HILLCREST HIGH SCHOOL

NATURAL SCIENCE EXAM

GRADE 9 **NOVEMBER 2020**
TIME : 2 HRS **TOTAL : 120**
EXAMINERS: MRS SMITH
MRS KNOX-WHITEHEAD

INSTRUCTIONS

1. This question paper consists of **16 PAGES and 2 SECTIONS: A AND B.**
2. Answer all of the questions from **SECTIONS A** and **SECTION B** in the answer book provided.
3. Non-programmable calculators may be used. Round answers off to **TWO DECIMAL PLACES** where applicable.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Write neatly and in pen.
6. **LEAVE A LINE** between each answer.
7. **RULE OFF** after each question 1-13.
8. A **PERIODIC TABLE** is attached at the end of the exam. You may detach it to work with for SECTION B.

FORMULA SHEET

$R = \frac{V}{I}$ $\quad Rs = r_1 + r_2 + r_3 \ldots\ldots$ $\quad \frac{1}{R_P} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} \ldots\ldots$

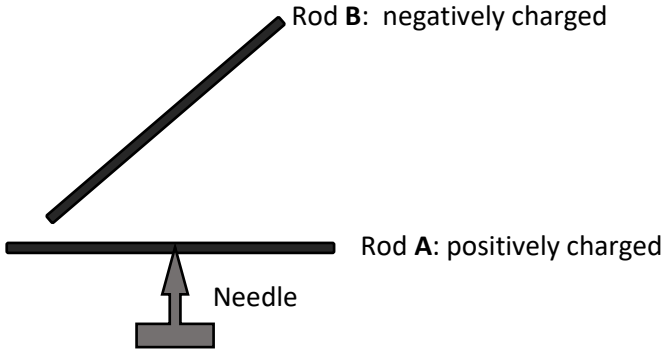
$Fres = F1 + F2 + \cdots$

SECTION A : ENERGY AND CHANGE [60]

QUESTION 1: MULTIPLE CHOICE QUESTIONS [1 x 6 = 6]

Four options are provided as possible answers to the following questions. Each question has only one correct answer. Write only the letter (A-D) next to the question number (1.1 – 1.6) in the answer book.

1.1 A positively charged rod, rod **A**, is balanced on a needle. Rod **A** is free to rotate. A negatively charged rod, rod **B**, is brought closer to rod **A** as shown in the drawing below.



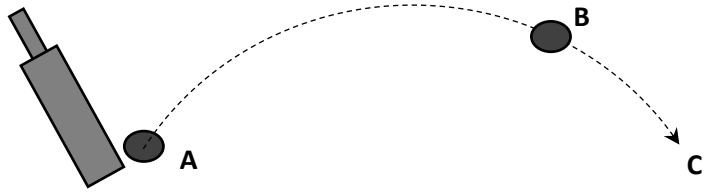
What will be observed when rod **B** is brought closer to rod **A**?

A Rod **A** remains stationary.
B Rod **A** is pushed away and rotates away from rod **B**.
C Rod **A** is attracted by rod **B** and rotates away from rod **B**.
D Rod **A** is attracted by rod **B** and rotates towards rod **B**.

1.2 To oppose the flow of electric current in a circuit, a … is used.

A resistor
B ammeter
C battery
D fuse

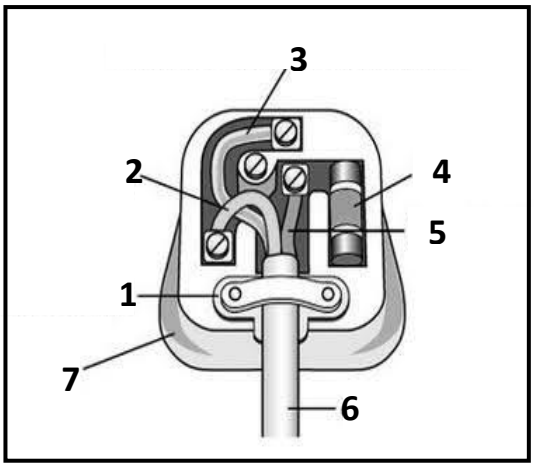
1.3 Study the diagram below. A cricket player hits a cricket ball with a bat at point **A**. The ball passes point **B** while moving through the air and lands on the ground at point **C**.



Which of the following best describes the forces on the ball?

	Force at A	**Force at B**
A	field force between the bat and the ball.	gravitational force
B	field force between the bat and the ball.	magnetic force
C	contact force between the bat and the ball.	gravitational force
D	contact force between the bat and the ball.	magnetic force

1.4 Study the diagram of the three-pin plug below.



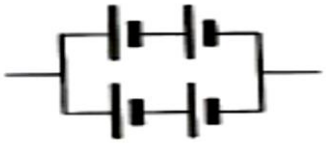
The correct colours for wires 2, 3 and 5 are:

	wire 2	**wire 3**	**wire 5**
A	blue	yellow green	brown
B	brown	yellow green	blue
C	yellow green	blue	brown
D	yellow green	brown	blue

1.5 Which statement is true about current in a PARALLEL circuit?

A It is produced by resistance.
B It divides among the branches.
C It decreases if another resistor is added in parallel.
D It is the same at every point in the circuit.

1.6 A battery consists of four identical 3 V cells connected as shown in the diagram. The total voltage across the battery is:



A 12 V
B 6 V
C 4 V
D 3 V

_____ (**rule off**) _____

QUESTION 2 : TERMINOLOGY **[4]**

Write down only the correct scientific term / words for the following descriptions.

2.1 The component in an electrical circuit that measures the potential difference between two points in the circuit. (1)

2.2 The type of force that exists when the South poles of two magnets are near each other. (1)

2.3 The gravitational force that a planet exerts on an object on its surface. (1)

2.4 A device which measures the flow of an electric current in a circuit. (1)

_____ (**rule off**) _____

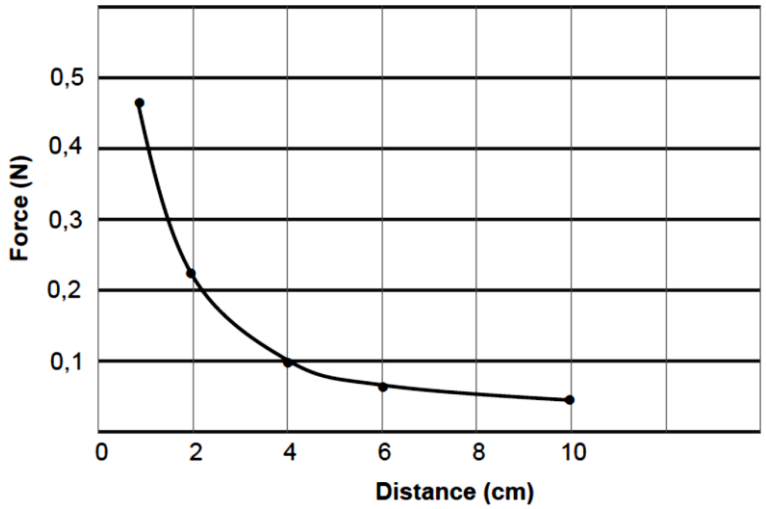
QUESTION 3 **[15]**

3.1 Two magnets are placed such that their north poles are facing each other.

3.1.1 Is the force the two magnets exert on each other, a **field force** or a **contact force?** (1)

3.1.2 Draw in your answer book the magnetic field line pattern that can be observed between the two north poles of these magnets shown in the diagram in 3.1. (2)

3.2 The graph below shows how the magnetic force changes with the distance between the two magnets.



3.2.1 What is the size (magnitude) of the magnetic force exerted by one magnet on another when the distance between the magnets is 4 cm? (1)

3.2.2 How far apart should the magnets be to experience a force of 0,15 N? (1)

3.2.3 What conclusion can be made based on the results in the graph? (2)

3.3 Two teams are competing at a game of 'Tug-o-War' as shown in picture below:

- Team A consists of **THREE** people, pulling to the **RIGHT** with a combined force of 8000 N.
- Team B consists of **FOUR** people pulling to the **LEFT** with a combined force of 6400 N.

3.3.1 Does the diagram show **balanced** or **unbalanced** forces? Explain your answer. (2)

3.3.2 Calculate the size of the resultant force acting on the rope. (3)

3.3.3 In which direction does the resultant force act? (Say only **left** or **right**.) (1)

3.3.4 Calculate the average force exerted by each member of Team B. (2)

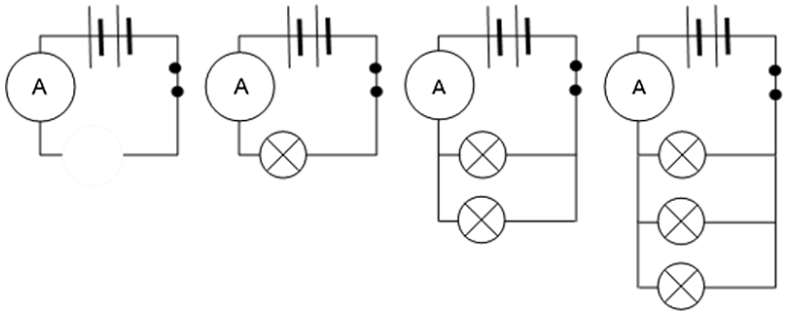
_____ (**rule off**) _____

QUESTION 4 **[11]**

Alisha sets out to investigate the relationship between the number of light bulbs connected in parallel and the strength of the current flowing through the circuit.

Her hypothesis is as follows: ***"If more bulbs are connected in parallel, then the current in the circuit will decrease."***

To test her hypothesis, she sets up the following four circuits.



- she uses identical cells and bulbs in each circuit.
- she allows the current to flow for three minutes in each circuit before taking the readings on the ammeters.
- readings were taken for each circuit and the results obtained in the investigation are recorded in the table below.

number of bulbs in parallel	current strength (A)
0	0
1	1,8
2	3,6
3	5,4

4.1 Identify the independent variable for this investigation. (1)

4.2 Identify any two controlled variables for this investigation. (2)

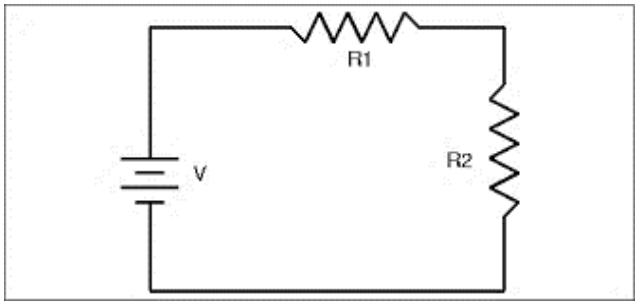
4.3 Draw a line graph of the results obtained from the investigation. (6)

4.4 Do the results **CONFIRM** or **REJECT** Alisha's hypothesis? Explain your answer. (2)

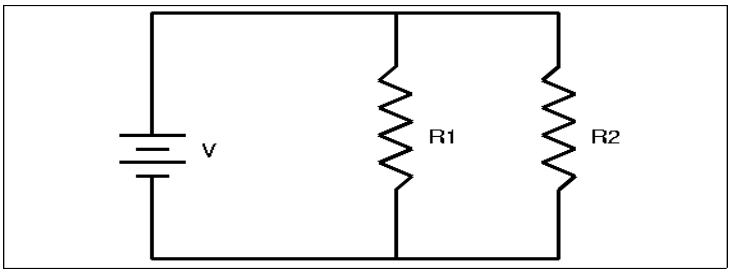
_____ (**rule off**)_____

QUESTION 5 **[6]**

5.1 In the diagram below, the resistance of R_1 is 5Ω and the resistance of R_2 is 10 Ω. Calculate the total resistance of the circuit**.** (3)



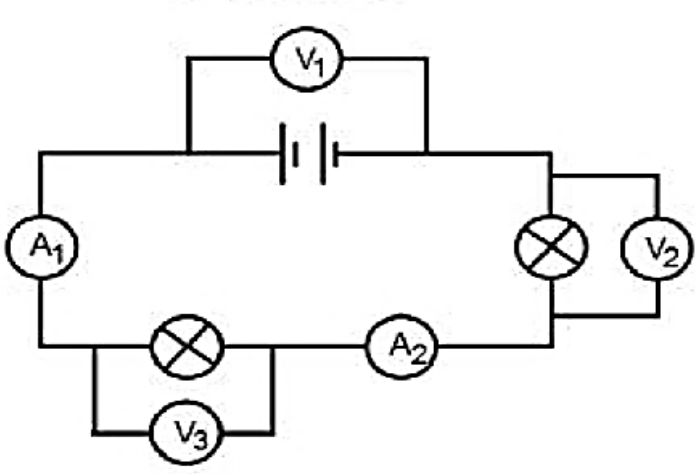
5.2 In the diagram below, the resistance of R_1 is 3Ω and the resistance of R_2 is 6Ω. Calculate the total resistance of the circuit**.** (3)



_____ (**rule off**) _____

QUESTION 6 **[10]**

Study the circuit diagram below. The voltage of each cell is 3 V.
All bulbs are NOT necessarily identical. Answer the questions that follow.



6.1 What is the reading on V_1? (1)

6.2 The reading on V_3 is 2,5 V. Calculate the reading on V_2. (2)

6.3 The reading on A_1 is 2 A. What is the reading on A_2? (1)

6.4 Calculate the resistance of the light bulb across V_2 ? (3)

6.5 If the light bulb across V_3 was replaced with a piece of connecting wire similar to the rest of the circuit, what would happen to the:

6.5.1 reading on A_1 (say only **increase /decrease / stay the same**) (1)

6.5.2 reading on V_2 (say only **increase / decrease / stay the same**) (1)

6.5.3 reading on V_1 (say only **increase / decrease / stay the same**) (1)

_____ (**rule off**) _____

QUESTION 7: DATA RESPONSE **[8]**

Read the passage below and answer the questions that follow:

Thousands of jellyfish have invaded Koeberg nuclear power station, causing a drastic reduction in electricity supply.

Eskom said Koeberg operations had been cut by 40 percent after an abnormally high number of jellyfish packed into the power plant's sea-water intake basin.

Spokesperson Carin de Villiers said although there were no safety implications for people, in the past few days thousands of jellyfish had died after getting stuck in the filters of the station's cooling condensers.

"They get sucked into the intakes and then trapped in the filter screens," she said.

"As a result of this, a high number of them are killed. What causes them in such unusual numbers we don't know. The station has continued to operate at about 60 percent throughout this period and will continue to do so."

She said the station was using sea water at the rate of *80 tons* *per second, enough to fill an Olympic-size pool in 30 seconds.

The station has already taken steps to reduce the number of jellyfish being killed and its emergency control centre has been staffed to monitor the situation.

"We have put up filter screens so we can get them off before they get caught up ... this gives them more chances of surviving," she said.

De Villiers said there was no electricity shortage in the province as extra power was being brought in from the Mpumalanga area via overhead transmission lines.

Leslie Rencontrie, director of electricity at the City of Cape Town, said the reduced supply had not had a serious effect on the city so far.

"It looks like the problem is reducing from their side and that should bring things to normal," he said.

Professor of Zoology at the University of Cape Town, Charles Griffiths, said the appearance of large numbers of jellyfish was not unusual, although he could not give a reason.

** (1 ton = 1 x 10^3 kg)*

Adapted from: ***NEWS SOUTH AFRICA*** / **11 MAY 2005, 3:52PM /** SIPOKAZI MAPOSA

7.1 What type of fuel does Koeberg use to generate electricity? (1)

7.2.1 Which marine organism invasion interrupted the electricity supply coming from Koeberg? (1)

7.2.2 How did these organisms die? (1)

7.2.3 What have engineers done to ensure that this incident doesn't happen again? (1)

7.2.4 Why do **you** think there were large numbers of these organisms in the ocean around the Koeberg plant to begin with? (1)

7.3 How many kilograms of ocean water enter the plant every hour?
Show your working. (2)

7.4 Where did the city of Cape Town gets its extra electricity supply from when the power from Koeberg was interrupted? (1)

TOTAL SECTION A : [60]

SECTION B: MATTER AND MATERIALS [60]

INSTRUCTIONS

1. Start this section at the top of a new page.
2. Leave a line between each sub question for example, between QUESTION 8.1 and QUESTION 8.2.
3. Rule off after each question for example between QUESTION 8 and QUESTION 9.
4. A **PERIODIC TABLE** is attached at the end of the exam. You may detach it to work with for SECTION B.

QUESTION 8 : MULTIPLE CHOICE QUESTIONS [10]

Four options are provided as possible answers to the following questions. Each question has only one correct answer. Write only the letter (A-D) next to the question number (8.1 – 8.10) in the answer book.

8.1 The total number of atoms contained in $5NaHCO_3$ is …

A. 4
B. 6
C. 20
D. 30

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

Which ONE is the most BASIC substance?

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

8.3 Which one of the following chemical equations correctly represents the reaction between magnesium hydroxide and hydrochloric acid?

A. $Mg(OH)_2 + 2\ HCl \rightarrow MgCl_2 + 2\ H_2O$
B. $MgOH + HCl \rightarrow MgCl + H_2O$
C. $Mg(OH)_2 + 2\ HCl \rightarrow MgCl_2 + 2\ H_2 + O_2$
D. $MgOH + 2\ HCl \rightarrow MgCl_2 + 2\ H_2O$

8.4 The correct name for the compound $Al_2(SO_4)_3$ is

A. aluminium sulphide
B. aluminium (III) sulphite
C. aluminium sulphur oxide
D. aluminium sulphate

8.5 The chemical symbol for **sodium** is …

A. S
B. Na
C. K
D. Sm

8.6 Hydrogen nitrate (HNO_3) consists of the following elements:

A. hydrogen, nitrate and oxygen
B. hydrogen and nitrate
C. hydrogen, nitrogen and oxygen
D. hydrogen, nitrogen and oxide

8.7 Which ONE of the following chemical equations does NOT represent a balanced chemical equation?

A. $SO_2 + H_2O \rightarrow H_2SO_3$
B. $4\ Na + O_2 \rightarrow 2\ Na_2O$
C. $Ca(OH)_2 + 2\ HCl \rightarrow CaCl_2 + 2\ H_2O$
D. $2Al + 3\ O_2 \rightarrow Al_2O_3$

8.8 The compound Li_2CO_3 is made up of the following ions …

A. $Li^{+2} + CO_3^{-1}$
B. $Li^{+1} + C^{+4} + O_3^{-2}$
C. $Li^{+1} + CO_3^{-2}$
D. $Li^{-1} + CO_3^{+2}$

8.9 What do the following elements have in common?

N, F, Cl, O

A. They have the same number of protons.
B. They all form diatomic molecules.
C. They are found in the same period on the periodic table.
D. They are found in the same group on the periodic table.

8.10 New substances that are formed during chemical reactions are called …

A. reactants
B. molecules
C. products
D. elements

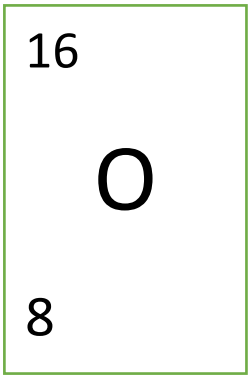
QUESTION 9 : MATCHING COLUMNS [10]

Match the statements in column A with the correct words in column B.
Write only the correct letter next to the number in your answer book e.g. (**9.1 = A)**

COLUMN A		**COLUMN B**	
9.1	Arrangement of all the known elements	A	Metal
9.2	Process taking place when vinegar is mixed with sodium bicarbonate	B	Indicator
9.3	… + oxygen → acidic oxide	C	Periodic Table
9.4	A substance that changes colour depending on the pH of the solution in which it is placed.	D	Rusting
9.5	This process can be used to prevent iron from corroding.	E	Neutralisation
9.6	H_2SO_4	F	Non-metal
9.7	Acid + base → … + water	G	Electroplating
9.8	Sodium hydroxide dissolved in water.	H	Acid
9.9	Reaction of iron in the presence of air and water.	I	Salt
9.10	An element that can conduct electricity.	J	Alkali

QUESTION 10 [8]

The following information **on the right** is available for an element.



10.1 What is the name of this element? (1)

10.2 Give the element's Atomic number. (1)

10.3 In which group on the Periodic Table does this element appear? (1)

10.4 Is this element a metal, a non-metal or a semi-metal? (1)

10.5 How many neutrons does an atom of this element have in its nucleus? Show how you arrived at this answer. (2)

10.6 Write down the NAME of the compound formed when this element reacts with sulphur. (1)

10.7 Write down a balanced equation for the reaction in QUESTION 10.6. (1)

QUESTION 11 [4]

Two **UNKNOWN** elements X and Y are represented by $^{12}_{6}X$ and $^{24}_{12}Y$ respectively.

Use the Periodic Table and answer the following questions relating to X and Y.

Write down:

11.1 The NAME of the element represented by **Y**. (1)

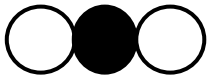
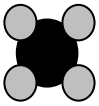
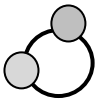
11.2 The CHEMICAL SYMBOL of the element represented by **X**. (1)

11.3 Is **Y** an example of a metal, non-metal or semi-metal? (1)

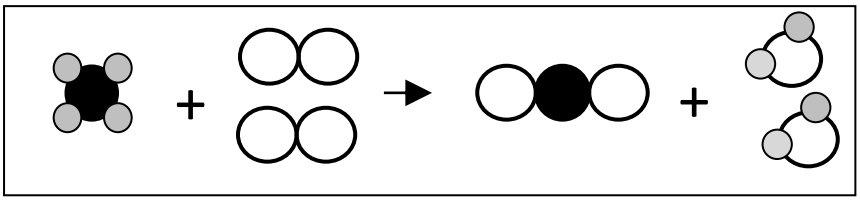
11.4 The Mass number of **Y**. (1)

QUESTION 12 [18]

Study the information in the table and answer the questions that follow.

NAME OF SUBSTANCE	FORMULA	STRUCTURE USED TO REPRESENT MOLECULES OF THE VARIOUS SUBSTANCES
Carbon dioxide	CO_2	
Methane	CH_4	
Oxygen gas	O_2	
Water	H_2O	

12.1 Use the information in the table and write a BALANCED CHEMICAL EQUATION for the reaction represented by the following diagram:



(3)

12.2 Re-write and balance the following chemical equations:

12.2.1 $H_2S + SO_2 \rightarrow S + H_2O$ (2)

12.2.2 $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + H_2O$ (1)

12.3 Name the following compounds. Use Stock notation where necessary.

12.3.1 $Mg(NO_3)_2$

12.3.2 $CuCl_2$

12.3.3 Li_2CO_3

12.3.4 NH_3 (4)

12.4 Write formulae for the following compounds:

12.4.1 dihydrogen monosulfide

12.4.2 beryllium phosphide

12.4.3 calcium sulfate

12.4.4 iron (III) hydroxide (4)

12.5 Write the following word equation into symbols and then balance the equation.

Sulfur dioxide gas reacts with oxygen gas to form sulphur trioxide gas. (4)

QUESTION 13 [10]

The following experiment is carried out to demonstrate the combustion of two elements, namely magnesium and carbon, in oxygen gas.

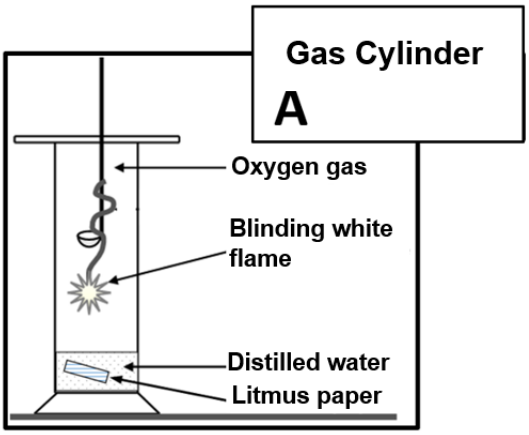
A small piece of each of the elements are placed in two separate deflagrating spoons and heated over open flames. The heated elements are then lowered into two separate gas cylinders (A and B), filled with oxygen gas.

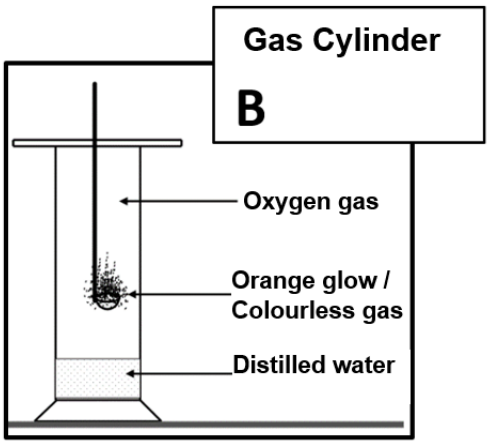
Observations:

The element which was placed in **gas cylinder A** burned with a blinding white flame.

The product which formed during this reaction was dissolved in distilled water at the bottom of the cylinder. A piece of pink litmus paper turned blue after it was placed in this solution.

The element placed in **gas cylinder B** glowed with a bright orange colour and produced a colourless gas.





13.1. Answer the following questions considering the observations and results from the above experiment.

13.1.1 Write down the SYMBOL of the element burned in oxygen in gas cylinder **A**. (1)

13.1.2 Write down the NAME of the element burned in oxygen in gas cylinder **B**. (1)

13.1.3 Write down the NAME of the PRODUCT which formed in gas cylinder **B**. (1)

13.1.4 Write down the COLOUR of the PRODUCT which formed in gas cylinder **A**. (1)

13.2 Complete and balance the following chemical equation:

$Mg + O_2 \rightarrow \ldots$ (2)

13.3 The acid that forms when the product from **B** dissolves in moisture which is found in the atmosphere is very harmful to our environment. Give the common name used to describe this acid and describe THREE of its negative effects. (4)

TOTAL SECTION B: [60]
GRAND TOTAL : [120]

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