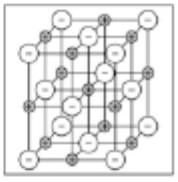
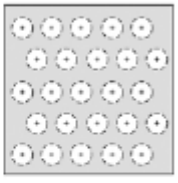
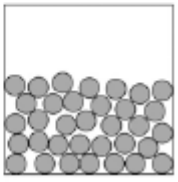
Q1. This question is about different substances and their structures.

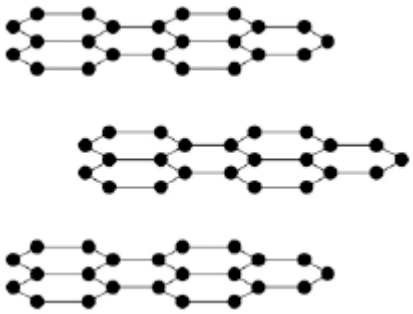
(a) Draw **one** line from each statement to the diagram which shows the structure.

Statement	Structure
The substance is a gas	
The substance is a liquid	
The substance is ionic	
The substance is a solid metal	
	

(4)

(b) **Figure 1** shows the structure of an element.

Figure 1



What is the name of this element?

Tick **one** box.

Carbon ☐

Chloride ☐

Nitrogen ☐

Xenon ☐

(1)

(c) Why does this element conduct electricity?

Tick **one** box.

It has delocalised electrons ☐

It contains hexagonal rings ☐

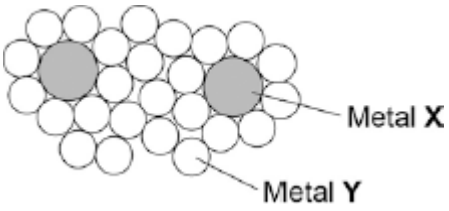
It has weak forces between the layers ☐

It has ionic bonds ☐

(1)

(d) **Figure 2** shows the structure of an alloy.

Figure 2



Explain why this alloy is harder than the pure metal **Y**.

.....

.....

.....

.....

(2)

(e) What percentage of the atoms in the alloys are atoms of **X**?

.....

.....

.....

.....

(2)

(f) What type of substance is an alloy?

Tick **one** box.

Compound ☐

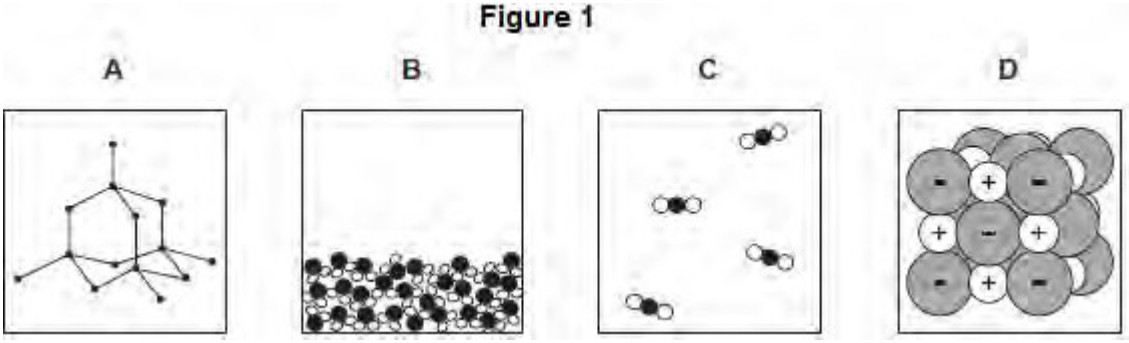
Element ☐

Mixture ☐

(1)
(Total 11 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?

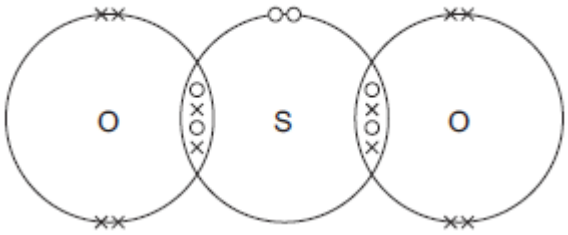
(1)

(iv) Which substance is made of ions?

(1)

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

Figure 2



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

Draw a ring around the correct answer.

SO_2 **SO^2** **S_2O**

(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 salts.

(a) Salt (sodium chloride) is added to many types of food.

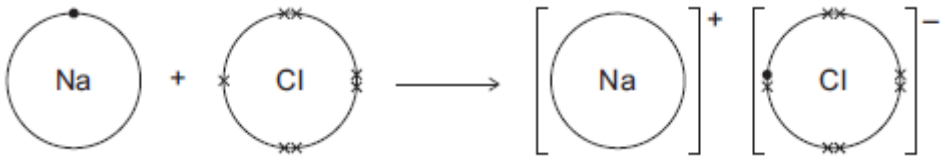
Sodium chloride is produced by reacting sodium with chlorine.

sodium + chlorine ⟶ sodium chloride

The diagram shows what happens to atoms of sodium and chlorine in this reaction.

The dots (•) and crosses (×) represent electrons.

Only the outer electrons are shown.



Describe, in terms of electrons, what happens when a sodium atom reacts with a chlorine atom to produce sodium chloride.

.....

.....

.....

.....

.....

.....

(3)

(b) Lack of iodine can affect the learning ability of children.

One idea is that salt (sodium chloride) should have iodine added.

(i) Iodine consists of simple molecules.

What is a property of substances that have simple molecules?

Tick (✓) **one** box.

Have no overall electric charge ☐

Have high boiling points ☐

Have giant covalent structures ☐

(1)

(ii) Which one of the following questions cannot be answered by science alone?

Tick (✓) **one** box.

How much sodium chloride is in food? ☐

What harm does a lack of iodine do? ☐

Should iodine be added to salt in food? ☐

Give **one** reason why this question cannot be answered by science alone.

.....

.....

(2)

(c) A student produced the salt ammonium nitrate by adding an acid to ammonia solution.

(i) Name the acid used.

.....

(1)

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

an acid	**an alkali**	**a salt**

Ammonia solution (ammonium hydroxide) is ..... .

(1)

(iii) The student added a few drops of a solution which changed colour when the reaction was complete.

Complete the sentence.

The solution added is an ..... .

(1)

(d) Farmers buy solid ammonium nitrate in poly(ethene) sacks.

(i) How is solid ammonium nitrate made from a solution of ammonium nitrate?

Tick (✓) **one** box.

Crystallisation ☐

Decomposition ☐

Electrolysis ☐

(1)

(ii) Why do farmers use ammonium nitrate on their fields?

.....

.....

(1)

(iii) The properties of poly(ethene) depend on the reaction conditions when it is made.

State **one** reaction condition that can be changed when making poly(ethene).

.....

.....

(1)

(Total 12 marks)

Q4. 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. ☐

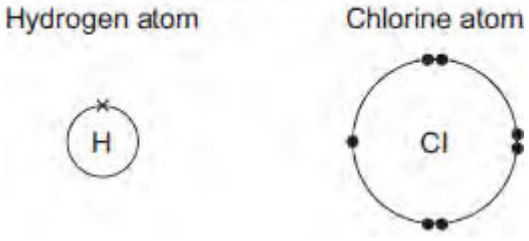
Hydrogen ions move faster than sodium ions. ☐

(1)

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

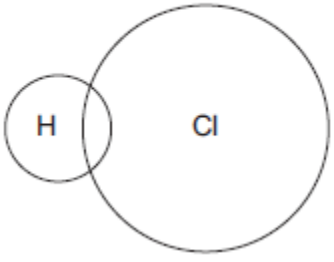
The diagrams in **Figure 1** show how the outer electrons are arranged in an atom of hydrogen and an atom of chlorine.

Figure 1



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

Figure 2



(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. ☐

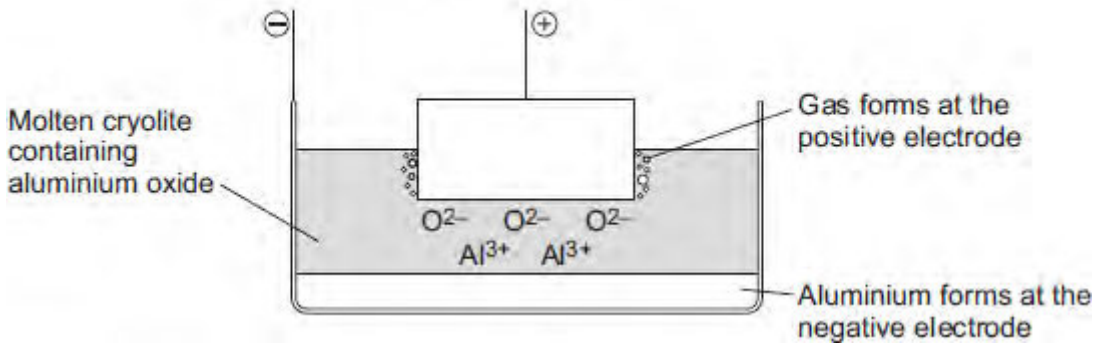
Hydrogen chloride does not conduct electricity. ☐

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**.

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 ☐

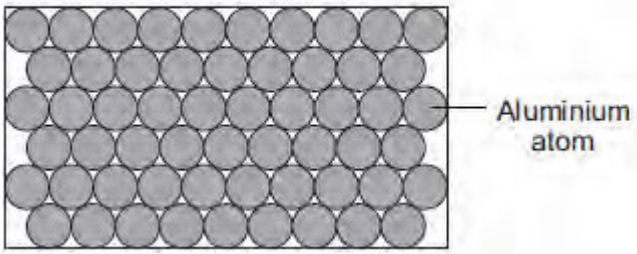
Oxidation ☐

Reduction ☐

(1)

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

Figure 4



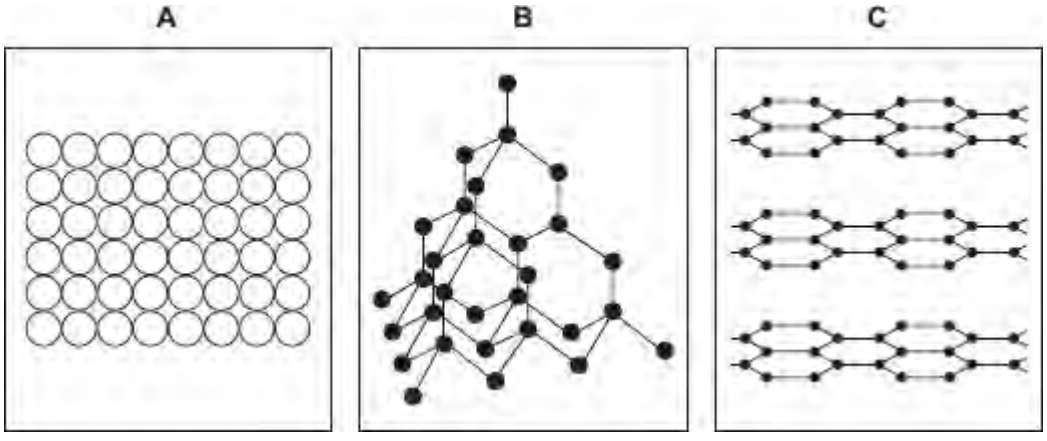
Complete the sentence.

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**

The graphite does not melt at 950 °C because

graphite has ..... .

(1)

(Total 14 marks)

Q5. This question is about diamonds.

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

(a) Diamonds are found in meteorites.

(i) Meteorites get very hot when they pass through the Earth's atmosphere, but the diamonds do not melt.

Diamond has a (high / low / very low) melting point.

(1)

(ii) Most diamonds found in meteorites are nanodiamonds.

A nanodiamond contains a few (hundred / thousand / million.) atoms

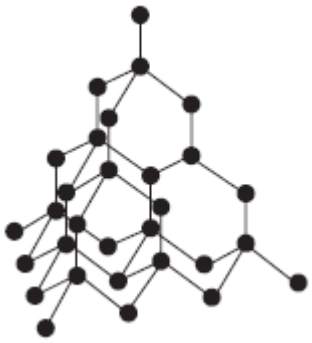
(1)

(b) Diamonds are used for the cutting end of drill bits.

Diamonds can be used for drill bits because they are (hard. / shiny. / soft.)

(1)

(c) The figure below shows the arrangement of atoms in diamond.



(i)

Diamond is made from [carbon / nitrogen / oxygen] atoms.

(1)

(ii)

Each atom in diamond is bonded to [three / four / five] other atoms.

(1)

(iii)

[covalent]

Diamond has a giant | ionic / metallic | structure.

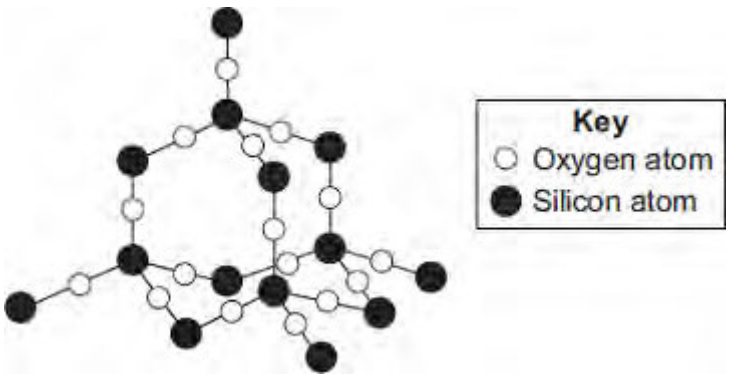
(1)

(iv)

In diamond | all / none / some | of the atoms are bonded together.

(1)
(Total 7 marks)

Q6. 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 | oxygen atoms.

four

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.

brittle.

The word ‘nano’ means the wires are very

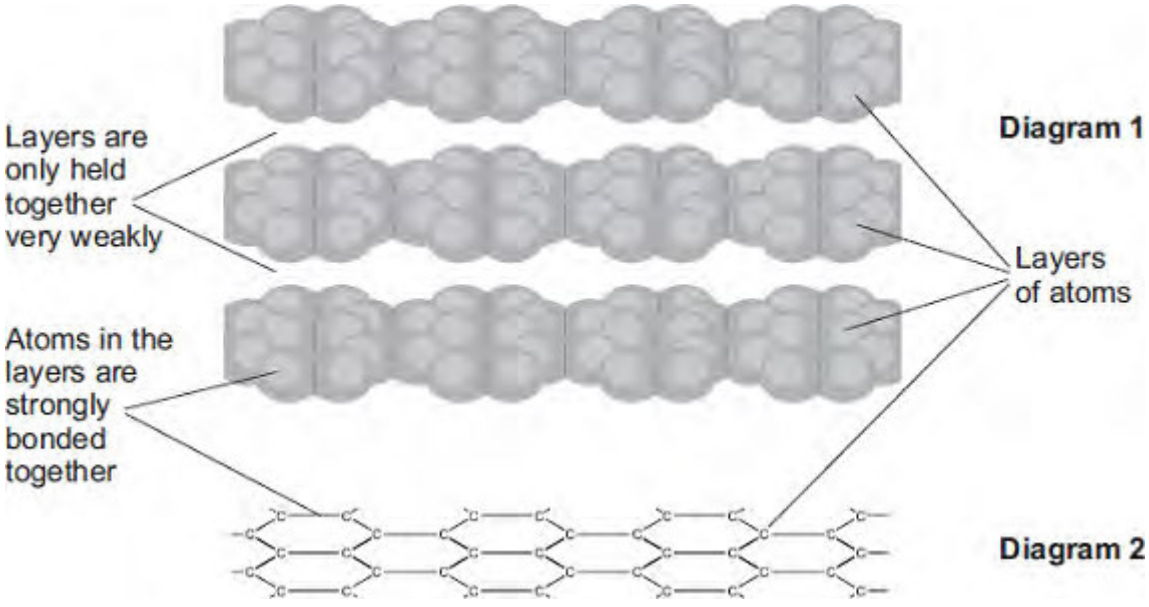
thick.
thin.

(1)
(Total 4 marks)

Q7. The picture shows a student filling in a multiple choice answer sheet using a pencil.

The pencil contains graphite. Graphite rubs off the pencil onto the paper.

Diagrams **1** and **2** show how the atoms are arranged in graphite.



(a) Use the diagrams to help you explain why graphite can rub off the pencil onto the paper.

.....

.....

.....

.....

(2)

(b) Draw a ring around the type of bond which holds the atoms together in each layer.

covalent **ionic** **metallic**

(1)
(Total 3 marks)