



# education

Department of  
Education  
FREE STATE PROVINCE

**GRADE 9**

**NATURAL SCIENCES**



**TIME: 1 HOUR**

**MARKS: 50**



This question paper consists of 8 pages and a Periodic Table on page 9.

**INSTRUCTIONS AND INFORMATION:**

1. Answer ALL questions in this question paper.
2. This question paper consists of TWO sections:  
**SECTION A: 10 MARKS**  
**SECTION B: 40 MARKS**
3. Number all your answers according to the numbering system used in the question paper.
4. You may use a non-programmable calculator where necessary.
5. In case of calculations, show all steps.
6. Use a pencil for drawings.
7. Write neatly and legibly.
8. Make use of the Periodic Table at the end of this question paper, where necessary.



**SECTION A**

**QUESTION 1**

1.1. Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) next to the question number (1.1.1 – 1.1.5), e.g., 1.1.6 D.

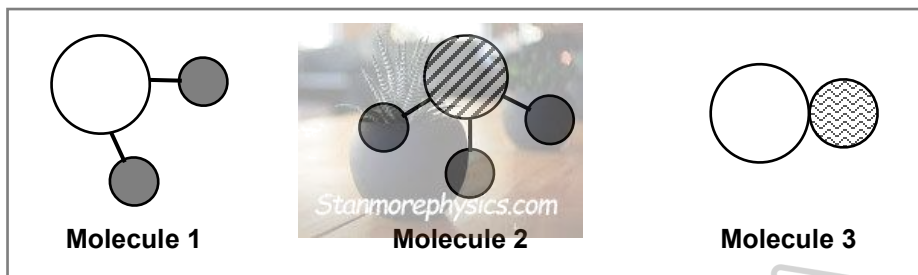
1.1.1 The correct chemical formula for sulphur trioxide is:

- A SO<sub>2</sub>
  - B SO<sub>3</sub>
  - C SuO
  - D SuO<sub>3</sub>
- (1)

1.1.2 Identify the element in period 3, group 15. Use the Periodic Table at the end of the question paper.

- A Platinum
  - B Polonium
  - C Arsenic (As)
  - D Phosphorus
- (1)

1.1.3 The molecular diagrams of three compounds are shown below:



Which one of options A, B, C or D, represents the correct chemical formulae for the three compounds?

	<b>Molecule 1</b>	<b>Molecule 2</b>	<b>Molecule 3</b>
A	Na <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub>
B	H <sub>2</sub> O	SO <sub>2</sub>	CO
C	H <sub>2</sub> O	NH <sub>3</sub>	CO
D	H <sub>2</sub> O	NH <sub>3</sub>	O <sub>2</sub>

(1)

1.1.4 A piece of metal burns with a blinding white flame in oxygen to form a white metal oxide. Which balanced equation represents this reaction?

- A  $C + O_2 \rightarrow CO_2$
- B  $2SO_2 + O_2 \rightarrow 2SO_3$
- C  $3Fe + 2O_2 \rightarrow Fe_3O_4$
- D  $2Mg + O_2 \rightarrow 2MgO$  (1)

1.1.5 Which combination is an example of an ACID and a BASE?

- A Vinegar and lemon juice.
  - B Sulphuric acid and calcium oxide.
  - C Carbonic acid and carbon dioxide.
  - D Magnesium oxide and bicarbonate of soda. (1)
- [5]**

1.2 Choose the process in COLUMN B that matches the description in COLUMN A. Write only the letter (A – E) next to the question number (1.2.1 – 1.2.5) in your answer book.

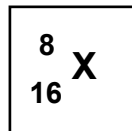
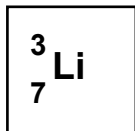
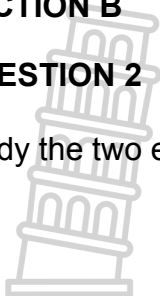
COLUMN A		COLUMN B	
1.2.1	When a compound is broken down into elements.	A	Neutralisation
1.2.2	When an acid reacts with a base.	B	Combustion
1.2.3	When a metal rusts.	C	Chemical bonding
1.2.4	When an element burns in oxygen.	D	Decomposition
1.2.5	When two atoms combine to form a molecule.	E	Corrosion

**TOTAL SECTION A: [5]**  
**10**

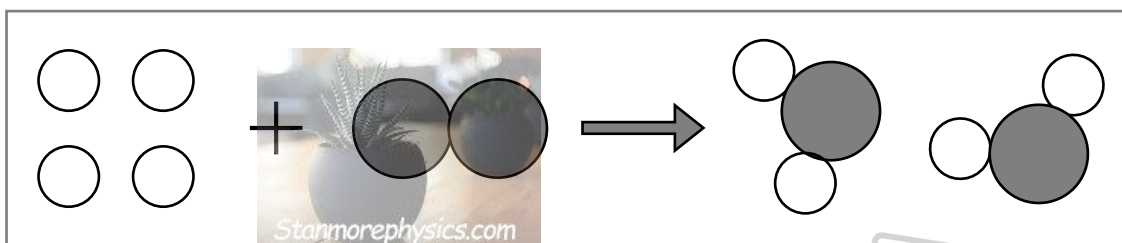
**SECTION B**

**QUESTION 2**

Study the two elements given below.



- 2.1 Provide the chemical name for Li. (1)
- 2.2 What is the mass number of Li? (1)
- 2.3 How many neutrons are there in an atom of Li? (2)
- 2.4 What is the atomic number of element X? (1)
- 2.5 Use the Periodic Table provided and identify element X. Give the NAME of the element. (1)
- 2.6 Which of the two elements is a metal? (1)
- 2.7 The picture equation for the reaction between Li (white circle) and element X (grey circle) is given below:



Use the correct chemical symbols and write down the balanced chemical equation for the reaction.

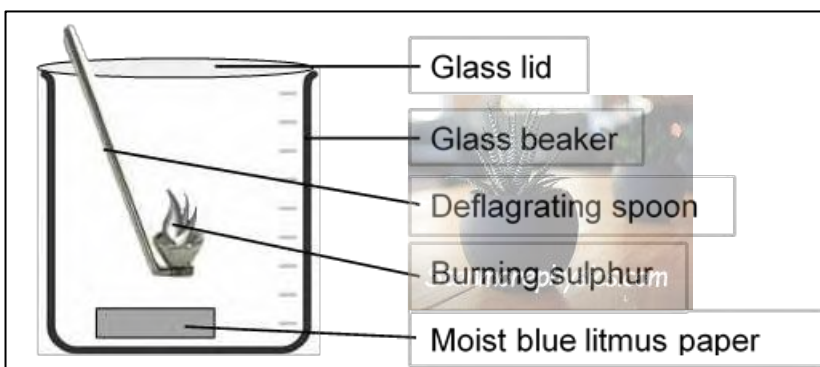
(3)  
[10]



### QUESTION 3

The aim of the investigation below is to determine whether non-metal oxides are basic oxides or acidic oxides.

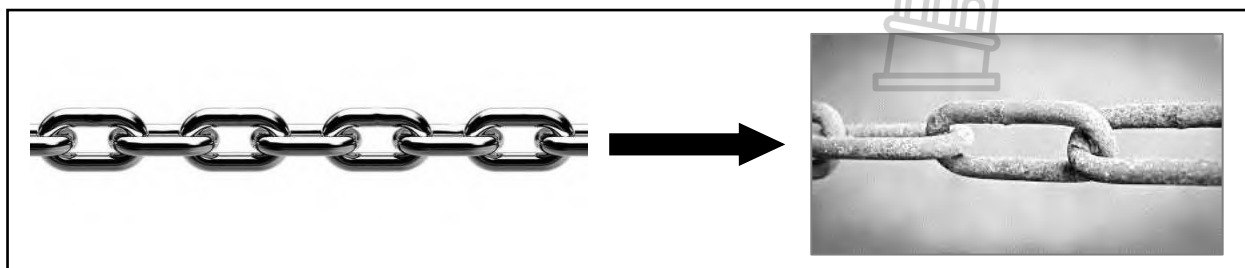
In the diagram, sulphur powder is burned in oxygen gas in a glass beaker. While the reaction is taking place, white fumes are formed, and the piece of moist litmus paper gradually changes colour from blue to red.



- 3.1 Explain why the glass beaker should be closed with a lid. (1)
  - 3.2 Provide the NAME for the white fumes that form during this reaction. (1)
  - 3.3 Write down a balanced chemical equation for the reaction that takes place inside the glass beaker. (2)
  - 3.4 Is the oxide that forms during this reaction, ACIDIC, BASIC, or NEUTRAL? Explain your answer, based on the observations made during the reaction. (2)
  - 3.5 Write down the conclusion for this investigation. (1)
- [7]**

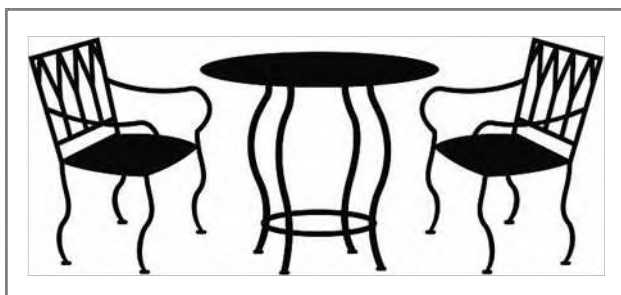
### QUESTION 4

The diagram below shows the rusting of an iron chain over time.



- 4.1 Describe what rust looks like. (1)

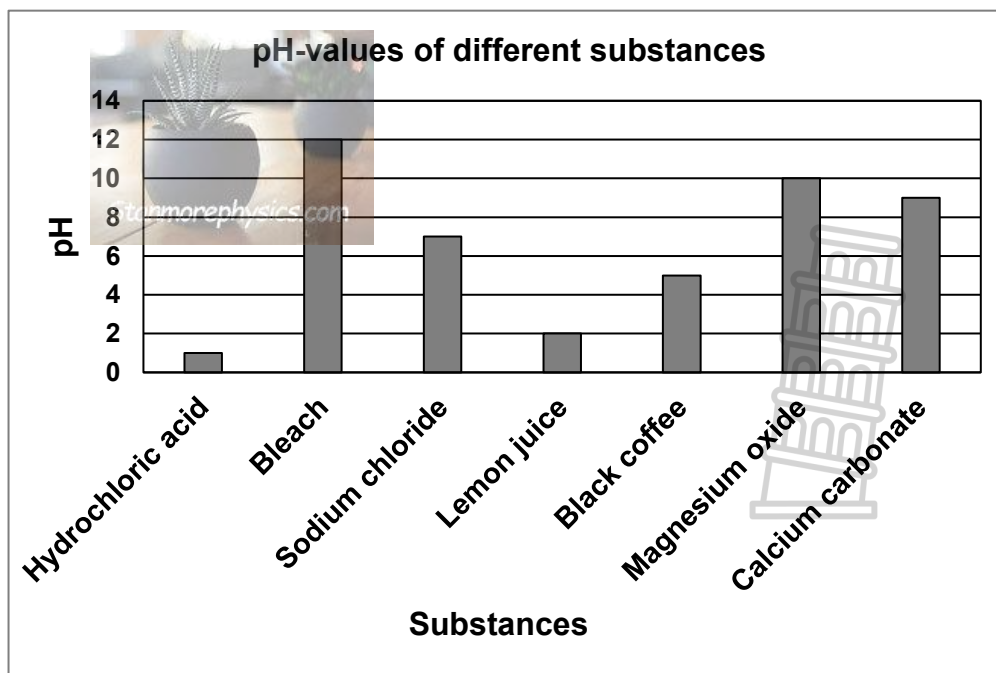
- 4.2 Give the NAMES of the two reactants in this chemical reaction. (2)
- 4.3 Write down the balanced chemical equation to show how rust is formed. (3)
- 4.4 What is the chemical name of the product? (1)
- 4.5 The painted iron table and chairs, shown below, are used as outdoor furniture in the garden. The furniture is exposed to air and rain.



Even after a long period of time, the furniture does not show any signs of rusting. Explain, with reasons, how this is possible. (2)  
[9]

### QUESTION 5

The bar graph below illustrates the results obtained in a scientific investigation. Use the graph to answer the questions that follow.



- 5.1 Arrange the substances shown in the bar graph from MOST acidic to LEAST acidic. (2)

- 5.2 Formulate the relationship between the pH and the acidity of a substance. (2)
- 5.3 Why would black coffee not be the best remedy for heartburn? (1)
- 5.4 The table below, shows the pH scale and colours for **universal indicator**.

pH	Colour of universal indicator	pH	Colour of universal indicator
0	Dark red	8	Greenish blue
1	Red	9	Blue
2	Red	10	Navy blue
3	Orange red	11	Purple
4	Orange	12	Dark purple
5	Orange yellow	13	Violet
6	Greenish yellow	14	Violet
7	Green		

What COLOUR will be observed when universal indicator is added to each of the following?

- 5.4.1 Sodium chloride (1)
- 5.4.2 Bleach (1)
- 5.5 Magnesium oxide with a **pH of 10** is added to hydrochloric acid with a **pH of 1**, resulting in a final solution with a **pH of 6**.
- 5.5.1 Explain the change in the pH-values during the reaction. (2)
- 5.5.2 Write down a balanced chemical equation for the reaction between magnesium oxide (MgO) and hydrochloric acid (HCl). (3)
- 5.6 Sometimes, the soil in a garden is too acidic for plants to grow effectively. Based on the information presented in the bar graph, which option, calcium carbonate or sodium chloride, would you choose to lower the soil's acidity? Give a reason for your answer. (2)

[14]

**TOTAL SECTION B: 40**  
**GRAND TOTAL: 50**





# Periodic Table of the Elements

1																													18			
1 <b>H</b> 1.01	2																													2 <b>He</b> 4.00		
3 <b>Li</b> 6.94	4 <b>Be</b> 9.01												5 <b>B</b> 10.81	6 <b>C</b> 12.01	7 <b>N</b> 14.01	8 <b>O</b> 16.00	9 <b>F</b> 19.00	10 <b>Ne</b> 20.18														
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.31												13 <b>Al</b> 26.98	14 <b>Si</b> 28.09	15 <b>P</b> 30.97	16 <b>S</b> 32.07	17 <b>Cl</b> 35.45	18 <b>Ar</b> 39.95														
19 <b>K</b> 39.10	20 <b>Ca</b> 40.08	21 <b>Sc</b> 44.96	22 <b>Ti</b> 47.87	23 <b>V</b> 50.94	24 <b>Cr</b> 51.99	25 <b>Mn</b> 54.94	26 <b>Fe</b> 55.85	27 <b>Co</b> 58.93	28 <b>Ni</b> 58.69	29 <b>Cu</b> 63.55	30 <b>Zn</b> 65.38	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.63	33 <b>As</b> 74.92	34 <b>Se</b> 78.97	35 <b>Br</b> 79.90	36 <b>Kr</b> 84.80															
37 <b>Rb</b> 84.47	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.91	40 <b>Zr</b> 91.22	41 <b>Nb</b> 92.91	42 <b>Mo</b> 95.95	43 <b>Tc</b> 98.91	44 <b>Ru</b> 101.07	45 <b>Rh</b> 102.91	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.87	48 <b>Cd</b> 112.41	49 <b>In</b> 114.82	50 <b>Sn</b> 118.71	51 <b>Sb</b> 121.76	52 <b>Te</b> 127.6	53 <b>I</b> 126.90	54 <b>Xe</b> 131.25															
55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.33	57-71	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.95	74 <b>W</b> 183.84	75 <b>Re</b> 186.21	76 <b>Os</b> 190.23	77 <b>Ir</b> 192.22	78 <b>Pt</b> 195.09	79 <b>Au</b> 196.97	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.38	82 <b>Pb</b> 207.2	83 <b>Bi</b> 208.98	84 <b>Po</b> [208.98]	85 <b>At</b> 209.99	86 <b>Rn</b> 222.02															
87 <b>Fr</b> 223.02	88 <b>Ra</b> 226.03	89-103	104 <b>Rf</b> [261]	105 <b>Db</b> [262]	106 <b>Sg</b> [266]	107 <b>Bh</b> [264]	108 <b>Hs</b> [269]	109 <b>Mt</b> [268]	110 <b>Ds</b> [269]	111 <b>Rg</b> [272]	112 <b>Cn</b> [277]	113 <b>Uut</b> unknown	114 <b>Fl</b> [289]	115 <b>Uup</b> unknown	116 <b>Lv</b> [298]	117 <b>Uus</b> unknown	118 <b>Uuo</b> unknown															
																		57 <b>La</b> 138.91	58 <b>Ce</b> 140.12	59 <b>Pr</b> 140.91	60 <b>Nd</b> 144.24	61 <b>Pm</b> 144.91	62 <b>Sm</b> 150.36	63 <b>Eu</b> 151.96	64 <b>Gd</b> 157.25	65 <b>Tb</b> 158.93	66 <b>Dy</b> 162.50	67 <b>Ho</b> 164.93	68 <b>Er</b> 167.26	69 <b>Tm</b> 168.93	70 <b>Yb</b> 173.06	71 <b>Lu</b> 174.97
																		89 <b>Ac</b> 227.03	90 <b>Th</b> 232.04	91 <b>Pa</b> 231.04	92 <b>U</b> 238.03	93 <b>Np</b> 237.05	94 <b>Pu</b> 244.06	95 <b>Am</b> 243.06	96 <b>Cm</b> 247.07	97 <b>Bk</b> 247.07	98 <b>Cf</b> 251.08	99 <b>Es</b> [254]	100 <b>Fm</b> 257.10	101 <b>Md</b> 258.1	102 <b>No</b> 259.10	103 <b>Lr</b> [262]



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**GRADE 9**

**NATURAL SCIENCES**

**MEMORANDUM**

**JUNE 2023**

**TIME: 1 HOUR**

**MARKS: 50**

This memorandum consists of 5 pages.

**SECTION A**

**QUESTION 1**

- 1.1.1 B ✓ (1)
  - 1.1.2 D ✓ (1)
  - 1.1.3 C ✓ (1)
  - 1.1.4 D ✓ (1)
  - 1.1.5 B ✓ (1)
- [5]**

- 1.2.1 D ✓ (1)
  - 1.2.2 A ✓ (1)
  - 1.2.3 E ✓ (1)
  - 1.2.4 B ✓ (1)
  - 1.2.5 C ✓ (1)
- [5]**

**TOTAL SECTION A: 10**

**SECTION B**

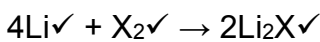
**QUESTION 2**

- 2.1 Lithium ✓ (1)
- 2.2 Mass number = 7 ✓ (1)
- 2.3 Number of neutrons = 7 - 3 ✓  
= 4 ✓ (Award TWO marks if only the answer is given) (2)
- 2.4 Atomic number = 8 ✓ (1)
- 2.5 Oxygen ✓ (1)
- 2.6 Li / Lithium ✓ (1)

**Positive marking: mark with mistake**



**OR**



**Marking criteria:**

- ✓ 4Li (coefficient of 4 and Li)
- ✓ O<sub>2</sub> or X<sub>2</sub> (one diatomic molecule)
- ✓ 2Li<sub>2</sub>O or 2Li<sub>2</sub>X (coefficient of 4 and the correct formula)

(3)  
**[10]**

**QUESTION 3**

3.1 The lid prevents the gas from being released into the air.  
The white fumes / sulphur dioxide / product that forms is/are harmful✓ and should not be inhaled. (1)

3.2 Sulphur dioxide✓ (1)

3.3  $S + O_2 \rightarrow SO_2$

Marking criteria	Marks
Both reactants (S + O <sub>2</sub> ) are correct.	1
The product (SO <sub>2</sub> ) is correct.	1

**Penalise with ONE mark, if any incorrect balancing is indicated.** (2)

3.4 Acidic✓  
The blue litmus paper turned red.✓ (2)

3.5 Non-metal oxides are acidic oxides.✓ (1)  
**[7]**

**QUESTION 4**

4.1 Rust is a (brittle/flaky) reddish-brown substance✓ that easily crumbles into a powder. (1)

4.2 Iron✓  
Oxygen✓ (2)

4.3  $4Fe + 3O_2 \rightarrow 2Fe_2O_3$

Marking criteria	Mark
Both reactants (Fe + O <sub>2</sub> ) are correct.	1
The product (Fe <sub>2</sub> O <sub>3</sub> ) is correct.	1
Coefficients for balancing the equation are correct.	1

4.4 Iron oxide✓ (1)

4.5 The paint✓ keeps the air / oxygen and the rain / water / moisture away from the iron✓ to prevent rusting. (2)  
**[9]**

**QUESTION 5**

- 5.1 Hydrochloric acid  
Lemon juice  
Black coffee  
Sodium chloride  
Calcium carbonate  
Magnesium oxide  
Bleach
- ↓
- Most acidic  
to  
least acidic

**OR**

Hydrochloric acid, Lemon juice, Black coffee, Sodium chloride, Calcium carbonate, Magnesium oxide, Bleach

Marking criteria	Mark
Most acidic: Hydrochloric acid Least acidic: Bleach	1
Correct order for the other 5 substances	1

(2)

- 5.2 The lower the pH, the higher the acidity.

**OR**

The higher the pH, the lower the acidity.

Marking criteria	Mark
Mention both variables: pH and acidity	1
Indicate the RELATIONSHIP between the variables.	1

(2)

- 5.3 Black coffee with a pH of 5 is acidic and will not be able to neutralise the stomach acid✓causing heartburn.

(1)

- 5.4.1 Green✓

(1)

- 5.4.2 Dark purple✓

(1)

- 5.5.1 As the basic/alkaline magnesium oxide✓ is added to the acid, a neutralisation reaction takes place with the acid becoming less acidic / more basic✓ and the pH of the solution increasing from 1 to 6.

(2)



Marking criteria	Mark
Both reactants ( $\text{MgO} + \text{HCl}$ ) correct; in any order	1
Both products ( $\text{MgCl}_2 + \text{H}_2\text{O}$ ) correct; in any order	1
Coefficients for balancing the equation ( <u>2</u> $\text{HCl}$ )	1

(3)

5.6 Calcium carbonate ✓

Calcium carbonate is a base / has a pH of 9 and will neutralise the acidic soil and lower the acidity of the soil. ✓

**OR**

Calcium carbonate with a pH of 9 will neutralise the acidic soil and increase the pH of the soil. ✓

(2)

[14]

**TOTAL SECTION B: 40**  
**GRAND TOTAL: 50**

