

Chemical Bonds; Ionic; Covalent; Metal

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.2 Bonding Structure + Props Matter
Sub-Topic	Chemical Bonds; Ionic; Covalent; Metal
Difficulty Level	Bronze Level
Booklet	Question Paper 1

Time Allowed: 55 minutes

Score: /54

Percentage: /100

Grade Boundaries:

Q1. John Newlands arranged the known elements into a table in order of atomic weight.

Figure 1 shows part of Newlands' table.

Figure 1

Group	1	2	3	4	5	6	7
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca				

(a) What are the names of the elements in Group 5 of Newlands' table?

Tick **one** box.

Calcium and sulfur

☐

Carbon and silicon

☐

Chlorine and silver

☐

Chromium and tin

☐

(1)

(b) In what order is the modern periodic table arranged?

Tick **one** box.

Atomic mass

☐

Atomic number

☐

Atomic size

☐

Atomic weight

(1)

- (c) Give **two** differences between Group 1 of Newlands' table and Group 1 of the periodic table.

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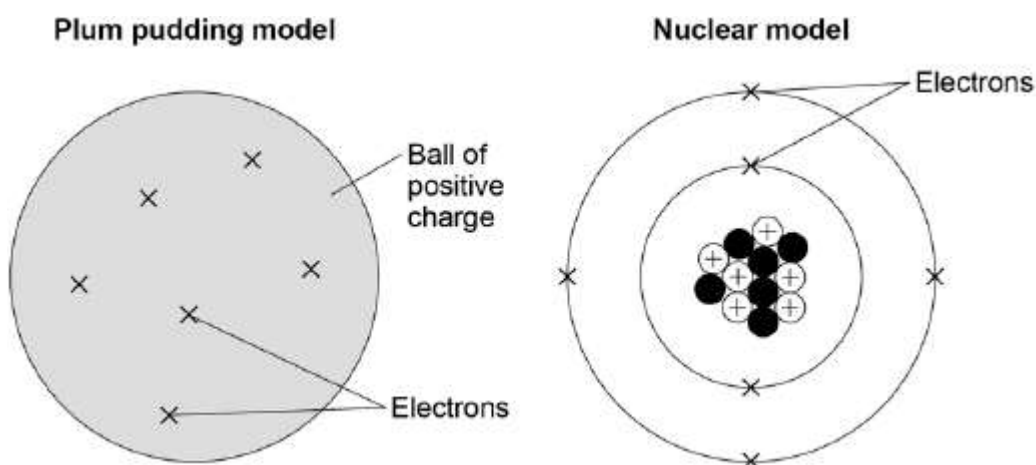
(2)

- (d) In 1864, atoms were thought to be particles that could not be divided up into smaller particles.

By 1898, the electron had been discovered and the plum pudding model of an atom was proposed.

Figure 2 shows the plum pudding model of an atom of carbon and the nuclear model of an atom of carbon.

Figure 2



Compare the position of the subatomic particles in the plum pudding model with the nuclear model.

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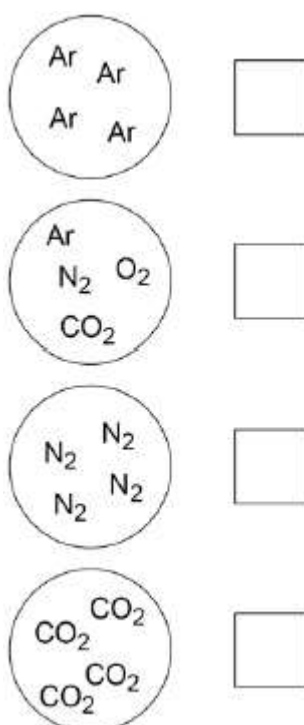
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(4)

- (e) Models are used to show the differences between elements, compounds and mixtures.

Which circle shows a model of a mixture?

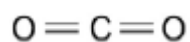
Tick **one** box.



(1)

- (f) **Figure 3** shows a model of carbon dioxide.

Figure 3



What does each line between the atoms in **Figure 3** represent?

Tick **one** box.

Covalent bond

☐

Intermolecular force

☐

Ionic bond

☐

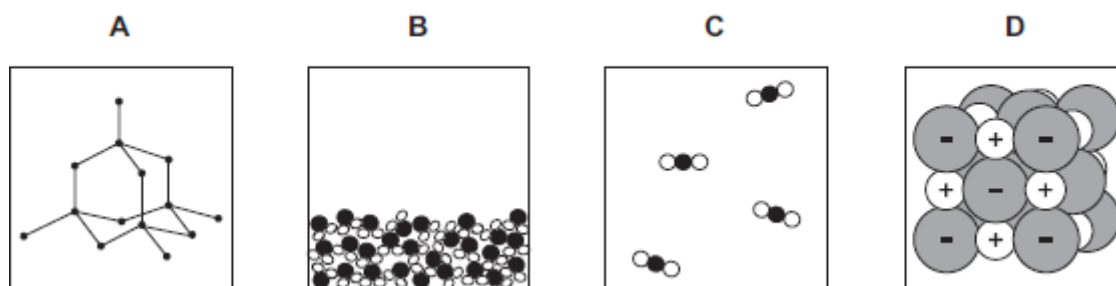
Metallic bond

☐

(1)
(Total 10 marks)

Q2. The structures of four substances, **A**, **B**, **C** and **D**, are represented in **Figure 1**.

Figure 1



(a) Use the correct letter, **A**, **B**, **C** or **D**, to answer each question.

(i) Which substance is a gas?

☐

(1)

(ii) Which substance is a liquid?

☐

(1)

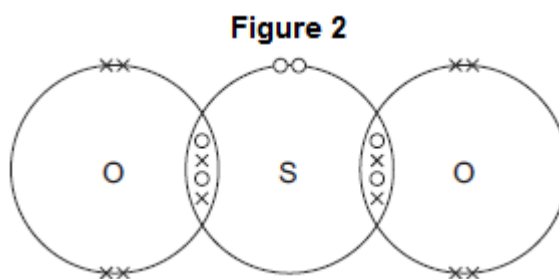
(iii) Which substance is an element?

(1)

(iv) Which substance is made of ions?

(1)

(b) **Figure 2** shows the bonding in substance **C**.



(i) What is the formula of substance **C**?

Draw a ring around the correct answer.

SO₂

SO²

S₂O

(1)

(ii) Use the correct answer from the box to complete the sentence.

delocalised

shared

transferred

When a sulfur atom and an oxygen atom bond to produce substance **C**,
electrons are

(1)

(iii) What is the type of bonding in substance **C**?

Draw a ring around the correct answer.

covalent

ionic

metallic

(1)
(Total 7 marks)

Q3. This question is about electrolysis.

- (a) Metal spoons can be coated with silver.
This is called electroplating.

Suggest **one** reason why spoons are electroplated.

.....
.....

(1)

- (b) When sodium chloride solution is electrolysed the products are hydrogen and chlorine.

- (i) What is made from chlorine?

Tick (✓) **one** box.

Bleach

☐

Fertiliser

☐

Soap

☐

(1)

- (ii) Sodium chloride solution contains two types of positive ions, hydrogen ions (H^+) and sodium ions (Na^+).

Why is hydrogen produced at the negative electrode and **not** sodium?

Tick (✓) **one** box.

Hydrogen is a gas.

☐

Hydrogen is less reactive than sodium.

☐

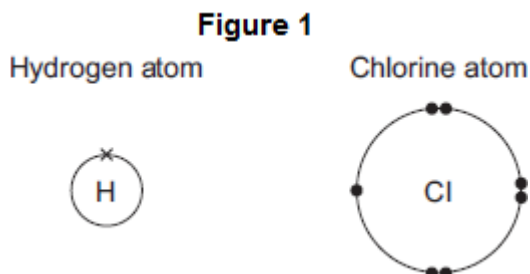
Hydrogen ions move faster than sodium ions.

☐

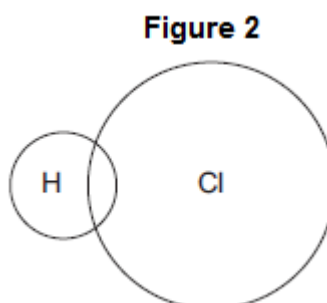
(1)

(iii) Hydrogen and chlorine can be used to produce hydrogen chloride.

The diagrams in **Figure 1** show how the outer electrons are arranged in an atom of hydrogen and an atom of chlorine.



Complete **Figure 2** to show how the outer electrons are arranged in a molecule of hydrogen chloride (HCl).



(1)

(iv) What is the type of bond in a molecule of hydrogen chloride?

Tick (✓) **one** box.

Covalent

☐

Ionic

☐

Metallic

☐

(1)

(v) Why is hydrogen chloride a gas at room temperature (20 °C)?

Tick (✓) **two** boxes.

Hydrogen chloride has a low boiling point.

☐

Hydrogen chloride has a high melting point.

☐

Hydrogen chloride is made of simple molecules.

☐

Hydrogen chloride does not conduct electricity.

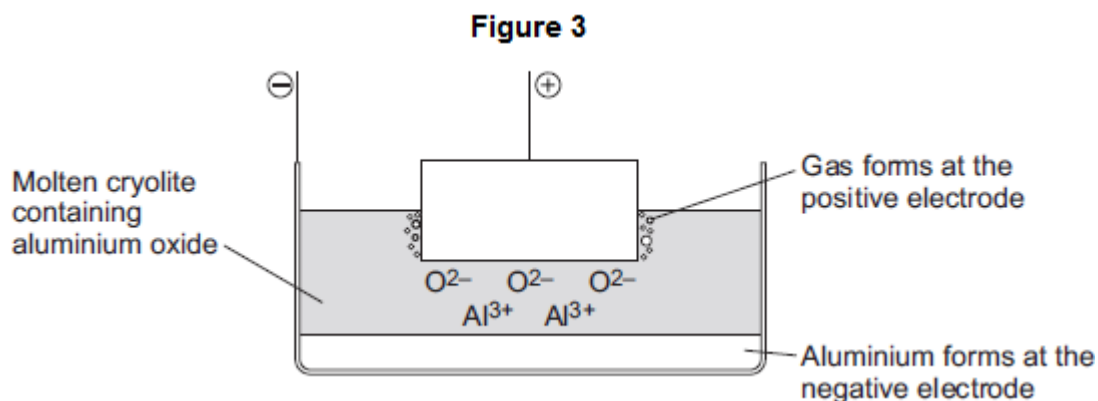
☐

Hydrogen chloride has a giant structure.

☐

(2)

- (c) Aluminium is produced by electrolysis of a molten mixture of aluminium oxide and cryolite.
This is shown in **Figure 3**.



- (i) Name a gas produced at the positive electrode.

.....

(1)

- (ii) Aluminium ions move to the negative electrode.

Explain why.

.....

.....

.....

.....

(2)

- (iii) At the negative electrode, the aluminium ions gain electrons to produce aluminium.

What is this type of reaction called?

Tick (✓) **one** box.

Combustion

☐

Oxidation

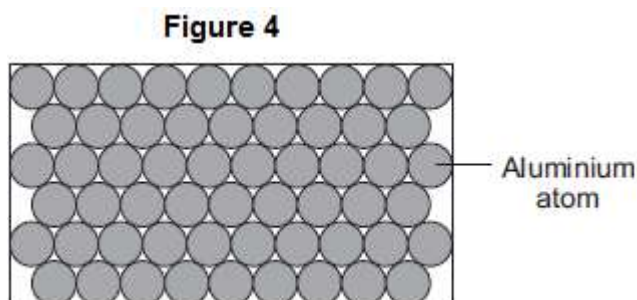
☐

Reduction

☐

(1)

- (iv) Aluminium has layers of atoms, as shown in **Figure 4**.



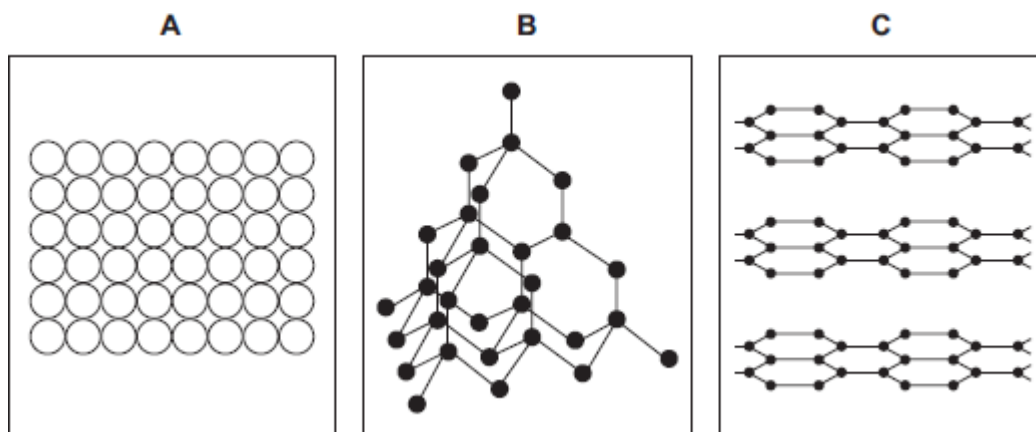
Complete the sentence.

Metals can be bent and shaped because the layers of atoms can

(1)

- (d) Electrodes used in the production of aluminium are made from graphite.

- (i) Which diagram, **A**, **B** or **C**, shows the structure of graphite?



The structure of graphite is shown in diagram

(1)

- (ii) The temperature for the electrolysis is 950 °C.

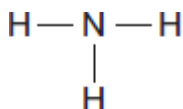
Use the correct answer from the box to complete the sentence.

cross links	a giant ionic lattice	strong covalent bonds
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The graphite does not melt at 950 °C because
graphite has

(1)
(Total 14 marks)

Q4.(a) A particle of ammonia is represented by the formula NH_3 or as:



(i) How many different elements are there in a particle of ammonia?

.....

(1)

(ii) Draw a ring around the correct answer to complete the sentence.

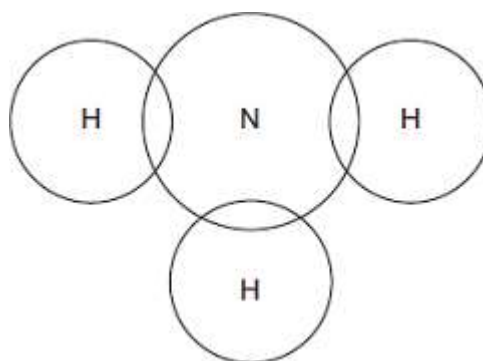
A particle of ammonia is called

an atom.
an ion.
a molecule.

(1)

(iii) Complete the dot and cross bonding diagram for ammonia.

Show **only** electrons in the outer energy level of each atom.



(2)

- (b) Ammonia gas reacts with hydrogen chloride gas to produce a white solid.

The formula of the white solid is NH_4Cl

- (i) Complete the equation by adding the correct state symbols.



(1)

- (ii) The white solid has the formula NH_4Cl

Complete the name of the white solid.

Ammonium

(1)

- (c) Concentrated ammonia solution gives off ammonia gas.

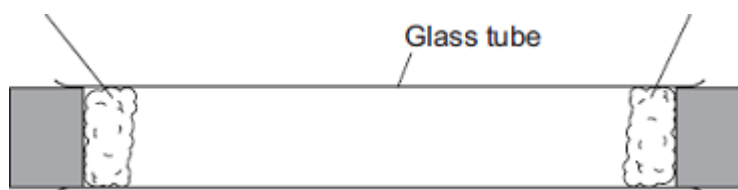
Concentrated hydrochloric acid gives off hydrogen chloride gas.

Apparatus was set up as shown in **Diagram 1**.

Diagram 1

Cotton wool soaked
in concentrated
hydrochloric acid

Cotton wool soaked
in concentrated
ammonia solution



- (i) Concentrated hydrochloric acid is corrosive.

Give **one** safety precaution you should take when using concentrated hydrochloric acid.

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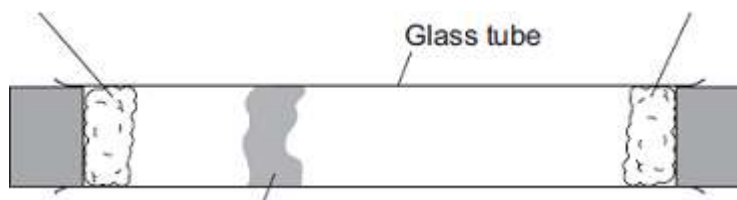
(1)

- (ii) After 3 minutes a white solid was seen in the glass tube, as shown in **Diagram 2**.

Diagram 2

Cotton wool soaked
in concentrated
hydrochloric acid

Cotton wool soaked
in concentrated
ammonia solution



White solid formed here

Suggest why the white solid is seen nearer the concentrated hydrochloric acid than the concentrated ammonia.

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(1)

- (iii) The experiment was repeated at a higher temperature.

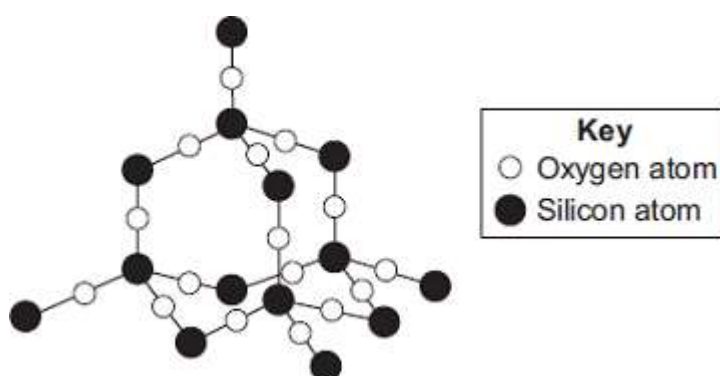
Explain why the white solid was produced in less than 3 minutes.

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(2)
(Total 10 marks)

Q5. The diagram shows a small part of the structure of silicon dioxide.



(a) Use the diagram above to answer the question.

Draw a ring around the correct answer to complete each sentence.

In silicon dioxide, each silicon atom is bonded with

two
three
four

oxygen atoms.

The bonds in silicon dioxide are

ionic.
covalent.
metallic.

(2)

(b)



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Silicon dioxide is used as the inside layer of furnaces.

Suggest why.

.....

.....

(1)

- (c) Nanowires can be made from silicon dioxide.

Draw a ring around the correct answer to complete the sentence.

The word 'nano' means the wires are very

brittle.
thick.
thin.

(1)
(Total 4 marks)

Q6. Kelp is a seaweed.

Kelp can be burned to give out energy.



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- (a) Draw a ring around the correct answer to complete each sentence.

Reactions which give out energy are

endothermic

exothermic.

reversible.

(1)

- (b) Which **two** of the following questions **cannot** be answered by scientific experiments alone?

Tick (✓) **two** boxes.

Question	Tick (✓)
How much carbon dioxide is produced when 100 g of kelp is burned?	
Does kelp give out more heat energy than coal when burned?	
Should people use kelp instead of oil as an energy source?	
Will kelp be more popular than coal in the next 10 years?	

(2)

(c) Potassium iodide can be produced from kelp.

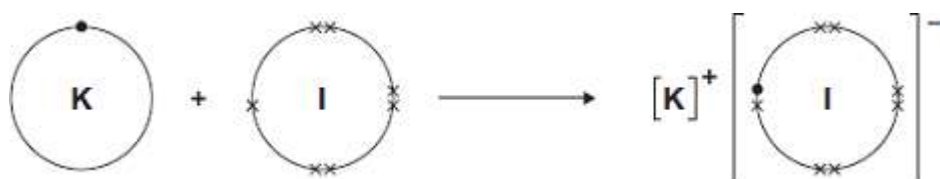
(i) Potassium can be reacted with iodine to produce potassium iodide.



The diagram shows how this happens.

Only the outer electrons are shown.

The dots (•) and crosses (x) are used to represent electrons



Use the diagram to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with iodine to produce potassium iodide.

To get full marks you should use the words atom, electron and ion in your answer.

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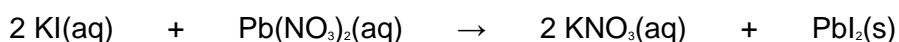
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(4)

(ii) Potassium iodide reacts with lead nitrate.



Why is this reaction a precipitation?

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(1)

(iii) How can the precipitate be removed from the reaction mixture?

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(1)

(Total 9 marks)