This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 02

26MAR2025

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.(a) Table **1** lists three subatomic particles.
Complete table **1** by giving the relative mass and relative charge of each subatomic particle.
(3)

Subatomic particle	Relative mass	Relative charge
proton		
electron		
neutron		

Table 1

(b) Table **2** shows the number of protons, neutrons and electrons in particles P, Q, R, S and T.

Particle	Number of protons	Number of neutrons	Number of electrons
P	11	12	10
Q	8	8	10
R	10	10	10
S	9	10	9
T	12	12	12

Table 2

Use table **2** to answer these questions.
Each particle, P, Q, R, S and T, may be used once, more than once or not at all.

(i) State which particle has the highest mass number.
(1)

.....

(ii) State which particle contains two electrons in its outer shell.
(1)

.....

(iii) State which particle is a negative ion.

(1)

.....

(iv) State which particle is an atom of an element in Group 7 of the Periodic Table.

(1)

.....

(c) Which of these statements is correct for isotopes of the same element?

(1)

- ☐ **A** they have a different atomic number
- ☐ **B** they have a different number of electrons
- ☐ **C** they have the same number of neutrons
- ☐ **D** they have the same number of protons

(Total for Question 1 = 8 marks)

2. The diagram shows a section of the Periodic Table.

Period	1	2	Group						3	4	5	6	7	0
1			1 H Hydrogen 1											4 He Helium 2
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
3	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

(a)(i) The elements in the Periodic Table are arranged in order of increasing

(1)

- ☐ **A** atomic number
- ☐ **B** mass number
- ☐ **C** neutron number
- ☐ **D** relative atomic mass

(ii) Identify the element that is in Period 3 and Group 5 of the Periodic Table.

(1)

.....

(iii) Name two elements in Period 2 that form acidic oxides.

(2)

1 .....

2 .....

(iv) Describe the environmental problem that occurs when acidic oxides dissolve in water in the atmosphere.

(2)

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(b) Magnesium and sulfur react to form an ionic compound.
The equation for this reaction is

$$Mg + S \rightarrow MgS$$

(i) Write a word equation for this reaction.

(1)

.....

.....

(ii) Describe the changes in electronic configurations when magnesium reacts with sulfur to form the ionic compound MgS.

Show the charges on the ions.

(3)

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(Total for Question 2 = 10 marks)

3. Carbon dioxide gas forms when dilute nitric acid is added to marble chips.
The word equation for the reaction is

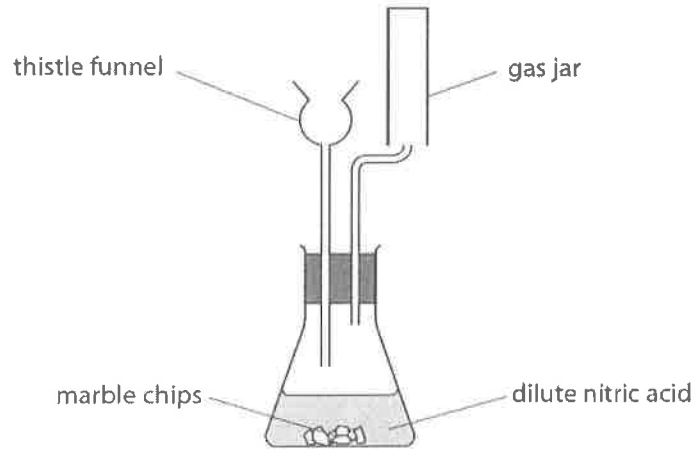
calcium carbonate + nitric acid → calcium nitrate + carbon dioxide + water

(a) Write a chemical equation for the reaction.

(2)

.....

(b) A student needs to prepare and collect some carbon dioxide gas, using the reaction between marble chips and dilute nitric acid.
The diagram shows how he sets up his apparatus.



State two reasons why the student's set-up is not suitable for collecting carbon dioxide.

(2)

1 .....

.....

2 .....

.....

(c) Some carbon dioxide is bubbled into distilled water containing universal indicator.
A solution of pH 6 is produced. This shows that the solution is

(1)

☐ **A** alkaline
☐ **B** neutral
☐ **C** acidic
☐ **D** not enough information to determine its characteristics

(d) Carbon dioxide contains simple molecules. The atoms in the molecules are joined by covalent bonds.

(i) State what is meant by the term covalent bond.

(2)

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(ii) Explain why carbon dioxide has a low boiling point.

(2)

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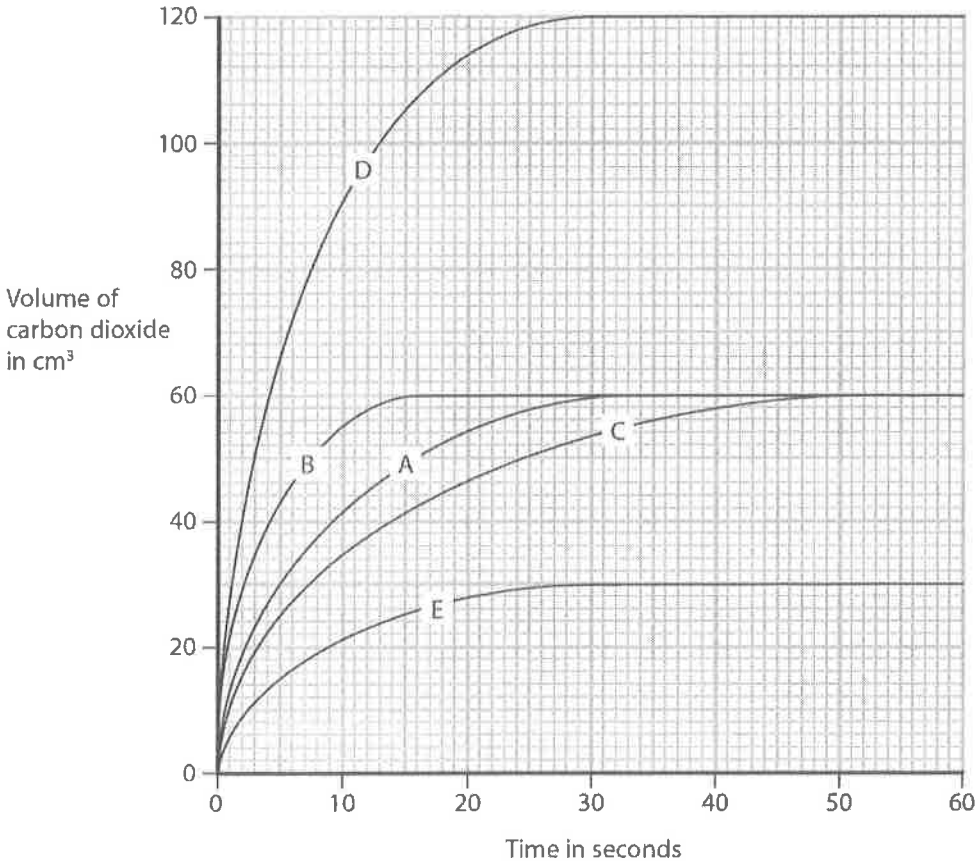
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(iii) Draw a diagram, using dots and crosses, to show the arrangement of the electrons in a molecule of carbon dioxide.

Show **only** the outer shell electrons.

(2)

(e) The graph shows the volumes of carbon dioxide given off when marble chips are reacted with nitric acid in five different experiments.



Curve A shows the volume of carbon dioxide given off when some marble chips are reacted with an excess of 1.0 mol/dm³ hydrochloric acid.

(i) Explain which curve, B, C, D or E, could represent the results obtained if half the mass of marble chips is used with excess of the acid.

(2)

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(ii) Explain which curve, B, C, D or E, could represent the results obtained if the reaction is performed at a lower temperature, with the same mass of marble chips and excess of the acid.

(2)

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(iii) Explain which curve, B, C, D or E, could represent the results obtained if the marble chips are replaced by the same mass of powdered marble chips and excess of the acid.

(2)

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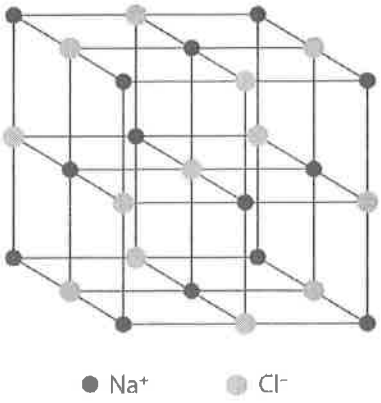
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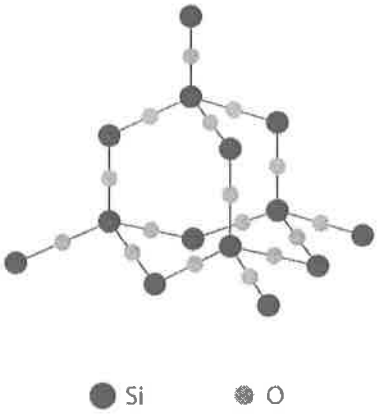
(Total for Question 3 = 17 marks)

4. Sodium chloride (NaCl) and silicon dioxide (SiO_2) both have giant lattice structures. Sodium chloride is an ionic compound. Silicon dioxide is a covalent compound.

Structure of sodium chloride



Structure of silicon dioxide



The table shows some properties of each compound.

Sodium chloride	Silicon dioxide
melting point = 801 °C	melting point = 1610 °C
soluble in water	insoluble in water
conducts electricity when molten	does not conduct electricity when molten

(a)(i) Explain why silicon dioxide has a high melting point.

(2)

.....

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.....

(ii) Suggest why the melting point of silicon dioxide is higher than the melting point of sodium chloride.

(1)

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(b) Explain fully why sodium chloride is soluble in water. You may draw a labelled diagram.

(3)

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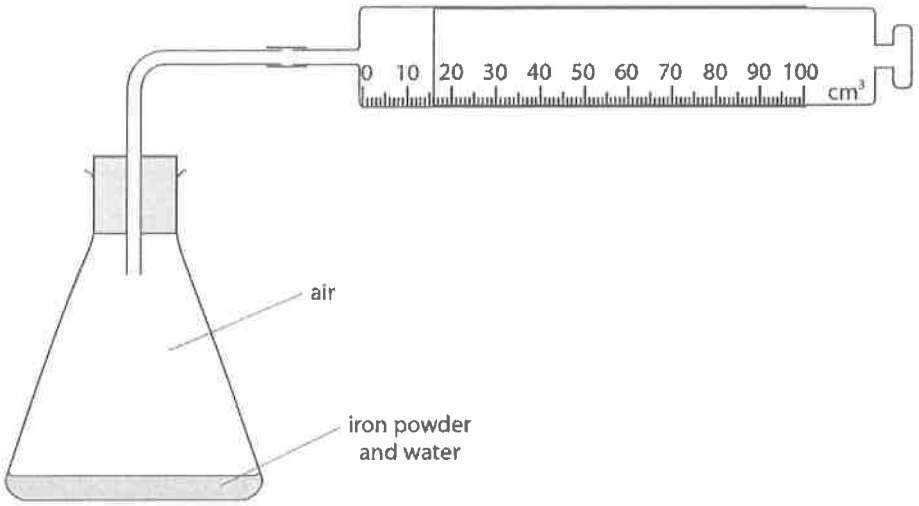
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(Total for Question 4 = 6 marks)

5. A student uses the reaction between iron and oxygen in an experiment to find the percentage by volume of oxygen in air.
The diagram shows his apparatus.



(a) State the advantage of using iron powder rather than pieces of iron.

(1)

.....

.....

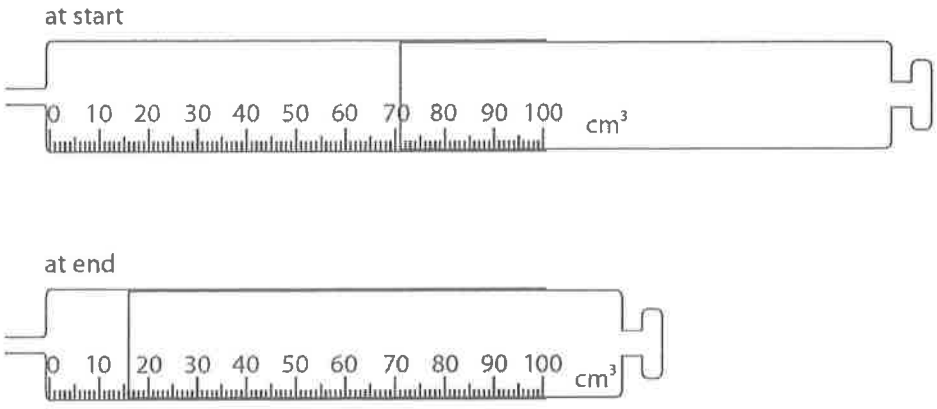
(b) Why is it necessary for the student to mix the iron powder with water?

(1)

.....

.....

(c) The student records the reading on the syringe at the start of the experiment.
He then records the reading every day until there is no further change.
The diagram shows the syringe at the start and at the end of the experiment.



Use the readings to complete the table, entering all values to the nearest 1 cm^3.

(3)

Volume reading at start in cm^3	
Volume reading at end in cm^3	
Change in volume in cm^3	

(d) The student repeats the experiment but obtains a much smaller change in volume.
Which of these could be a reason for the smaller change in volume?

(1)

☐ **A** he uses 10 cm^3 of water instead of 5 cm^3
☐ **B** he leaves the apparatus for a longer time
☐ **C** he leaves the apparatus in a warmer place
☐ **D** he uses a smaller mass of iron powder

(e) During another experiment, the student writes down these values.

volume of air in conical flask and glass tube	250 cm^3
syringe reading at start in cm^3	90
syringe reading at end in cm^3	20
volume of oxygen reacting	70 cm^3

The student incorrectly calculates the percentage by volume of oxygen in air.
This is his working.

$$\frac{70 \times 100}{90} = 78\,\%$$

(i) Identify the mistake in his working.

(1)

.....

.....

(ii) Use values from the table to correctly calculate the percentage by volume of oxygen in air.

(2)

percentage =..... %

(Total for Question 5 = 9 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.

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.(a) Table **1** lists three subatomic particles.
Complete table **1** by giving the relative mass and relative charge of each subatomic particle.
(3)

Subatomic particle	Relative mass	Relative charge
proton	1	+1
electron	$\frac{1}{2000}$	−1
neutron	1	0

Table 1

(b) Table **2** shows the number of protons, neutrons and electrons in particles P, Q, R, S and T.

Particle	Number of protons	Number of neutrons	Number of electrons
P	11	12	10
Q	8	8	10
R	10	10	10
S	9	10	9
T	12	12	12

Table 2

Use table **2** to answer these questions.
Each particle, P, Q, R, S and T, may be used once, more than once or not at all.

(i) State which particle has the highest mass number.
(1)

T

(ii) State which particle contains two electrons in its outer shell.
(1)

T

(iii) State which particle is a negative ion.

(1)

Q ✓ (1)

(iv) State which particle is an atom of an element in Group 7 of the Periodic Table.

(1)

S ✓ (1)

(c) Which of these statements is correct for isotopes of the same element?

(1)

- ☐ **A** they have a different atomic number
- ☐ **B** they have a different number of electrons
- ☐ **C** they have the same number of neutrons
- ☒ **D** they have the same number of protons

(1) ✓

(Total for Question 1 = 8 marks)

2. The diagram shows a section of the Periodic Table.

Period	1	2	Group									0
1			1 H Hydrogen 1									4 He Helium 2
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
3	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

(a)(i) The elements in the Periodic Table are arranged in order of increasing

(1)

(1) ✓

- ☒ **A** atomic number
- ☐ **B** mass number
- ☐ **C** neutron number
- ☐ **D** relative atomic mass

(ii) Identify the element that is in Period 3 and Group 5 of the Periodic Table.

(1)

P ✓ (1)

(iii) Name two elements in Period 2 that form acidic oxides.

(2)

1 Carbon ✓ (1)

2 Sulfur ✓ (1)

(iv) Describe the environmental problem that occurs when acidic oxides dissolve in water in the atmosphere.

(2)

Acidic oxides such as sulfur dioxide dissolve in rain forming acid rain. ✓ (1)

Acid rain causes several environmental problems among which the deterioration of the maritime life. ✓ (1)

(b) Magnesium and sulfur react to form an ionic compound.
The equation for this reaction is

$$Mg + S \rightarrow MgS$$

(i) Write a word equation for this reaction.

(1)

Magnesium reacts with sulfur to produce magnesium sulfide ✓ (1)

(ii) Describe the changes in electronic configurations when magnesium reacts with sulfur to form the ionic compound MgS.

Show the charges on the ions.

(3)

Mg : 2.8.(2) ✓ ⟶ Mg^{2+} : $[2.8]^{2+}$ ✓ (1)

S : 2.8.6 ✓ ⟶ S^{2-} : $[2.8.8]^{2-}$ ✓ (1)

Magnesium atoms give their valence $\bar{e}$ to sulfur atoms, thus forming ✓ (1) magnesium and sulfide ions.

(Total for Question 2 = 10 marks)

3. Carbon dioxide gas forms when dilute nitric acid is added to marble chips.
The word equation for the reaction is

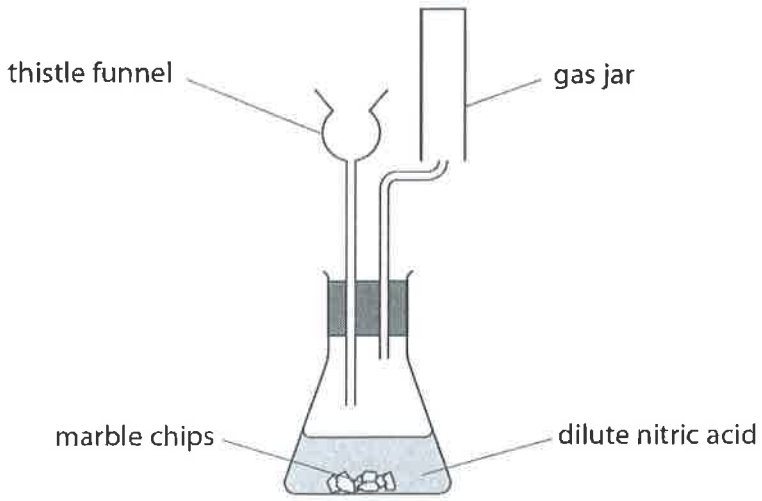
calcium carbonate + nitric acid → calcium nitrate + carbon dioxide + water

(a) Write a chemical equation for the reaction.

(2)

$CaCO_3 + 2HNO_3 \longrightarrow Ca(NO_3)_2 + CO_2 + H_2O$ (1)

(b) A student needs to prepare and collect some carbon dioxide gas, using the reaction between marble chips and dilute nitric acid.
The diagram shows how he sets up his apparatus.



State two reasons why the student's set-up is not suitable for collecting carbon dioxide.

(2)

1 CO_2 is dense, therefore should be collected downward (1)

2 CO_2 can escape through the open thistle funnel (1)

(c) Some carbon dioxide is bubbled into distilled water containing universal indicator.
A solution of pH 6 is produced. This shows that the solution is

(1)

- ☐ **A** alkaline
- ☐ **B** neutral
- ☒ **C** acidic (1)
- ☐ **D** not enough information to determine its characteristics

(d) Carbon dioxide contains simple molecules. The atoms in the molecules are joined by covalent bonds.

(i) State what is meant by the term covalent bond.

(2)

It's the electrostatic attraction between the nuclei of atoms and the shared pair of e⁻.

(ii) Explain why carbon dioxide has a low boiling point.

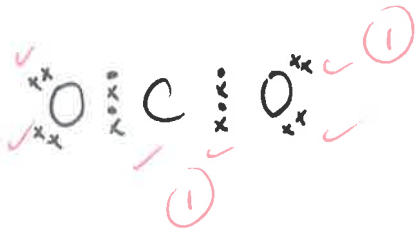
(2)

Carbon dioxide has a simple covalent structure. Weak intermolecular forces exist between the molecules. These forces require low amount of energy to be broken.

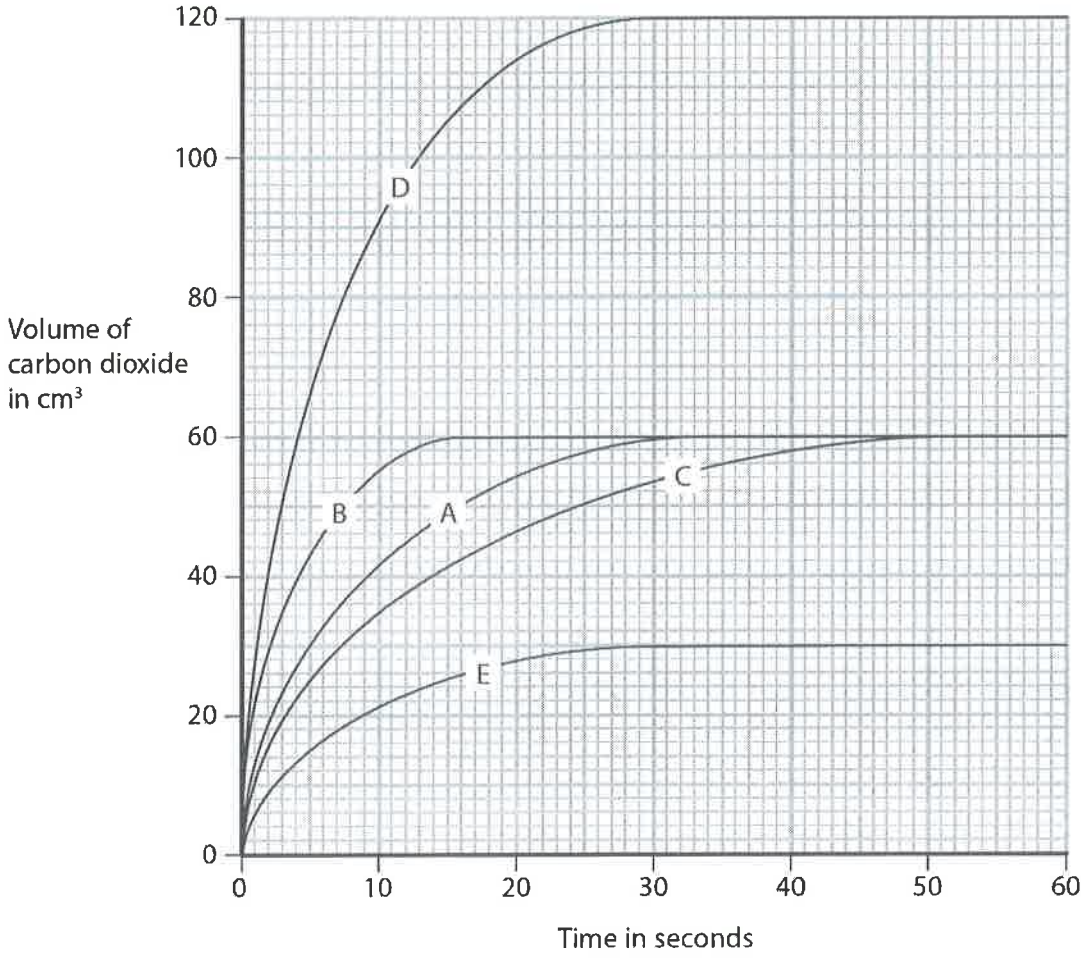
(iii) Draw a diagram, using dots and crosses, to show the arrangement of the electrons in a molecule of carbon dioxide.

Show **only** the outer shell electrons.

(2)



(e) The graph shows the volumes of carbon dioxide given off when marble chips are reacted with nitric acid in five different experiments.



Curve A shows the volume of carbon dioxide given off when some marble chips are reacted with an excess of 1.0 mol/dm³ hydrochloric acid.

(i) Explain which curve, B, C, D or E, could represent the results obtained if half the mass of marble chips is used with excess of the acid.

(2)

It's curve E. ✓(1)
Half the total volume of CO_2 is produced (compared to that obtained in curve A) when half the mass of marble chips is used ✓(1)

(ii) Explain which curve, B, C, D or E, could represent the results obtained if the reaction is performed at a lower temperature, with the same mass of marble chips and excess of the acid.

(2)

It's curve C. ✓ (1)
With the same amount of substance but at low temperature, a slower rate of reaction would be observed but, the same final volume of CO_2 obtained. ✓ (1)

(iii) Explain which curve, B, C, D or E, could represent the results obtained if the marble chips are replaced by the same mass of powdered marble chips and excess of the acid.

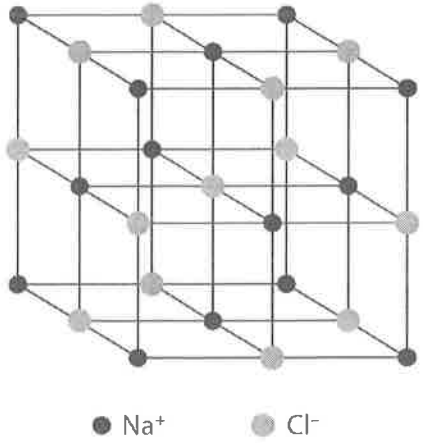
(2)

It's curve B. ✓ (1)
Faster rate of reaction would be observed with powdered marble as they present a greater surface area. But the same final volume of CO_2 produced. ✓ (1)

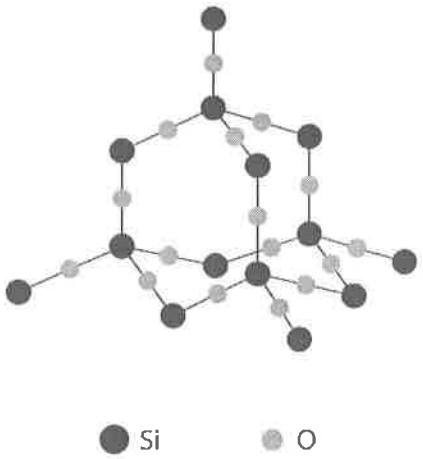
(Total for Question 3 = 17 marks)

4. Sodium chloride (NaCl) and silicon dioxide (SiO_2) both have giant lattice structures. Sodium chloride is an ionic compound. Silicon dioxide is a covalent compound.

Structure of sodium chloride



Structure of silicon dioxide



The table shows some properties of each compound.

Sodium chloride	Silicon dioxide
melting point = 801 °C	melting point = 1610 °C
soluble in water	insoluble in water
conducts electricity when molten	does not conduct electricity when molten

(a)(i) Explain why silicon dioxide has a high melting point.

(2)

Silicone dioxide has a giant covalent structure, (1)
where the atoms are covalently bonded.
These attractions require high amount of
energy to be broken, hence high T_m. (1)

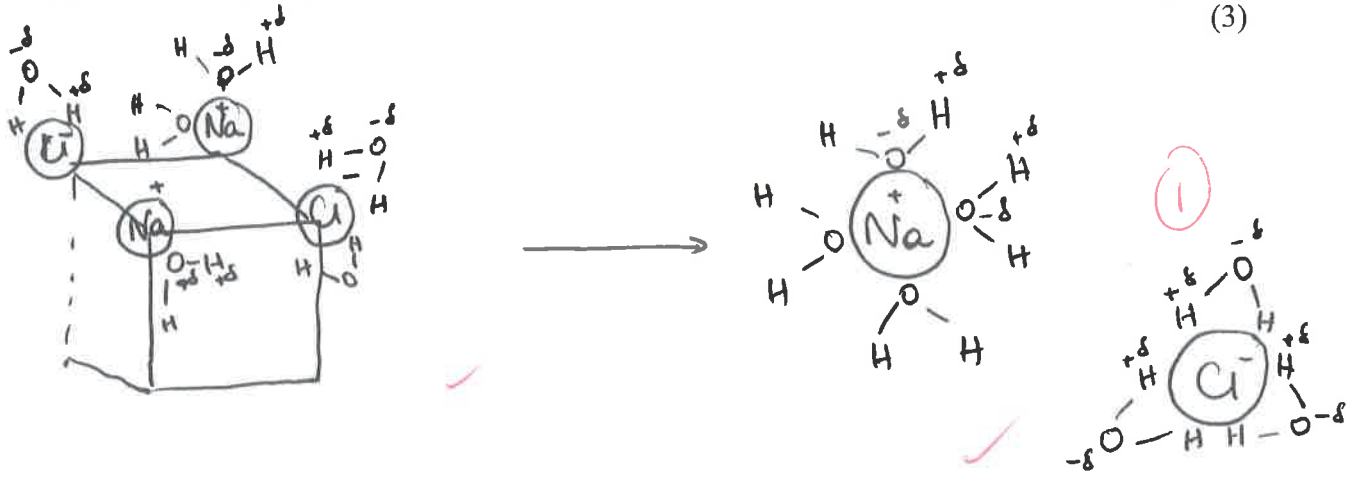
(ii) Suggest why the melting point of silicon dioxide is higher than the melting point of sodium chloride.

(1)

The tetrahedral arrangement of atoms require more energy to break compared to the cubic structure (1)

(b) Explain fully why sodium chloride is soluble in water. You may draw a labelled diagram.

(3)

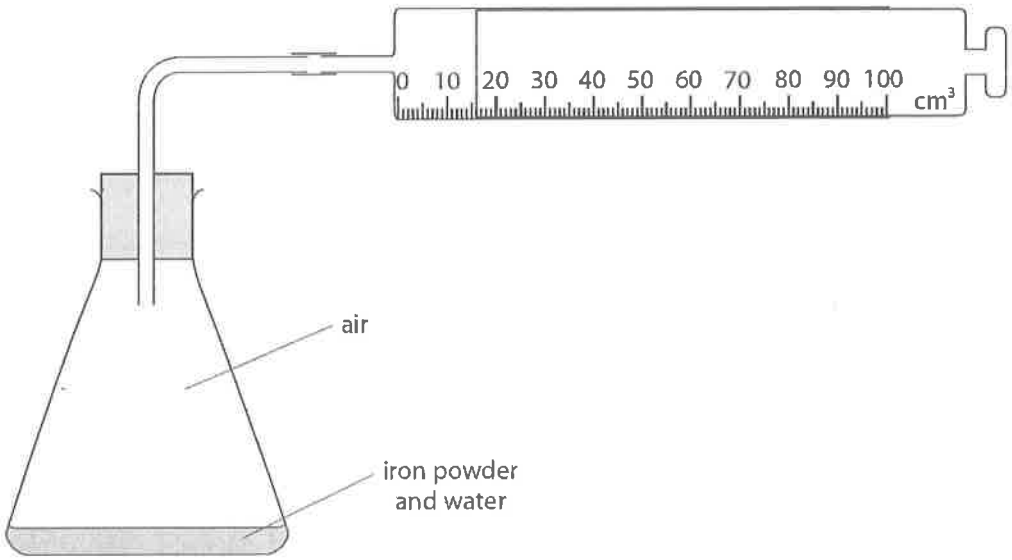


The ions in NaCl are attracted to H_2O molecules as shown in the diagram. (1)

As more water molecules are attracted to the ions, the ionic attractions weakens to the point that it breaks causing the (1) structure to collapse and forming hydrated ions.

(Total for Question 4 = 6 marks)

5. A student uses the reaction between iron and oxygen in an experiment to find the percentage by volume of oxygen in air.
The diagram shows his apparatus.



(a) State the advantage of using iron powder rather than pieces of iron.

(1)

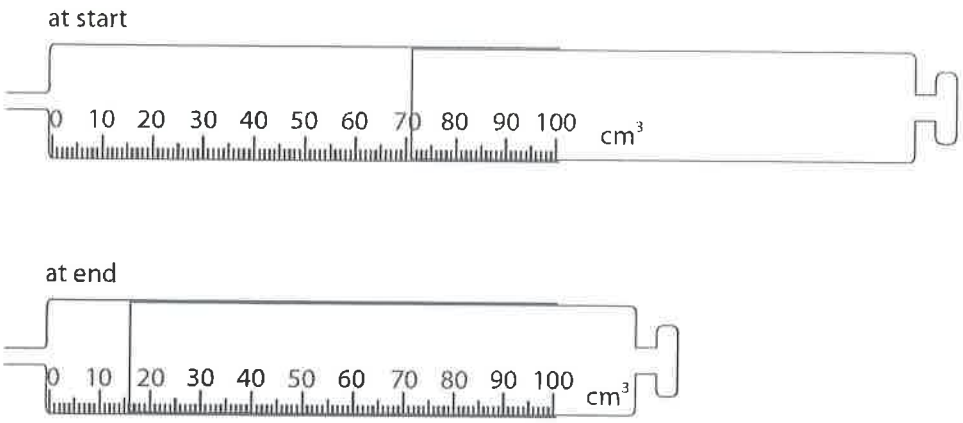
It provides a greater surface area, hence faster rate of reaction. ✓ (1)

(b) Why is it necessary for the student to mix the iron powder with water?

(1)

Water acts as a catalyst. ✓ (1)

(c) The student records the reading on the syringe at the start of the experiment.
He then records the reading every day until there is no further change.
The diagram shows the syringe at the start and at the end of the experiment.



Use the readings to complete the table, entering all values to the nearest 1 cm^3.

(3)

Volume reading at start in cm^3	71
Volume reading at end in cm^3	16
Change in volume in cm^3	55

(d) The student repeats the experiment but obtains a much smaller change in volume.
Which of these could be a reason for the smaller change in volume?

(1)

- ☐ **A** he uses 10 cm^3 of water instead of 5 cm^3
- ☐ **B** he leaves the apparatus for a longer time
- ☐ **C** he leaves the apparatus in a warmer place
- ☒ **D** he uses a smaller mass of iron powder

(e) During another experiment, the student writes down these values.

volume of air in conical flask and glass tube	250 cm^3
syringe reading at start in cm^3	90
syringe reading at end in cm^3	20
volume of oxygen reacting	70 cm^3

The student incorrectly calculates the percentage by volume of oxygen in air.
This is his working.

$$\frac{70 \times 100}{90} = 78\%$$

(i) Identify the mistake in his working.

(1)

The total volume used is incorrect ✓ (1)

(ii) Use values from the table to correctly calculate the percentage by volume of oxygen in air.

(2)

$\%O_2 = \frac{70}{90+250} \times 100$ ✓ (1)

✓ (1)

percentage = 21.9 %

(Total for Question 5 = 9 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.