This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School

for Boys and Girls Loueizeh - Baabda

Stage Exam 04

20-25JUN2025

Do NOT write in this box. Your MARK will be placed here.

Subject :	Chemistry	
Class :	9A	
Teacher :	Mrs. Saydeh Nasrallah	
Duration :	1 hour	
You are to answer the questions to this exam on : This exam paper		
Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

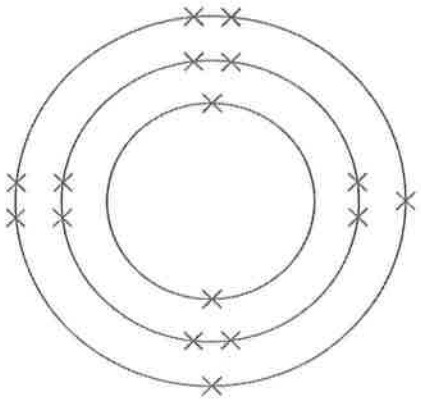
- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

Answer ALL questions.

Some questions must be answered with a cross in a box. If you change your mind about an answer, put a line through the box and then mark your new answer with a cross.

1. This question is about sulfur.

(a) The diagram represents the electronic configuration of an atom of sulfur.



(i) Which period of the Periodic Table contains sulfur?

(1)

☐ **A** 2
☐ **B** 3
☐ **C** 4
☐ **D** 6

(ii) What is the charge on a sulfide ion?

(1)

☐ **A** 1+
☐ **B** 2+
☐ **C** 1–
☐ **D** 2–

(b) When a mixture of sulfur and zinc is heated to a high temperature a reaction occurs, forming the compound zinc sulfide, ZnS

(i) Give a reason why the mixture of sulfur and zinc needs heating before a reaction occurs.

(1)

.....

.....

(ii) Calculate the relative formula mass (Mr) of zinc sulfide, ZnS.

(1)

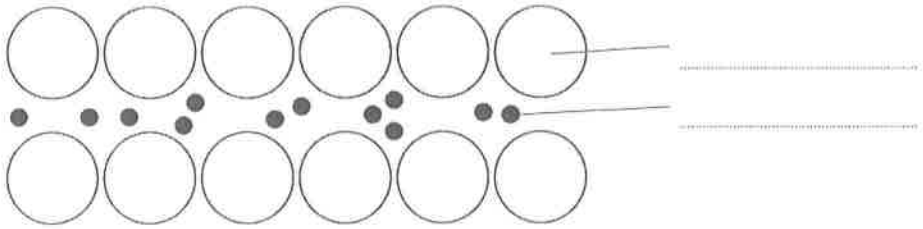
Mr = ...

(Total for Question 1 = 4 marks)

2. This question is about magnesium metal and its compounds.

(a)(i) The diagram represents the structure of magnesium.
Complete the diagram by adding the labels.

(2)



(ii) Explain why magnesium is malleable.

(2)

.....

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.....

(b) Magnesium burns in oxygen gas to form solid magnesium oxide.

(i) Complete the chemical equation for the reaction by balancing the equation and adding the state symbols.

(2)

..... Mg(s) + O_2(.....) → ..... MgO(.....)

(ii) Give a reason why magnesium is oxidised in this reaction.

(1)

.....

.....

(c) A student uses this method to make a solution of magnesium chloride.

Step 1 measure 25 cm^3 of dilute hydrochloric acid into a beaker
Step 2 add magnesium powder a little at a time
Step 3 keep adding magnesium powder until it is in excess
Step 4 remove the excess magnesium powder by filtration

This is the equation for the reaction.

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

(i) Explain why the student uses magnesium powder rather than magnesium ribbon.

(2)

.....

.....

(ii) Give a reason why the student adds an excess of magnesium in **step 3**.

(1)

.....

.....

(iii) Which of these is a correct statement about the gas formed in the reaction above?

(1)

☐ **A** it makes a squeaky pop with a lighted splint
☐ **B** it relights a glowing splint
☐ **C** it turns damp blue litmus paper red
☐ **D** it turns limewater milky

(iv) Calculate the minimum mass of magnesium needed to react with 0.5 mol of hydrochloric acid.

(2)

mass = ... g

(d) In another preparation, magnesium was placed in a known volume of sulfuric acid, H_2SO_4, in order to prepare hydrated crystals of magnesium sulfate.

The obtained solution was heated and the hydrated crystals were collected.

After drying the crystals, the student weighs them and then heats them until they reach a constant mass.
This equation represents the change that occurs during heating.

$$MgSO_4.xH_2O \rightarrow MgSO_4 + xH_2O$$

These are the student's results.

mass of dry crystals before heating = 17.2 g
mass of crystals after heating to a constant mass = 8.3 g

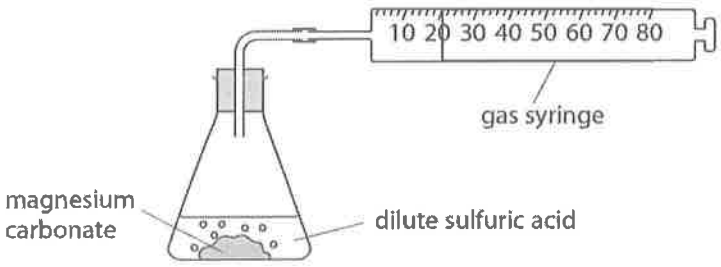
Use these results to find the value of x in the formula of $MgSO_4.xH_2O$
[Mr values: $MgSO_4$ = 120, H_2O = 18]

(4)

value of x = ...

(Total for Question 2 = 17 marks)

4. A student carries out an investigation on the reaction between magnesium carbonate and dilute sulfuric acid. He uses this apparatus.

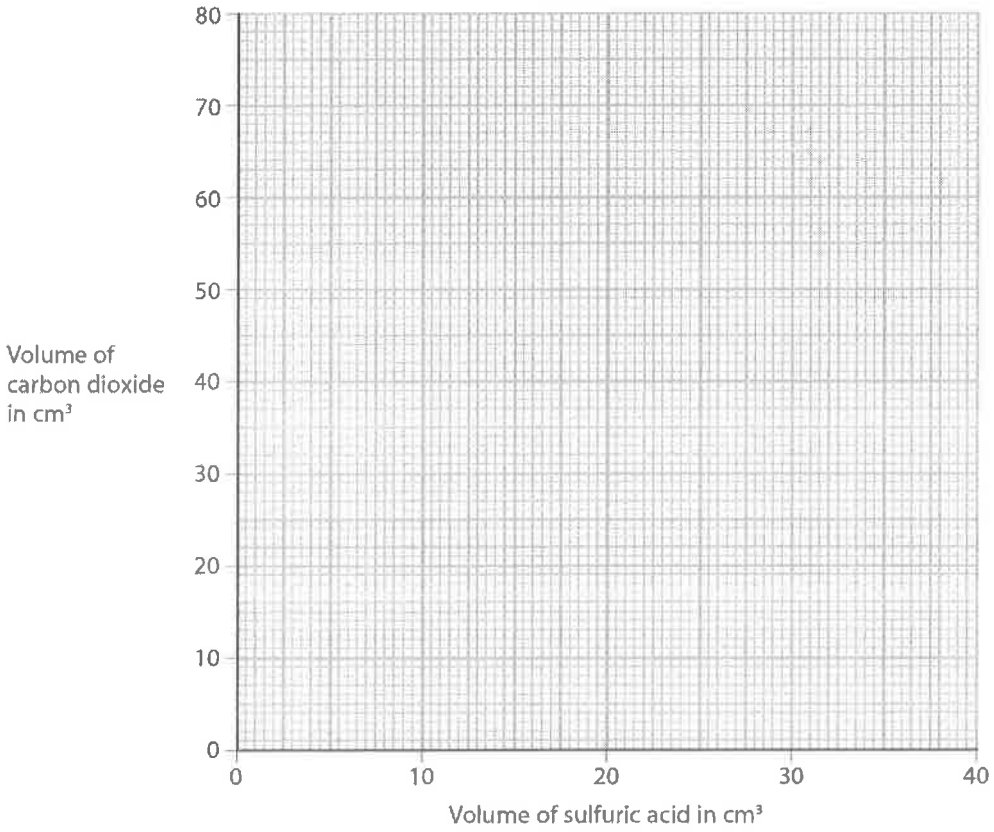


The student carries out seven experiments. In each experiment he uses the same mass of magnesium carbonate but a different volume of acid. He measures the total volume of carbon dioxide collected in each experiment. The table shows his results.

Volume of sulfuric acid used in cm^3	0	5	15	20	25	30	35	40
Volume of carbon dioxide collected in cm^3	0	16	47	61	64	78	80	80

(a) Plot the results on the grid and draw a curve of best fit.

(3)



(b)(i) Which volume of sulfuric acid produces an anomalous result?

(1)

.....

(ii) Explain what the results with 35 cm^3 and 40 cm^3 of sulfuric acid indicate about the reaction.

(2)

.....

.....

.....

.....

(iii) Use the graph to find the volume of carbon dioxide that would be collected if 10 cm^3 of acid were used.

(1)

volume of carbon dioxide = ... cm^3

(iv) Use the graph to find the volume of sulfuric acid that would result in 55 cm^3 of carbon dioxide being collected.

(1)

volume of sulfuric acid = ... cm^3

(Total for Question 4 = 8 marks)

5. This question is about different metals.
The list shows part of the reactivity series of metals.

potassium — most reactive
sodium
magnesium
zinc
iron
lead
copper — least reactive

(a) Name a metal from the list that **readily** reacts with water.

(1)

.....

(b) Uranium is a metal that is in between magnesium and zinc in the reactivity series.

Equal sized pieces of these three metals are placed in separate solutions of dilute hydrochloric acid of the same concentration and at the same temperature.

The observations for magnesium and zinc are shown in the table.

Complete the table by stating the observations that would be made for uranium.

(2)

Metal	Observations
Magnesium	Bubbles of gas produced very rapidly. Solid disappears very quickly.
Zinc	Bubbles of gas produced slowly. Solid disappears slowly.
Uranium	

(c)(i) Metals high in the reactivity series react readily with water.
Name the compound formed when potassium reacts with water.

(1)

.....

(ii) Give the formula of the compound formed when magnesium reacts with steam.

(1)

.....

(d) Zinc can be extracted by heating zinc oxide with carbon. The equation for the reaction is

$$ZnO + C \rightarrow Zn + CO$$

(i) Explain whether zinc or carbon is the more reactive element.

(2)

.....

.....

.....

.....

(ii) Explain which element is acting as a reducing agent in this reaction.

(2)

.....

.....

.....

.....

(Total for Question 5 = 9 marks)

6. The car fuel contains some impurities, including sulfur. There is 600 g of sulfur in 20 kg of fuel.

(a) Calculate the percentage of sulfur in the fuel.

(2)

percentage of sulfur = ...%

(b) When the fuel burns, the 600 g of sulfur produces sulfur dioxide gas.

$$S + O_2 \rightarrow SO_2$$

Calculate the volume, in cm^3, of sulfur dioxide gas that would be produced at room temperature and pressure (rtp) when the fuel burns.
[for a gas, molar volume = 24 dm^3 at rtp]

(3)

volume of sulfur dioxide = ... cm^3

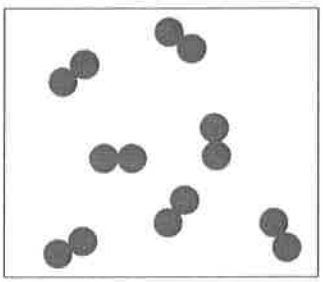
(c) State the name of the environmental problem caused by sulfur dioxide in the atmosphere.

(1)

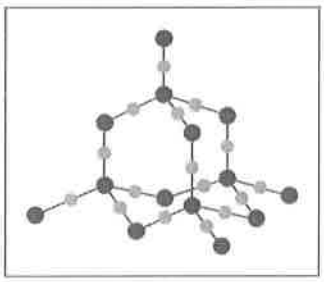
.....

(Total for Question 6 = 6 marks)

7. The properties of substances can be explained in terms of their bonding and structure.
Electricity can be transmitted by overhead power lines. This method of transmission requires electrical conductors and insulators.
The main substance that acts as an insulator in this method of transmission of electricity is air, which is mostly nitrogen.The power lines are supported by solid insulators. Most solid insulators are manufactured using silica.The diagram shows the structures of nitrogen and silica.



Nitrogen



Silica

Explain, in terms of bonding and structure, why nitrogen is a gas at room temperature but silica is a solid with a high melting point.

Nitrogen .....

.....

.....

.....

.....

.....

Silica .....

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(Total for Question 7 = 6 marks)

TOTAL FOR PAPER = 50 MARKS

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4		Key relative atomic mass **atomic symbol** name atomic (proton) number									11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated						

**** The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.***

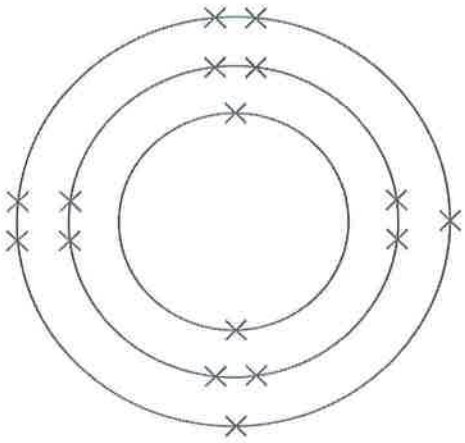
The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

Answer ALL questions.

Some questions must be answered with a cross in a box. If you change your mind about an answer, put a line through the box and then mark your new answer with a cross.

1. This question is about sulfur.

(a) The diagram represents the electronic configuration of an atom of sulfur.



(i) Which period of the Periodic Table contains sulfur?

(1)

- ☐ A 2
- ☒ B 3 ✓ (1)
- ☐ C 4
- ☐ D 6

(ii) What is the charge on a sulfide ion?

(1)

- ☐ A 1+
- ☐ B 2+
- ☐ C 1–
- ☒ D 2– ✓ (1)

(b) When a mixture of sulfur and zinc is heated to a high temperature a reaction occurs, forming the compound zinc sulfide, ZnS

(i) Give a reason why the mixture of sulfur and zinc needs heating before a reaction occurs.

(1)

The activation energy of the reaction is too high / Both reactants are in solid state ✓ (1)

(ii) Calculate the relative formula mass (Mr) of zinc sulfide, ZnS.

65 + 32 = 97

(1)

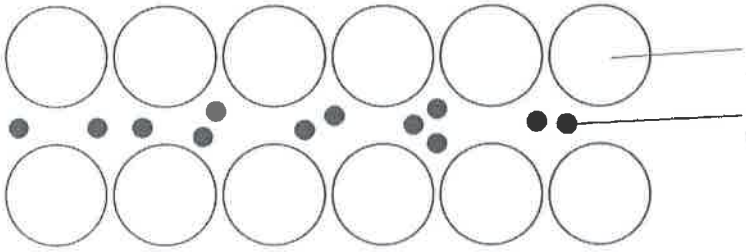
Mr = 97 ✓ (1)

(Total for Question 1 = 4 marks)

2. This question is about magnesium metal and its compounds.

(a)(i) The diagram represents the structure of magnesium.
Complete the diagram by adding the labels.

(2)



(ii) Explain why magnesium is malleable.

(2)

The sea of delocalised e^- prevent the repulsion between neighboring layers of cations as an external stress is applied

(b) Magnesium burns in oxygen gas to form solid magnesium oxide.

(i) Complete the chemical equation for the reaction by balancing the equation and adding the state symbols.

(2)

2 Mg(s) + O_2(g) → 2 MgO(s)

(ii) Give a reason why magnesium is oxidised in this reaction.

(1)

Magnesium gained oxygen

(c) A student uses this method to make a solution of magnesium chloride.

Step 1 measure 25 cm^3 of dilute hydrochloric acid into a beaker
Step 2 add magnesium powder a little at a time
Step 3 keep adding magnesium powder until it is in excess
Step 4 remove the excess magnesium powder by filtration

This is the equation for the reaction.

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

(i) Explain why the student uses magnesium powder rather than magnesium ribbon.

(2)

Magnesium powder provides a greater surface area, thus increasing the rate of reaction ✓1 ✓1

(ii) Give a reason why the student adds an excess of magnesium in **step 3**.

(1)

To ensure that all the acids have reacted ✓1

(iii) Which of these is a correct statement about the gas formed in the reaction above?

(1)

- [x] **A** it makes a squeaky pop with a lighted splint ✓1
- [ ] **B** it relights a glowing splint
- [ ] **C** it turns damp blue litmus paper red
- [ ] **D** it turns limewater milky

(iv) Calculate the minimum mass of magnesium needed to react with 0.5 mol of hydrochloric acid.

(2)

Mg : HCl
1 : 2 ✓

$\Rightarrow n_{(Mg)} = \frac{n_{HCl}}{2} = \frac{0.5}{2} = 0.25$ mol ✓1

$\Rightarrow m_{(Mg)} = 0.25 \times 24$

mass = 6 g ✓1

(d) In another preparation, magnesium was placed in a known volume of sulfuric acid, H_2SO_4, in order to prepare hydrated crystals of magnesium sulfate.

The obtained solution was heated and the hydrated crystals were collected.

After drying the crystals, the student weighs them and then heats them until they reach a constant mass.
This equation represents the change that occurs during heating.

$$MgSO_4.xH_2O \rightarrow MgSO_4 + xH_2O$$

These are the student's results.

mass of dry crystals before heating = 17.2 g
mass of crystals after heating to a constant mass = 8.3 g

Use these results to find the value of x in the formula of $MgSO_4.xH_2O$
[Mr values: $MgSO_4$ = 120, H_2O = 18]

(4)

$m_{H_2O} = 17.2 - 8.3 = 8.9\ g$ ✓(1)

$MgSO_4 : H_2O$

$\frac{8.3}{120} : \frac{8.9}{18}$ ✓(1)

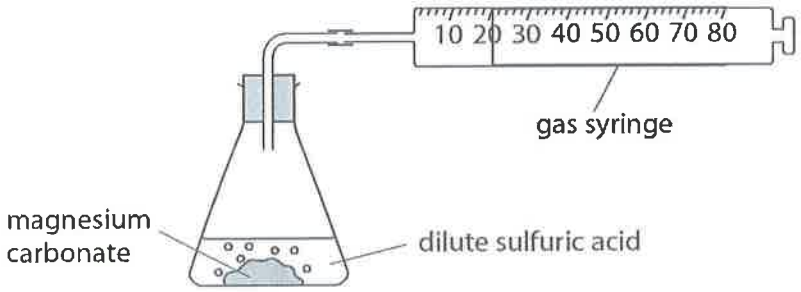
$\frac{0.069}{0.069} : \frac{0.494}{0.069}$ ✓(1)

1 : 7

value of x = 7 ✓(1)

(Total for Question 2 = 17 marks)

4. A student carries out an investigation on the reaction between magnesium carbonate and dilute sulfuric acid. He uses this apparatus.

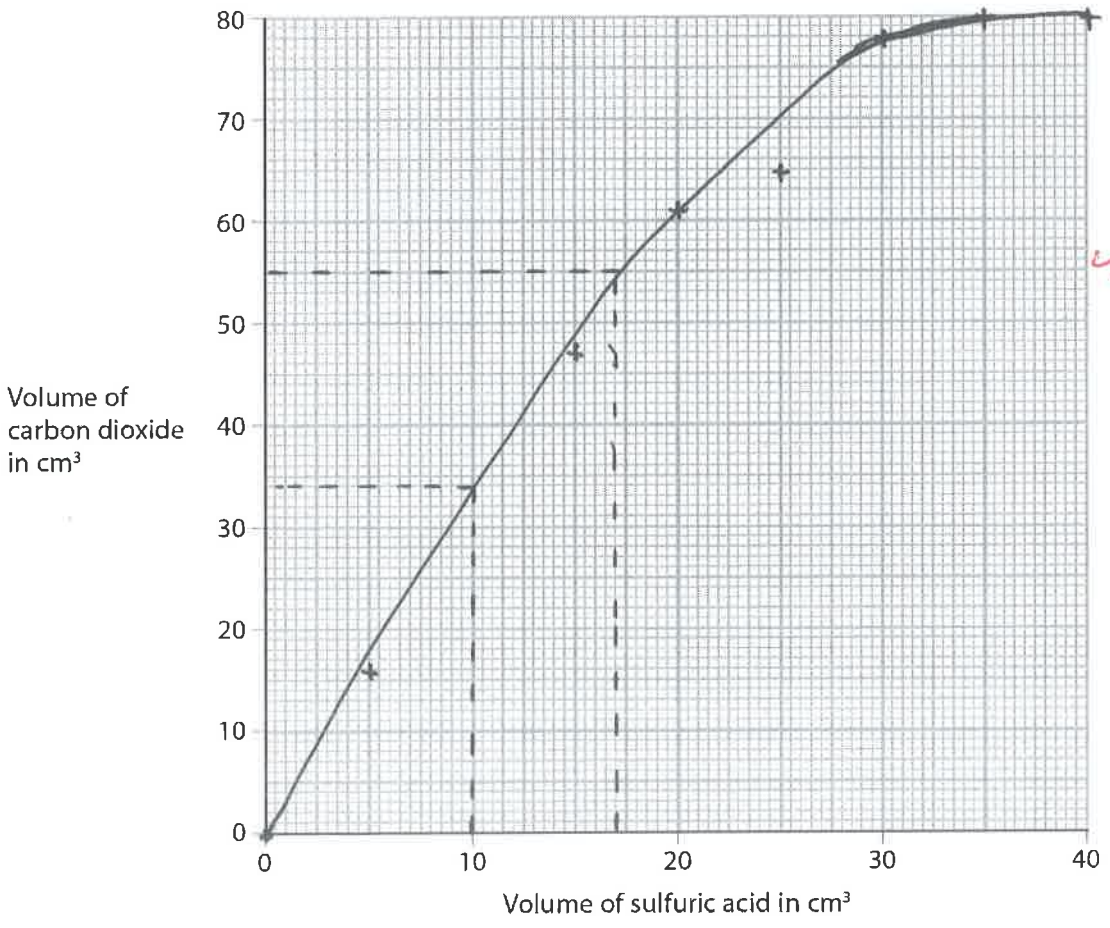


The student carries out seven experiments. In each experiment he uses the same mass of magnesium carbonate but a different volume of acid. He measures the total volume of carbon dioxide collected in each experiment. The table shows his results.

Volume of sulfuric acid used in cm^3	0	5	15	20	25	30	35	40
Volume of carbon dioxide collected in cm^3	0	16	47	61	64	78	80	80

(a) Plot the results on the grid and draw a curve of best fit.

(3)



(b)(i) Which volume of sulfuric acid produces an anomalous result?

(1)

25 cm^3 ✓1

(ii) Explain what the results with 35 cm^3 and 40 cm^3 of sulfuric acid indicate about the reaction.

(2)

As the volume of CO_2 produced reached a constant value ✓1 hence the reaction has finished. ✓1

(iii) Use the graph to find the volume of carbon dioxide that would be collected if 10 cm^3 of acid were used.

(1)

volume of carbon dioxide = 34 cm^3 ✓1

(iv) Use the graph to find the volume of sulfuric acid that would result in 55 cm^3 of carbon dioxide being collected.

(1)

volume of sulfuric acid = 17 cm^3 ✓1

(Total for Question 4 = 8 marks)

5. This question is about different metals.
The list shows part of the reactivity series of metals.

potassium — most reactive
sodium
magnesium
zinc
iron
lead
copper — least reactive

(a) Name a metal from the list that **readily** reacts with water.

(1)

Potassium / Sodium (1)

(b) Uranium is a metal that is in between magnesium and zinc in the reactivity series.

Equal sized pieces of these three metals are placed in separate solutions of dilute hydrochloric acid of the same concentration and at the same temperature.

The observations for magnesium and zinc are shown in the table.

Complete the table by stating the observations that would be made for uranium.

(2)

Metal	Observations
Magnesium	Bubbles of gas produced very rapidly. Solid disappears very quickly.
Zinc	Bubbles of gas produced slowly. Solid disappears slowly.
Uranium	Bubbles of gas produced rapidly (1) Solid disappears quickly (1)

(c)(i) Metals high in the reactivity series react readily with water.
Name the compound formed when potassium reacts with water.

(1)

Potassium hydroxide (1)

(ii) Give the formula of the compound formed when magnesium reacts with steam.

(1)

MgO (1)

(d) Zinc can be extracted by heating zinc oxide with carbon. The equation for the reaction is

$$ZnO + C \rightarrow Zn + CO$$

(i) Explain whether zinc or carbon is the more reactive element.

(2)

Carbon displaced zinc from its compound, therefore carbon is higher than zinc on the reactivity series. (2)

(ii) Explain which element is acting as a reducing agent in this reaction.

(2)

Carbon got oxidised, hence it's the reducing agent. (2)

(Total for Question 5 = 9 marks)

6. The car fuel contains some impurities, including sulfur. There is 600 g of sulfur in 20 kg of fuel.

(a) Calculate the percentage of sulfur in the fuel.

(2)

$$\%\ S = \frac{600}{20 \times 10^3} \times 100$$ (1)

(1)

percentage of sulfur = ... 30 .....%

(b) When the fuel burns, the 600 g of sulfur produces sulfur dioxide gas.

$$S + O_2 \rightarrow SO_2$$

Calculate the volume, in cm^3, of sulfur dioxide gas that would be produced at room temperature and pressure (rtp) when the fuel burns.
[for a gas, molar volume = 24 dm^3 at rtp]

(3)

$$n_S = \frac{600}{32} = 18.75 \text{ mol}$$ (1)

$$S : SO_2$$
$$1 : 1 \Rightarrow n_{SO_2} = 18.75 \text{ mol}$$ (1)

$$\Rightarrow V_{SO_2} = 18.75 \times 24 \times 10^3$$

(1)

volume of sulfur dioxide = ... 450,000 ..... cm^3

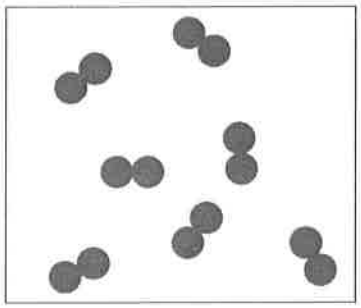
(c) State the name of the environmental problem caused by sulfur dioxide in the atmosphere.

(1)

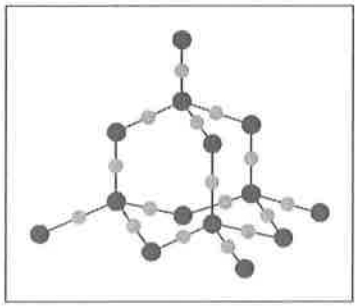
..... Acid rain ..... (1) .....

(Total for Question 6 = 6 marks)

7. The properties of substances can be explained in terms of their bonding and structure.
Electricity can be transmitted by overhead power lines. This method of transmission requires electrical conductors and insulators.
The main substance that acts as an insulator in this method of transmission of electricity is air, which is mostly nitrogen.The power lines are supported by solid insulators. Most solid insulators are manufactured using silica.The diagram shows the structures of nitrogen and silica.



Nitrogen



Silica

Explain, in terms of bonding and structure, why nitrogen is a gas at room temperature but silica is a solid with a high melting point.

Nitrogen has a simple covalent structure (1), where weak intermolecular forces exist between the particles. These forces (1) require small amount of energy to break, (1) which explains its low boiling point.

Silica has a giant tetrahedral structure (1) where the atoms are covalently bonded. The covalent bonds require high amount (1) of energy to be overcome in order to melt silica; which explains its state at room temperature and pressure. (1)

(Total for Question 7 = 6 marks)

TOTAL FOR PAPER = 50 MARKS

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.