3)

Hydrochloric acid is one of the most used acids in the industry. In one reaction hydrochloric acid is prepared as seen in the balanced chemical equation below.

$$KC\ell + H_2SO_4 \rightarrow KHSO_4 + HC\ell$$

4.4 Give the CHEMICAL NAME of the following compounds:

4.4.1 H_2SO_4 (1)

4.4.2 KCℓ (1)

4.5 Write an ionic equation for the formation of $KHSO_4$. (3)

4.6 Give the name of the type of bond that is formed in $KHSO_4$. (1)

4.7 Use the law of conservation of mass to show that mass is conserved in the reaction above. (5)
[22]

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QUESTION 5 (Start on a new page.)

The reaction of sodium carbonate and hydrochloric acid produces table salt, water and carbon dioxide according to the following balanced chemical equation.

$$Na_2CO_3 + 2HC\ell \rightarrow 2NaC\ell + H_2O + CO_2$$

5.1 Define the term *mole* of a substance. (2)

5.2 Calculate the:

5.2.1 Molar mass of Na_2CO_3. (2)

5.2.2 Number of atoms in 2 mol of $HC\ell$. (4)

5.2.3 Mole of Na_2CO_3 if 243,8 g was used in this reaction. (3)

5.2.4 Volume of CO_2, if 1,15 mol of CO_2 is produced in this reaction at STP. (3)
[14]

TOTAL: 75

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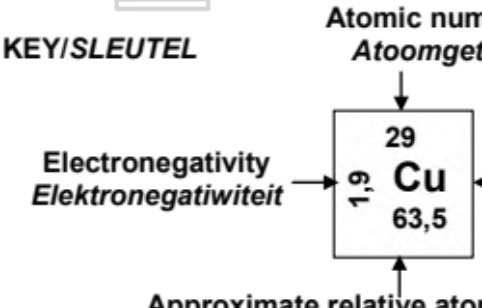
TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*

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*



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PROVINCIAL ASSESSMENT

GRADE 10

PHYSICAL SCIENCES: CHEMISTRY (P2)

JUNE 2024

MARKING GUIDELINES

MARKS: 75

This marking guideline consists of 6 pages including the cognitive grid.

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QUESTION 1

1.1 C ✓✓
1.2 D ✓✓
1.3 B ✓✓
1.4 A ✓✓
1.5 B ✓✓

[10]

QUESTION 2

2.1 A substance that cannot be separated into simpler components by physical methods. ✓✓ (2)

2.2 2.2.1 Air ✓ (1)

2.2.2 Copper wire ✓ (1)

2.2.3 Bromine ✓ (1)

2.3 2.3.1 B ✓, C ✓, A ✓ (3)

2.3.2 Liquid ✓ (1)

[9]

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QUESTION 3

3.1 Atoms of the same element having the same atomic number/number of protons, but different mass number/number of neutrons. ✓✓ (2)

3.2

3.2.1 $1s^2 2s^2 2p^6 3s^2 3p^5$ ✓✓ (2)

3.2.2 $M_r\ (C\ell) = \frac{35(75,77)\ ✓ + 37(24.23)\ ✓}{100}$

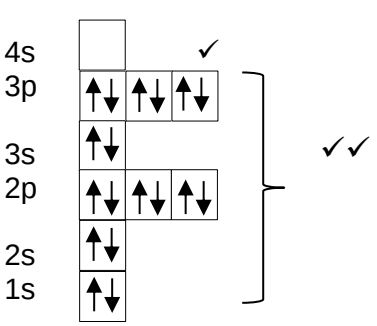
$M_r\ (C\ell) = 35,48$ AMU ✓ (3)

3.2.3 7 ✓ (1)

3.2.4 3 ✓ (1)

3.3

3.3.1 Ca^{2+}



(3)

3.3.2 Ca^{2+} and $C\ell^-$ ✓ (2)

3.4 Energy needed per mole to remove an electron(s) from an atom in the gaseous phase. ✓✓ (2)

3.5 3.5.1 Lithium is a metal that has an electron in the second energy level (1 valence electron). ✓ Its first energy level is full.
Fluorine has 7 electrons in its 2nd energy level (7 valence electrons). ✓
Lithium will rather donate and Fluorine will rather gain an electron. ✓
Therefore the difference in first ionisation energies. (3)

3.5.2 HIGHER THAN ✓ (1)

[20]

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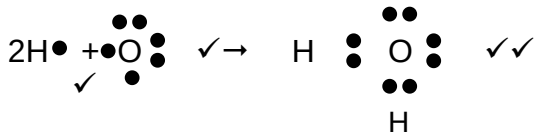
QUESTION 4

4.1 A pure substance that consists of two or more non-metal atoms chemically bonded together through the sharing of electrons. ✓✓ (2)

4.2 Chemical change ✓ (1)

4.3

4.3.1 

(4)

4.3.2 Covalent bond ✓ (1)

4.3.3 $HC\ell\ (aq) + MnO_2\ (s)$ ✓→ $MnC\ell_2\ (aq) + H_2O\ (\ell) + C\ell_2\ (g)$ ✓ ✓ (bal.)

Criteria:
If no phases are indicated or any phase(s) are wrong max $^2/_3$ (3)

4.4

4.4.1 Hydrogen sulphate ✓ (1)

4.4.2 Potassium chloride ✓ (1)

4.5 K^+ ✓+ HSO_4^- ✓→ $KHSO_4$ ✓(balancing) (3)

4.6 Ionic bond ✓ (1)

4.7 (39 + 35,5) ✓+ (2(1)+32+4(16)) ✓ = (39+1+32+4(16)) ✓ + (1+35,5) ✓
74,5 + 98 = 136 + 36,5
172,5 = 172,5 ✓ (5)
[22]

QUESTION 5

5.1 A mole of a substance is the same amount of particles as there is atoms in 12 g of the Carbon-12 isotope. ✓✓ (2)

5.2 5.2.1 $M(Na_2CO_3)$ = 2(23)+12+3(16) ✓
= 106 $g.mol^{-1}$ ✓ (2)

5.2.2 $N(HC\ell) = nN_A$ ✓
= 2 x 6,02 x 10^{23} ✓
= 1,204 x 10^{24} molecules ✓
∴ 2 x 1,204 x10^{24} = 2,408 x 10^{24} atoms ✓ (4)

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5.2.3 **POSITIVE MARKING FROM 5.2.1**

$n = \frac{m}{M}$ ✓

$= \frac{243,8}{106}$ ✓

= 2,3 mol ✓ (3)

5.2.4 $n(CO_2) = \frac{V}{V_m}$ ✓

$1,15 = \frac{V}{22,4}$ ✓

$V(CO_2)$ = 25,76 dm^3 ✓ (3)

[14]

TOTAL: 75

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SUBJECT:	PHYSICAL SCIENCES				ASSESSMENT TASK:	JUNE EXAMINATION PA					
QUESTION ANALYSIS GRID											DATE:
		Cognitive Levels									
QUESTION	Mark	1	2	3	4	States of matter and KMT	The atom	The Periodic table	Chemical bonding	Physical and chemical change	Quantitative	TOTAL
1.1.1	2		2			2						2
1.1.2	2			2				2				2
1.1.3	2		2						2			2
1.1.4	2				2					2		2
1.1.5	2		2								2	2
Ques 1	10	0	4	2	0	2	0	2	2	0	0	10
2.1	2	2				2						2
2.2.1	1		1			1						1
2.2.2	1		1			1						1
2.2.3	1		1			1						1
2.3.1	3				3	3						3
2.3.2	1			1		1						1
Ques 2	9	2	3	1	3	9	0	0	0	0	0	9
3.1	2	2					2					2
3.2.1	2		2				2					2
3.2.2	3				3		3					3
3.2.3	1		1				1					1
3.2.4	1		1					1				1
3.3.1	3			3			3					3
3.3.2	2		2				2					2
3.4	2	2						2				2
3.5.1	3			3				3				3
3.5.2	1				1			1				1
Ques 3	20	4	6	6	4	0	13	7	0	0	0	20
4.1	2	2							2			2
4.2	1		1							1		1
4.3.1	4			4					4			4
4.3.2	1								1			1
4.3.3	3			3						3		3
4.4.1	1		1							1		1
4.4.2	1		1							1		1
4.5	3		3						3			3
4.6	1		1						1			1
4.7	5			5						5		5
Ques 4	22	2	7	12	0	0	0	0	11	11	0	22
5.1	2	2									2	2
5.2.1	2		2								2	2
5.2.2	4			4							4	4
5.2.3	3			3							3	3
5.2.4	3			3							3	3
Ques 5	14	2	2	10	0	0	0	0	0	0	14	14
SUMMARY												
QUES 1	10	0	4	2	0	2	0	2	2	0	0	10
QUES 2	9	2	3	1	3	9	0	0	0	0	0	9
QUES 3	20	4	6	6	4	0	13	7	0	0	0	20
QUES 4	22	2	7	12	0	0	0	0	11	11	0	22
QUES 5	14	2	2	10	0	0	0	0	0	0	14	14
Total marks	75	10	22	31	7	11	13	9	13	11	14	75
Norm marks	75	11	26	30	7,5	9	10	9	12	23	12	75
Total %	100	89	84	103	93	122	130	100	108	48	117	100
Norm %	100	15	40	35	10							0

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