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GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

NOVEMBER 2023

GRADE 10

PHYSICAL SCIENCES: CHEMISTRY

PAPER 2

TIME: 2 hours

MARKS: 100

10 pages + 2 data sheets

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INSTRUCTION AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of SEVEN questions. Answer ALL the questions.
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. Write neatly and legibly.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the DATA SHEETS that are attached.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round-off your FINAL numerical answers to a minimum of TWO decimal places.

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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 numbers (1.1 to 1.9) in the ANSWER BOOK, e.g. 1.10 D.

1.1 Which of the following solids consist of a lattice of positive ions in a "sea" of delocalised electrons?

A Ice
B Iodine
C Diamond
D Potassium (2)

1.2 The chemical properties of an element are determined by the number and arrangement of the element's …

A atoms.
B protons.
C electrons.
D ions. (2)

1.3 An atom X forms an ion X^+. The atom X and ion X^+ have the same …

A number of electrons.
B atomic radius.
C ionisation energy.
D number of protons. (2)

1.4 Metal M forms a nitrate with the formula MNO_3. Which of the following formulae for compounds of M is NOT correct?

A M_2SO_4
B $M\ell$
C $M(OH)_2$
D M_2CO_3 (2)

1.5 Which of the following represents the electron configuration of an alkaline-metal ion?

A $1s^2$
B $1s^2\ 2s^2$
C $1s^2\ 2s^2\ 2p^5$
D $1s^2\ 2s^2\ 2p^6\ 3s^1$ (2)

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1.6 Which of the following equations represents a chemical change?

A $H_2O(s) \rightarrow H_2O(\ell)$
B $2H_2O(\ell) \rightarrow 2H_2(g) + O_2(g)$
C $NaC\ell(s) \rightarrow Na^+(aq) + C\ell^-(aq)$
D $CO_2(s) \rightarrow CO_2(g)$ (2)

1.7 The percentage water in $MgSO_4 \cdot 7H_2O$ is:

A 51,22
B 48,78
C 21
D 7 (2)

1.8 All of the following consist of approximately one mole of particle EXCEPT:

A 6×10^{23} helium atoms
B 1 g of hydrogen molecules
C 12 g of carbon atoms
D 22,4 dm^3 ammonia at STP (2)

1.9 2,7 g of sodium hydroxide is added to 250 cm^3 distilled water. Which of the following is the CORRECT concentration of solution in $mol.dm^{-3}$?

A 0,15
B 0,5
C 0,27
D 2,5 (2)

[18]

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QUESTION 2 (Start on a new page.)

Use the table of substances below to answer the following questions.

Br_2	C	$CuSO_4 \cdot xH_2O$	H_3O^+
H_2O	NH_3	OH^-	Ni
Brass	S	Si	$KMnO_4$

2.1 Write down a substance that is:

2.1.1 An anion (1)

2.1.2 A metalloid (1)

2.1.3 A magnetic substance (1)

2.1.4 A non-metal that is a conductor of electricity (1)

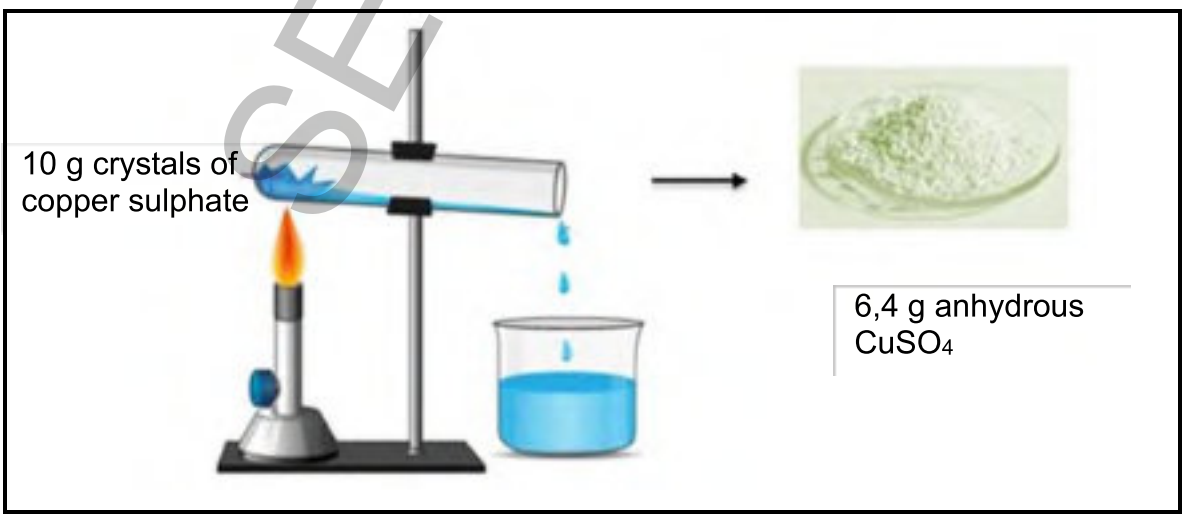
2.1.5 An alloy (1)

2.1.6 A diatomic molecule (1)

2.2 Compare the first ionisation energy of C and Si. (1)

2.3 Draw the Aufbau diagram of S. (3)

2.4 The experimental setup below is used to dry 10 g hydrated blue copper (II) sulphate crystals, $CuSO_4 \cdot \mathbf{X}H_2O$, to form 6,4 g anhydrous salt.



2.4.1 Define term *anhydrous*. (2)

2.4.2 Determine the number of moles, **X**, of water of crystallization. (4)

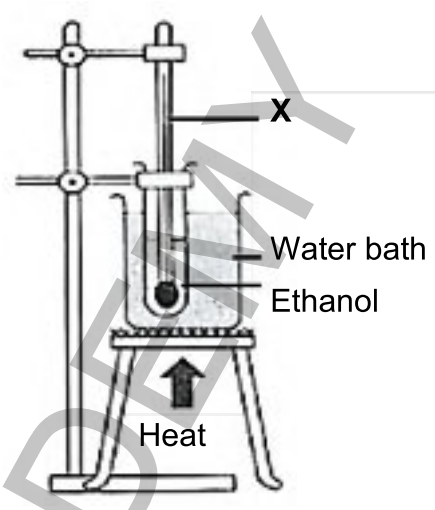
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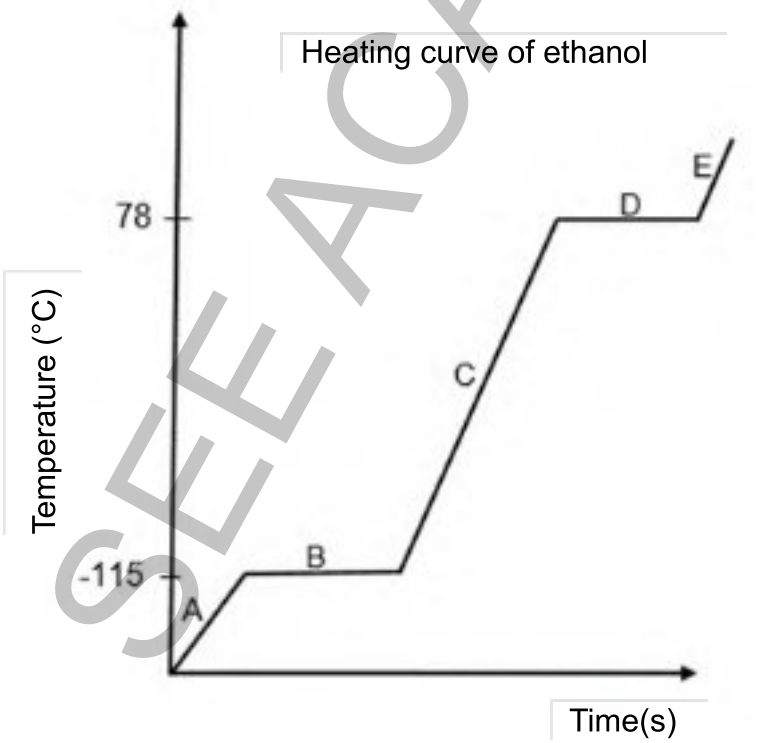
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QUESTION 3 (Start on a new page.)

The grade 10 learners conducted an experiment to investigate the effect of the increase in temperature on ethanol over a period of time at standard pressure.



The graph below was drawn using the results obtained.



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

3.2 Write down the value of standard pressure. (1)

3.3 Give the name of apparatus **X**. (1)

3.4 In what phase is ethanol at 0 °C? (1)

3.5 Explain, using the kinetic molecular theory, what is happening at section **D**. (3)

3.6 Will water or ethanol boil first at standard pressure? Explain the answer. (3)

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QUESTION 4 (Start on a new page.)

Strontium is best known for the brilliant reds it produces from its salts in fireworks and flares.



Strontium is an element on the Periodic Table in period 5 group 2.
The four isotopes of strontium have isotopic mass numbers of 84, 86, 87 and 88 and relative abundance of 0,56%, 9,86%, 7% and 82,58% respectively.

4.1 Define the term *isotope.* (2)

4.2 Write down the symbol of strontium. (1)

4.3 How many valence electrons does strontium have? (1)

4.4 Compare the atomic radius of strontium and magnesium. (2)

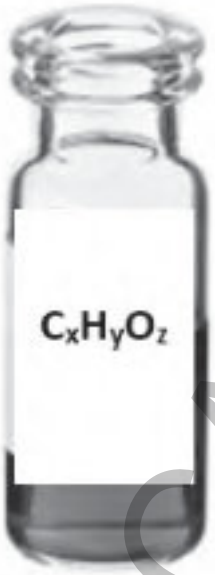
4.5 Calculate the relative atomic mass of strontium. (3)
[9]

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QUESTION 5 (**Start on a new page.**)

An unknown organic compound has a formula of $C_xH_yO_z$. The molar mass of this compound is 88 $g \cdot mol^{-1}$.



5.1 Define the term *empirical formula*. (2)

5.2 A 2 g sample of this compound contains 1,09 g carbon and 0,18 g hydrogen.

Calculate the:

5.2.1 Mass oxygen in this sample (1)

5.2.2 Empirical formula of this compound (6)

5.3 Determine the molecular formula of this compound. (3)

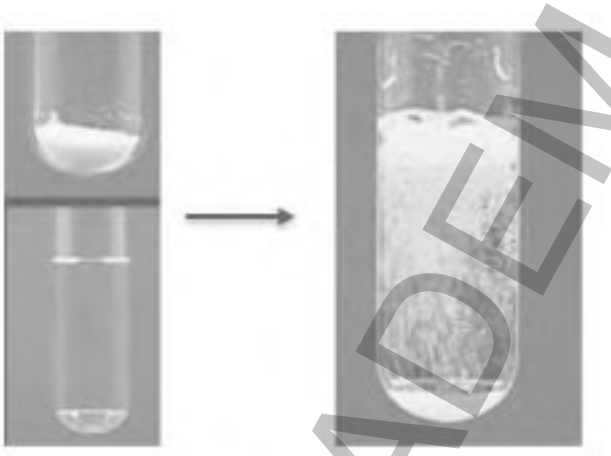
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QUESTION 6 (Start on a new page.)

In the reaction below, 3 g of Na_2CO_3 were reacted with hydrochloric acid solution and an effervescence is observed.



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

6.1 Copy and balance the chemical equation. (2)

6.2 Write the NAME and FORMULAE of the substance that caused the effervescence. (2)

6.3 From the chemical equation write down the FORMULAE of TWO compounds that are:

6.3.1 Covalent bonded (2)

6.3.2 Ionic bonded (2)

6.4 Draw Lewis dot diagrams for:

6.4.1 CO_2 (2)

6.4.2 H_2O (2)

6.5 Calculate the molar mass of Na_2CO_3. (2)

6.6 Calculate the number of moles of the 3 g of Na_2CO_3 used. (3)

6.7 Determine the number of oxygen atoms present in the 3 g of Na_2CO_3 used. (4)

[21]

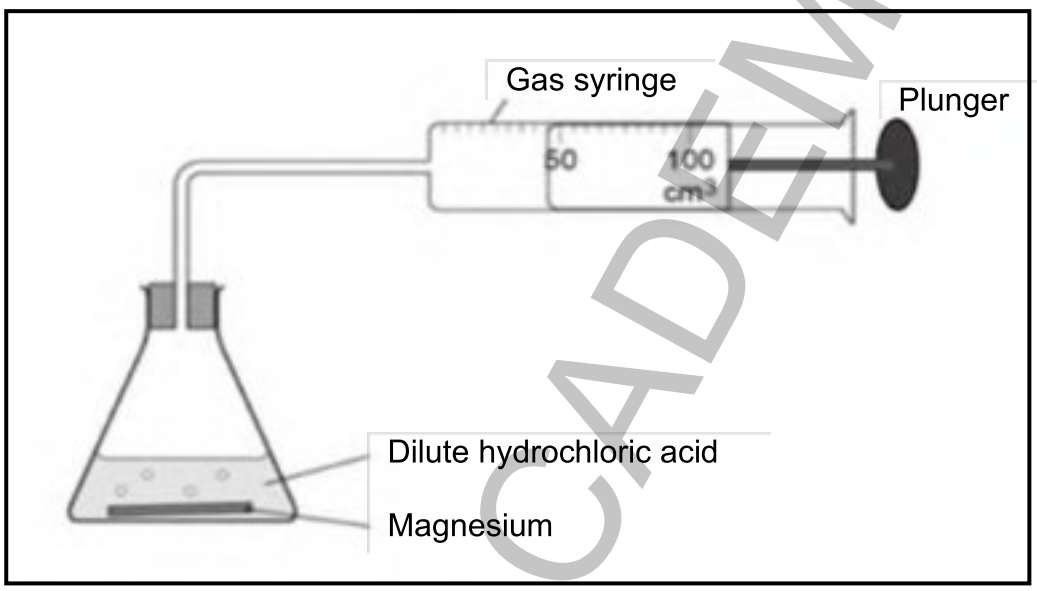
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QUESTION 7 (Start on a new page.)

In the reaction below, magnesium ribbon reacts with excess hydrochloric acid according to the following balanced chemical equation. When the reaction has stopped, the plunger in the syringe remained in the position as shown in the diagram below.

$$Mg(s) + 2HC\ell(aq) \rightarrow MgC\ell_2(s) + H_2(g)$$



7.1 Define *one-mole* of a substance. (2)

7.2 Write down the volume of H_2 gas collected in the syringe. (2)

7.3 Write down ONE physical observation that indicates that a reaction is taking place. (1)

7.4 Calculate the number of moles of hydrogen gas formed at STP. (4)

7.5 Determine the mass of the magnesium ribbon used. (4)
[13]

TOTAL: 100

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

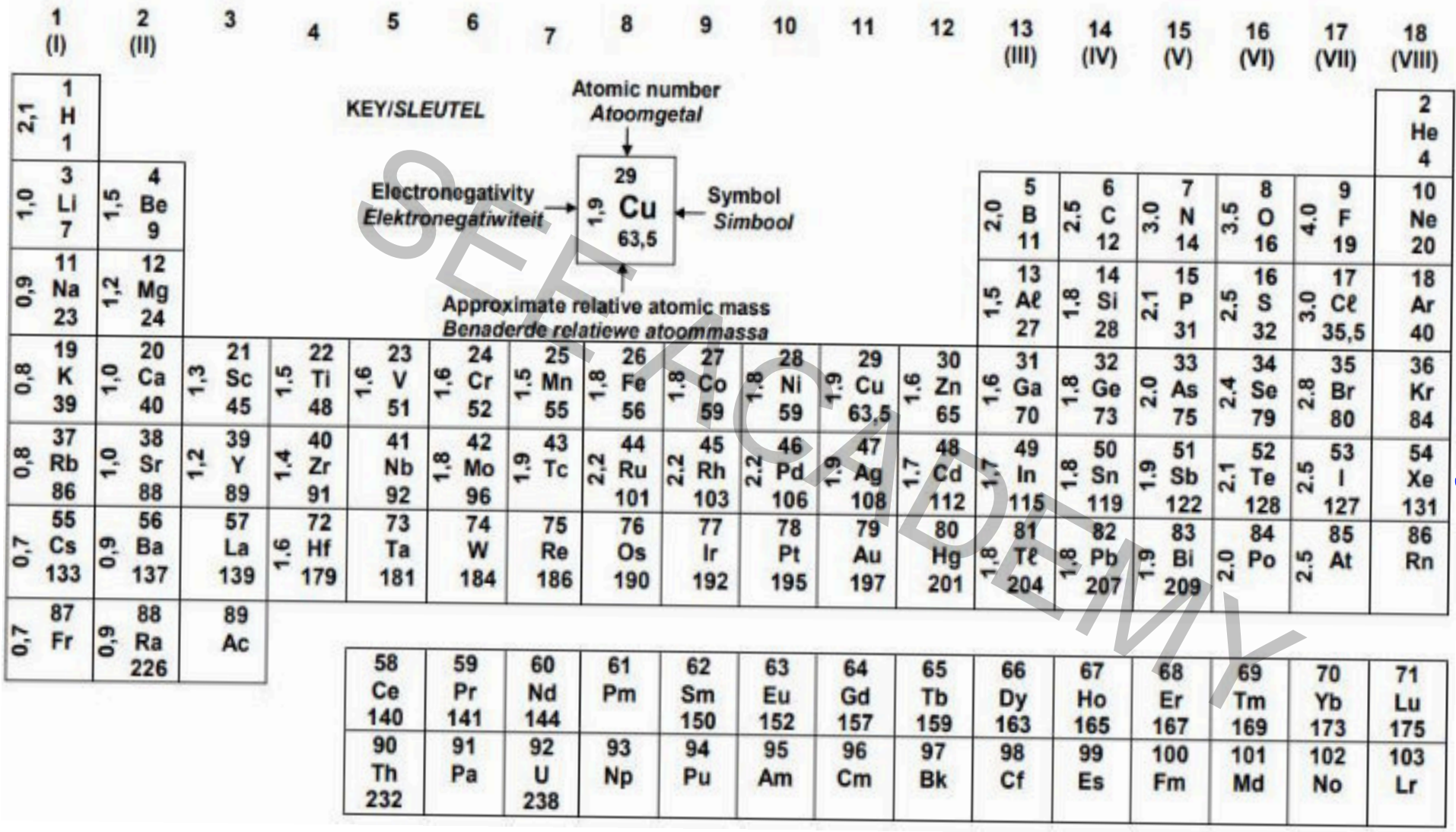
NAME/*NAAM*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Standard pressure *Standaarddruk*	p^{θ}	1,013 x 10^5 Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	22,4 $dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^{θ}	273 K
Charge on electron *Lading op elektron*	e	-1,6 x 10^{-19}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



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