This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 05

27APR2026

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

Subject :	Chemistry	
Class :	9A	
Teacher :	Ms. Lea Abdul Khalek	
Duration :	1 hour	
A periodic table is provided at the back.		
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.

1. The diagram shows the electronic configurations of six different atoms.

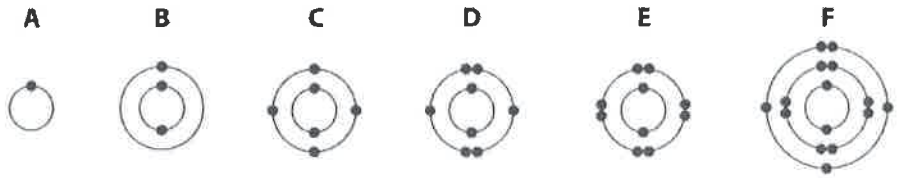


Figure 1

(a) You may use the Periodic Table to help you answer this question.
Answer each part by writing one of the letters A, B, C, D, E or F in the box provided.
You may use each letter once, more than once, or not at all.

Give the letter that represents an atom: (6)

(i) Of a noble gas [E] (1)

(ii) That contains three protons [B] (1)

(iii) Of phosphorus [F] (1)

(iv) Of an element in Group 4 of the Periodic Table [C] (1)

(v) Of an element in Period 3 of the Periodic Table [F] (1)

(vi) With a full outer shell of electrons [E] (1)

(b) Atoms of A and D combine to form a compound containing covalent bonds.

(i) Complete the sentence to describe a covalent bond. (2)

A covalent bond is the electrostatic attraction between a shared pair of (1) electrons and the nuclei (1) of 2 atoms.

(ii) Suggest, with reference to electronic configurations, the most likely formula of the compound formed between atoms of A and D. (1)

A_2D (1)

(Total for Question 1 = 9 marks)

2. Air is a mixture of gases.

The table gives the formulae of three gases and their approximate percentage by volume in a sample of dry, unpolluted air.

Gas	Percentage by volume
CO_2	0.04
N_2	78
O_2	21

Figure 2

(a)

(i) Give the **name** of the 2 main gases in the sample of air.

(1)

Nitrogen and oxygen gas (1)

(ii) Give the **name** of the gas that makes up most of the remaining 0.96% of the air.

(1)

Argon (1)

(b) Give the **name** of a gas present in polluted air that causes acid rain.

(1)

Any of those: sulfur dioxide, nitrogen oxide / dioxide... (1)

(c) Gases in the atmosphere that trap heat from the Sun are known as 'greenhouse gases'. Give one possible consequence of an increase in the amount of these gases in the atmosphere.

(1)

Earth's temperature would increase, causing global warming and climate change. Ice would melt, sea levels rise, floods would increase, extreme weather conditions... (1)

(d) A student used this apparatus to find the percentage by volume of oxygen in a sample of air.

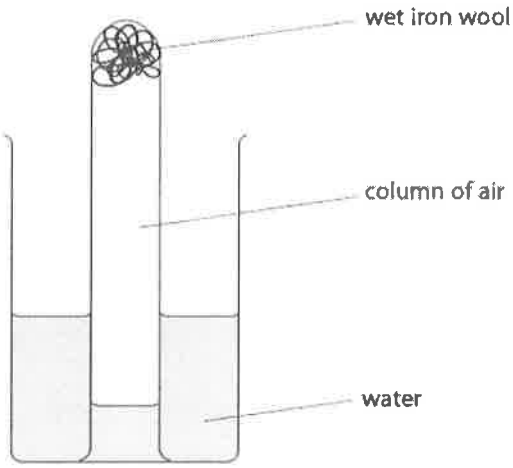


Figure 3

She used this method.

- Place some wet iron wool in the bottom of a test tube.
- Invert the test tube in a beaker containing water.
- Measure the height of the column of air in the test tube.
- Leave the test tube for one week.
- Measure the new height of the column of air.

The table shows her results.

Initial height of column of air in mm	80
Final height of column of air in mm	63

Figure 4

(i) Some of the iron turned into rust. Write a **word equation** for this reaction.

(2)

Iron + oxygen ⟶ iron(III) oxide

(1) (1)

(ii) Use the student's results to calculate the percentage of oxygen in this sample of air.

$\%\ \text{oxygen} = \frac{80-63}{80} \times 100 = 21.25\%$ (2)

(1)

Percentage of oxygen 21.25% (1)

(e) The student left the apparatus for another week and measured the height of the column of air again.

From this measurement, how could she tell whether all of the oxygen in the test tube had been used up in the first week?

(1)

If the height of the air column remains the same as before, this would indicate that all the oxygen in the test tube was used up in the first week. (1)

(Total for Question 2 = 9 marks)

3. Copper hydroxide, copper oxide and copper sulfide are three compounds of copper.

(a)

(i) Copper hydroxide is formed as a precipitate.

Which state symbol would be used in the equation to show that copper hydroxide is a precipitate. (1)

- ☐ A (aq)
- ☐ B (g)
- ☐ C (l)
- ☒ D (s)

(1)

(ii) In solution, copper chloride reacts with potassium hydroxide to form copper hydroxide and potassium chloride.

Write the **balanced equation** for this reaction. State symbols are required. (2)

$CuCl_2(aq.) + 2KOH(aq.) \rightarrow Cu(OH)_2(s) + 2KCl(aq.)$

(1) (1)

(b) Copper (II) carbonate hydroxide, commonly known as malachite, is another compound that's used as a pigment due to its vibrant green color.

It has the formula $Cu_2CO_3(OH)_2$.

Calculate the relative formula mass of copper hydroxide. Show your work.
(relative atomic masses: Cu = 63.5, C = 12, O = 16, H = 1)

(2)

$Cu_2CO_3(OH)_2$

$2Cu + C + 3O + 2O + 2H$

$RFM = (2 \times 63.5) + 12 + (5 \times 16) + 2$ (1)

$= 127 + 12 + 80 + 2$

$= 221$ (1)

(c) In an analysis of copper sulfide, 12.7g of copper was found to be combined with 3.2g of sulfur.

Calculate the empirical formula of the copper sulfide. Show your work.
(relative atomic masses: Cu = 63.5, S = 32)

(3)

Cu	S
$\frac{12.7}{63.5}$	$\frac{3.2}{32}$ (1)
$\frac{0.2}{0.1}$	$\frac{0.1}{0.1}$
2	1 (1)

Empirical formula = Cu_2S (1)

(d) Copper reacts with oxygen to form copper oxide.

$$2Cu + O_2 \longrightarrow 2CuO$$

Calculate the maximum mass of copper oxide that could be formed by reacting 25.4g of copper with excess oxygen.
(relative atomic masses: Cu = 63.5, O = 16)

(2)

* $RFM(CuO) = 63.5 + 16 = 79.5$
* $n_{Cu} = \frac{m_{Cu}}{M_{Cu}} = \frac{25.4}{63.5} = 0.4$ mol (1)
* ratio : Cu : CuO
  2 : 2
  1 : 1 $\Rightarrow n_{CuO} = 0.4$ mol

$m_{CuO} = n_{CuO} \times M_{CuO}$
$= 0.4 \times 79.5$
$= 31.8$g

Maximum mass of copper oxide = 31.8g (1)

(Total for Question 3 = 10 marks)

4. A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

(a) Figure 5 shows part of the apparatus used in the experiment.

Complete Figure 5 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas.

(2)

(1) for drawing
(1) for labelling

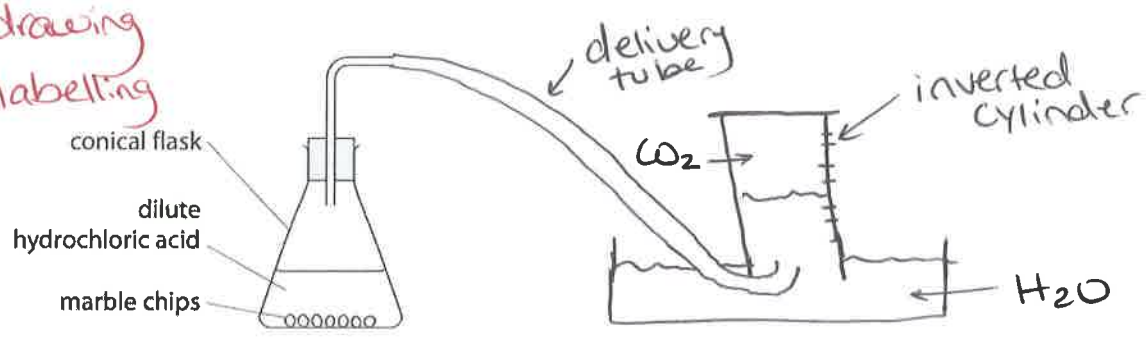


Figure 5

(b) Figure 6 shows a graph of the results of the experiment.

A tangent has been drawn on the curve at 3.5 minutes.

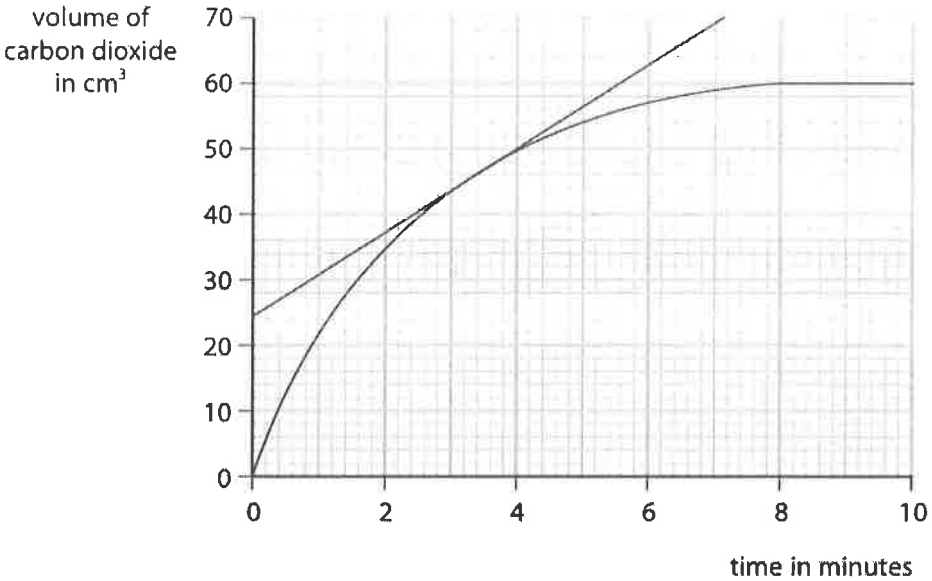


Figure 6

(i) State the total volume of carbon dioxide produced in the first 3.5 minutes.

(1)

Volume = (46, 47, 48) cm^3

accept any of those (1)

(ii) Using the tangent, calculate the rate of reaction at 3.5 minutes in cm^3 per minute.

Show your work.

(3)

A(6.2, 64)
B(0.6, 28)

$$\text{Rate} = \frac{y_A - y_B}{x_A - x_B} = \frac{64-28}{6.2-0.6} = \frac{36}{5.6} = 6.429 \text{ } cm^3/min$$

(1) (1)

Rate = 6.429 (1) cm^3 per minute

(c) The student repeats the same experiment using the same mass of smaller marble chips. All other conditions remain the same.

Explain the effect on the rate of reaction of using smaller marble chips.

(2)

Rate increases (1) because smaller marble chips have a higher surface area and experience a higher frequency of successful collisions per second with the reactant. (1)

(d) Which change would make the rate of reaction slower?

(1)

- ☐ **A** using the same acid at a higher temperature
- ☒ **B** using acid of a lower concentration (1)
- ☐ **C** using a larger flask
- ☐ **D** adding a catalyst

(e) Describe a test that shows that the gas collected is CO_2.

(1)

Bubble gas through clear limewater. If it turns milky, then it contains CO_2. (1)

(f) Carbon dioxide is used in some fire extinguishers because it does not support combustion. State another property of carbon dioxide that makes it suitable for use in fire extinguishers.

(1)

Carbon dioxide is more dense than oxygen, so it sinks and forms a layer between the flames and O_2, preventing further combustion. (1)

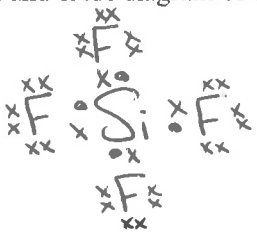
(Total for Question 4 = 11 marks)

5. This question is about the properties of different substances.

(a) Silicon tetrafluoride is a simple molecular covalent compound.

(i) A molecule of silicon tetrafluoride is composed of a silicon atom and four fluorine atoms.
Draw a dot and cross diagram of this molecule. Show outer electrons only.

(2)



(1) for dots
(1) for crosses

(ii) Explain why simple molecular compounds such as silicon tetrafluoride have low melting and boiling points.

(2)

Simple molecular ~~forces~~ compounds have very weak forces between molecules, so little energy is required to break the bonds during melting / boiling. (1) (1)

(b) Part of the structure of rubidium bromide is shown in Figure 7.

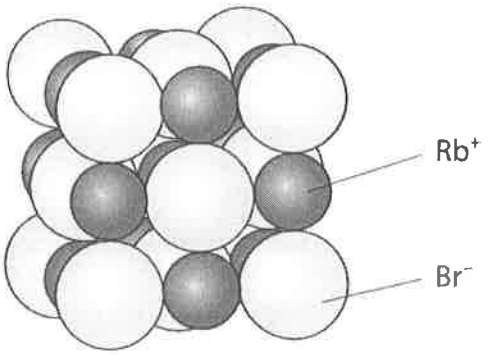


Figure 7

Which rows shows the most likely melting point and boiling point of rubidium bromide?

(1)

		melting point in °C	boiling point in °C
☐	A	6.93	134.0
☐	B	69.3	134.0
☐	C	69.3	1340
☒	D	693	1340

(1)

(c) Diamond and graphite are two forms of carbon. Figure 8 shows how carbon atoms are arranged in the structure of each of these forms of carbons.

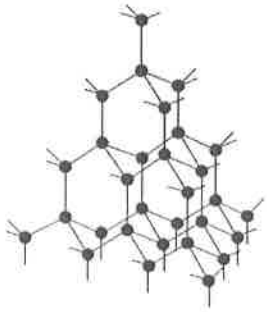
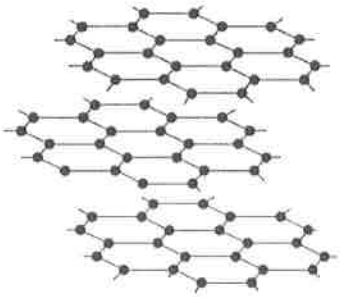
diamond	graphite
	

Figure 8

- Diamond is one of the hardest known substances on earth and is used in cutting tools.
- Graphite is soft and flaky.
- Diamond is a poor electrical conductor, but graphite is a good electrical conductor.

Explain, in terms of structure and bonding, these properties of diamond and graphite.

(6)

*Electrical Conductivity: in diamond, all 4 outer shell e^- of carbon form covalent bonds, leaving no free electrons available for electrical conductivity.

While in graphite, each carbon bonds to 3 other carbon atoms, leaving 1 free electron that can move between layers of graphite and carry a current whenever a potential difference is applied.

✱ Hardness: Diamond has strong covalent bonds between its carbon atoms, and the atoms are arranged in a giant covalent lattice, which requires high amounts of energy to overcome. While graphite, although it is also a giant covalent structure, with strong covalent bonds between carbon atoms in each layer, weak intermolecular forces are present between the layers themselves, which makes the layers slide easily.

(Total for Question 5 = 11 marks)

TOTAL FOR PAPER = 50 MARKS

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	[285] **Cn** copernicium 112	[286] **Uut** ununtrium 113	[289] **Fl** flerovium 114	[289] **Uup** ununpentium 115	[293] **Lv** livermorium 116	[294] **Uus** ununseptium 117	[294] **Uuo** ununoctium 118

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

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

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.