



education

Department of
Education
FREE STATE PROVINCE

GRADE 9

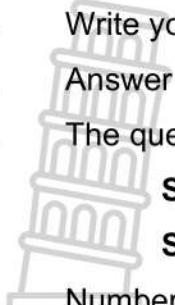
NATURAL SCIENCES

JUNE 2024

TIME: 1 HOUR

MARKS: 50

This question paper consists of 8 pages and a PERIODIC TABLE on page 8.

INSTRUCTIONS AND INFORMATION:

1. Write your name on the ANSWER BOOK.
2. Answer ALL questions in this question paper.
3. The question paper consists of TWO sections:
SECTION A: 10 MARKS
SECTION B: 40 MARKS
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave open one line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. Write neatly and legibly.
7. You are provided with a PERIODIC TABLE at the END of the question paper.

SECTION A**QUESTION 1**

1.1 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 number (1.1.1 – 1.1.5) in the ANSWER BOOK, e.g. 1.1.6 D.

1.1.1 The number of carbon atoms in 3CaCO_3 is

A 1
B 3
C 6
D 9 (1)

1.1.2 The correct chemical formula for potassium nitrate is:

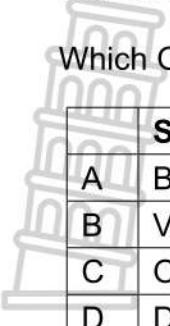
A CaCO_3
B CaSO_4
C K_2SO_4
D KNO_3 (1)

1.1.3 Which ONE of the following balanced chemical equations correctly represents the reaction between calcium oxide and hydrochloric acid?

A $\text{CaO} + 2\text{HCl} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O}$
B $\text{K}_2\text{O} + 2\text{HCl} \rightarrow 2\text{KCl} + \text{H}_2\text{O}$
C $\text{CaO} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O}$
D $\text{CaO} + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_2\text{O}$ (1)

1.1.4 The following table contains substances which are commonly found in most households with their respective pH values.

Which ONE is the most BASIC / ALKALINE substance? (1)



| | SUBSTANCE FOUND IN MOST HOUSEHOLDS | pH VALUE |
|---|------------------------------------|----------|
| A | Bleach | 13,1 |
| B | Vinegar | 3,2 |
| C | Oven cleaner | 11,2 |
| D | Distilled water | 7,05 |

1.1.5 Which ONE of the following equations best represents the combustion reaction of a metal in oxygen gas?

A $S + O_2 \rightarrow SO_2$
 B $4Na + O_2 \rightarrow 2Na_2O$
 C $C + O_2 \rightarrow CO_2$
 D $Mg + CO_2 \rightarrow 2MgO + C$ (1)
 [5]

1.2 Choose the item from COLUMN B that matches the description in COLUMN A. Write only the letter (A – G) next to the question number (1.2.1 – 1.2.5) in the ANSWER BOOK.

| | COLUMN A | COLUMN B | |
|-------|--|----------|----------------|
| 1.2.1 | The substances that react with one another during a chemical reaction. | A | Combustion |
| 1.2.2 | The process taking place when vinegar is mixed with bicarbonate of soda. | B | Magnesium |
| 1.2.3 | _____ + oxygen gas \rightarrow acidic oxide | C | Alkaline |
| 1.2.4 | A substance that changes colour depending on the pH of the solution in which it is placed. | D | Reactants |
| 1.2.5 | Burns with a blinding white flame in oxygen gas. | E | Non-metal |
| | | F | Neutralisation |
| | | G | Indicator |

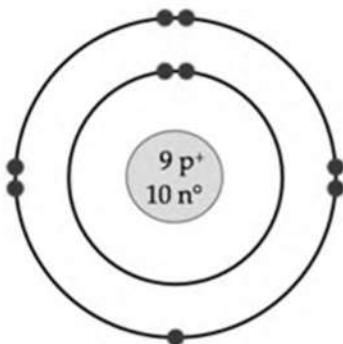
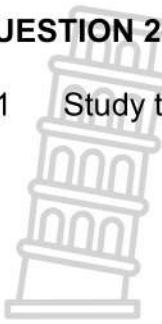
[5]

TOTAL SECTION A: 10

SECTION B

QUESTION 2

2.1 Study the model of an atom below.



Use the Periodic Table provided at the end of this paper to answer the following questions:

2.1.1 How many electrons are there in this atom? (1)

2.1.2 Explain why this atom is electrically neutral. (1)

2.1.3 Write down the NAME of this element. (1)

2.1.4 In which group is this element found on the Periodic Table? (1)

2.1.5 In which period is this element found on the Periodic Table? (1)

The general symbol for the atom of an element can be written as:

${}^A_Z E$ where A is the mass number and Z is the atomic number

2.1.6 A learner mistakenly writes the symbol for the element above as follows:

${}^{28}_9 F$

REWRITE the symbol in your answer book and correct the learner's mistake. (1)

2.2 Study the element below and answer the questions that follow.

${}^{35}_{17} Cl$

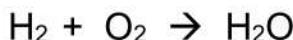
2.2.1 How many protons does this Cl-atom have? (1)

2.2.2 How many neutrons are there in the Cl-atom above? (1)

2.2.3 Write down the NAME of each of the compounds of Cl:

(a) HCl (1)
 (b) CaCl₂ (1)

2.3 Consider the following UNBALANCED chemical equation:



2.3.1 Re-write the equation in your answer book and BALANCE it. (2)

2.3.2 Use your knowledge of elements and compounds and explain why water (H_2O) is considered a compound whereas oxygen gas (O_2) is NOT considered to be a compound. (2)
[14]

QUESTION 3

3.1 Study the picture of a rusted iron shipwreck on the beach.



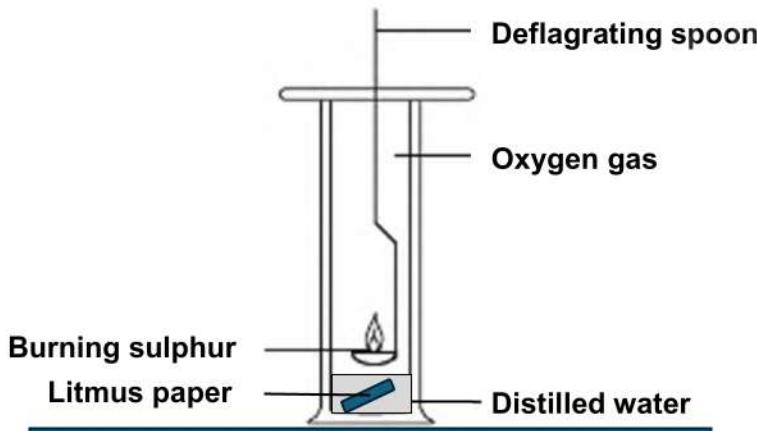
3.1.1 Tabulate ONE difference between rusting and combustion. (2)

3.1.2 Suggest TWO ways, apart from painting, to prevent rusting of iron objects. (2)

3.1.3 What is the chemical name of the reddish-brown substance on the shipwreck? (1)

3.1.4 Write down a balanced chemical equation for the rusting of iron. (3)

3.2 The combustion of sulphur in oxygen is investigated. Sulphur powder is ignited on a deflagrating spoon and then lowered into a glass flask filled with pure oxygen.



3.2.1 Describe ONE OBSERVATION which can be made during this combustion reaction. (Refer to the colour of the flame, smell, etc.) (1)

3.2.2 Is the product that forms a SOLID, a LIQUID or a GAS? (1)

3.2.3 Complete the equation for the chemical reaction that takes place:



The product that formed is now dissolved in the distilled water in the bottom of the flask. A piece of blue litmus paper is dipped into the solution and the litmus paper turns red.

3.2.4 Is the product an acid or a base? What observation from this experiment confirms your answer? (2)
[13]

QUESTION 4

An experiment is conducted to investigate how fast (rate) magnesium oxide reacts with hydrochloric acid solutions with different pH-values.

Method:

- Six samples of magnesium oxide, **each weighing exactly 10 g** are placed in six similar glass beakers labelled A to F.
- **A volume of 200 ml of hydrochloric acid**, each with a different pH-value, is poured into each of the glass beakers.
- The time taken for the magnesium oxide to completely react with the hydrochloric acid in each beaker is measured, using the same stopwatch.
(Completely reacts means that ALL the magnesium oxide was used up.)

The results were recorded in the table below:

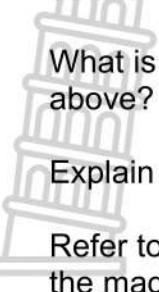
| Glass beaker | A | B | C | D | E | F |
|--|----|----|----|----|-----|-----|
| pH-value of the hydrochloric acid | 1 | 2 | 3 | 4 | 5 | 6 |
| Time (in seconds) taken for ALL the magnesium oxide to react with the acid | 15 | 40 | 65 | 95 | 125 | 160 |

4.1 Write down the CHEMICAL FORMULA for magnesium oxide. (1)

4.2 Complete the general word equation for the reaction between an acid and a metal oxide:



4.3 Name TWO properties of acids. (2)



4.4 What practical method can a scientist use to determine the pH of a solution? (1)

4.5 What is the pH-value of the solution with the highest acidity in the table above? (1)

4.6 Explain the meaning of a pH of 7. (1)

4.7 Refer to the table of results above and give the pH of the acid when all the magnesium oxide reacts within 95 s. (1)

4.8 Identify the independent variable in this experiment. (1)

4.9 Identify two variables that were controlled (kept constant) in this experiment. (2)

4.10 Formulate the conclusion for this investigation. (2)
[13]

TOTAL SECTION B: 40

GRAND TOTAL: 50

PERIODIC TABLE / PERIODIEKE TABEL



KEY/SLEUTEL

Atomic number / Atoomgetal

Symbol / Simbool

Mass number / Massagetal

| 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 | | | | | | | | | | | | | | | 10 Ne 20 | |
| 11 Na 23 | 12 Mg 24 | | | | | | | | | | | | | | | 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 101 | 44 Ru 103 | 45 Rh 106 | 46 Pd 108 | 47 Ag 112 | 48 Cd 115 | 49 In 119 | 50 Sn 122 | 51 Sb 128 | 52 Te 127 | 53 I 131 | 54 Xe |
| 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 209 | 85 At 209 | 86 Rn |
| 87 Fr 226 | 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 238 | 92 U | 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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MARKING GUIDELINE

SECTION A

QUESTION 1

1.1.1 B ✓
 1.1.2 D ✓
 1.1.3 C ✓
 1.1.4 A ✓
 1.1.5 B ✓ (5)

1.2.1 D ✓
 1.2.2 F ✓
 1.2.3 E ✓
 1.2.4 G ✓
 1.2.5 B ✓ (5)
 [10]

SECTION B

QUESTION 2

2.1.1 9 ✓ (1)

2.1.2. The atom contains 9 protons and 9 electrons. ✓
OR
 Equal number of protons/positive charges and electrons/negative charges. ✓ (1)

2.1.3 Fluorine ✓ (1)

2.1.4 Group 7 or 17✓ (1)

2.1.5 Period 2 ✓ (1)

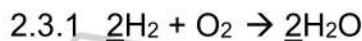
2.1.6 $^{19}_{9}F$ Accept: $^{19}_{9}F$ (1)

2.2.1 17✓ (1)

2.2.2 $35 - 17 = 18$ ✓ (1)

2.2.3 (a) Hydrochloric acid **OR** Hydrogen chloride✓ (1)

(b) Calcium chloride✓ (1)



| Marking criteria | Marks |
|--|---|
| Correct coefficient for H_2 | $\underline{2} \checkmark \text{H}_2$ |
| Correct coefficient for H_2O | $\underline{2} \checkmark \text{H}_2\text{O}$ |

(2)

2.3.2 The molecules of H_2O consist of two types of elements / atoms (more than one type) ✓ and therefore, considered to be a compound.

The molecules of O_2 consists of only one type of element / atom ✓ and is therefore NOT considered to be a compound (but an element).

(2)

[14]

QUESTION 3

3.1.1

| Rusting | Combustion |
|--|---|
| A slow reaction of a substance/metal with oxygen.✓ | A rapid/fast reaction of a substance with oxygen.✓ |
| Requires oxygen and moisture.✓ | Requires oxygen only.✓ |
| Only a small amount of heat is released during the reaction.✓ (Usually undetectable) | A significant amount of energy is released; usually in the form of heat and light energy✓ |
| One corresponding difference for TWO marks✓✓ (Deduct one mark if answer is not presented in a table.) | |

(2)

3.1.2 Galvanising.✓

Electroplating.✓

Covering (the metal) with oil or grease✓

Store iron objects correctly; keep it away from moisture✓ **(ANY TWO)**

➤ **DO NOT** accept painting.

(2)

3.1.3 Iron oxide✓

(1)



| Marking criteria | Marks |
|--|-------|
| Both reactants are correct; Fe and O_2 | ✓ |
| Correct product; Fe_2O_3 | ✓ |
| Correct coefficients for balancing | ✓ |

(3)

3.2.1 Sulphur burns in oxygen with a blue / purple flame. ✓

A suffocating gas is formed. / White fumes are formed. ✓ **(ANY ONE)**

(1)

3.2.2 Gas✓

(1)



(1)

3.2.4 An acid✓

The blue litmus paper turns red / pink.✓

(2)

[13]

QUESTION 4

4.1 MgO ✓ (1)

4.2 Metal oxide + Acid → Salt + Water✓ (Accept: H₂O) (1)

4.3 Sour taste✓
pH < 7✓
Corrosive✓
Feel coarse when rubbed between the fingers✓ (not smooth or soapy)
Bromothymol blue turns yellow / Blue litmus turns pink / Universal indicator turns red in acid✓ (ANY TWO) (2)

4.4 Use universal indicator / digital pH-meter ✓ (1)

4.5 pH = 1✓ (1)

4.6 A solution is neutral / neither acid nor base. ✓ (1)

4.7 pH = 4✓ (1)

4.8 pH✓ of the hydrochloric acid (1)

4.9 Volume✓ of the hydrochloric acid (200 ml)
Mass/Amount✓ of the magnesium oxide (10 g) (2)

4.10 **Possible answers:**

The lower the pH of the HCl, the shorter the time for the MgO to react.

The lower the pH of the HCl, the higher the rate of the reaction.

The higher the pH of the HCl, the longer the time for the MgO to react.

The higher the pH of the HCl, the lower the rate of the reaction.

As the pH increases, the time increases.

As the pH decreases, the time decreases.

As the acidity increases / pH decreases, the rate increases.

As the acidity decreases / pH increases, the rate decreases.

| Marking criteria | Marks |
|---|-------|
| Both variables are mentioned; pH and time / rate | ✓ |
| The RELATIONSHIP between the variables is indicated | ✓ |

(2)
[13]

SECTION A: 10 MARKS
SECTION B: 40 MARKS
GRAND TOTAL: 50 MARKS