**Q1.**

This question is about structure and bonding.

(a)  **Figure 1** shows part of the structure of calcium oxide (CaO).

**Figure 1**

****

What type of bonding is present in calcium oxide?

Tick **one** box.

|  |  |
| --- | --- |
| Covalent |  |
| Ionic |  |
| Macromolecular |  |
| Metallic |  |

**(1)**

(b)  **Figure 2** shows a particle of methane (CH4).

**Figure 2**

****

What type of particle is present in **Figure 2**?

Tick **one** box.

|  |  |
| --- | --- |
| An ion |  |
| A lattice |  |
| A molecule |  |
| A polymer |  |

**(1)**

(c)  **Figure 3** shows the structure of C60

**Figure 3**

****

Complete the sentence.

Choose the answer from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **diatomic** | **giant ionic** | **a fullerene** | **giant metallic** |

The structure of C60 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

**Figure 4** shows the structure of graphite.

**Figure 4**

****

(d)  What type of bond is labelled **A** in **Figure 4**?

Tick **one** box.

|  |  |
| --- | --- |
| covalent |  |
| double |  |
| ionic |  |
| metallic |  |

**(1)**

(e)  In graphite, each carbon atom forms bonds with other carbon atoms as shown in **Figure 4**

How many electrons does **one** carbon atom use to form **one** bond?

Tick **one** box.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **1** |  | **2** |  | **3** |  | **4** |  |

**(1)**

An electric current is passed through copper.

**Figure 5** shows the apparatus used.

**Figure 5**

****

(f)  Complete the sentence.

Choose the answer from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **gas** | **liquid** | **solid** | **solution** |

**Figure 5** shows that copper conducts electricity as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(g)  Complete the sentence.

Choose the answer from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **atoms** | **electrons** | **ions** | **molecules** |

Copper conducts electricity because of the movement of delocalised \_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(h)  **Figure 6** shows the apparatus used to investigate the effect of electricity on sodium chloride solution.

**Figure 6**

****

Complete the sentence.

Choose the answer from the box.

|  |  |  |
| --- | --- | --- |
| **dissolved** | **gaseous** | **molten** |

**Figure 6** shows that sodium chloride conducts electricity when \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(i)   Sodium chloride is made up of ions.

**Figure 7** shows the apparatus used to investigate the effect of electricity on solid sodium chloride and molten sodium chloride.

**Figure 7**

****

The table below shows the results.

|  |  |  |
| --- | --- | --- |
|   | **Solid sodium chloride** | **Molten sodium chloride** |
| **Observation** | The filament bulb does not light up | The filament bulb lights up |
| **Deduction** | Does not conduct electricity | Does conduct electricity |

Draw **one** line from each statement to the correct reason.

|  |  |  |
| --- | --- | --- |
| **Statement** |   | **Reason** |
|   |
|   |   | The ions are fixed. |
| Solid sodium chloride does |   |   |
| not conduct electricity. |   | The ions are mobile. |
|   |
| Molten sodium chloride |   | The ions are neutral. |
| conducts electricity. |   |   |
|   |   | The ions are vibrating. |

**(2)**

**(Total 10 marks)**

**Q2.**

This question is about the halogens.

(a)  Which group in the periodic table is known as the halogens?

Tick **one** box.

|  |  |
| --- | --- |
| Group 1 |  |
| Group 2 |  |
| Group 7 |  |
| Group 0 |  |

**(1)**

(b)  A fluorine atom has 7 electrons in the outer shell.

The diagram below shows part of a dot and cross diagram to represent a molecule of fluorine (F2).

Complete the dot and cross diagram.

You should show only the electrons in the outer shells.



**(2)**

(c)  Chlorine reacts with potassium bromide solution.

Complete the word equation.

        potassium               \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

chlorine  +  bromide  ⟶ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ +

                           \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(d)  What type of reaction happens when chlorine reacts with potassium bromide solution?

Tick **one** box.

|  |  |
| --- | --- |
| decomposition |  |
| displacement |  |
| neutralisation |  |
| precipitation |  |

**(1)**

(e)  Complete the sentence.

Choose the answer from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **an atom** | **an electron** | **a neutron** | **a proton** |

Chlorine is more reactive than bromine.

This is because chlorine gains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ more easily.

**(1)**

(f)  How does the size of a chlorine atom compare with the size of a bromine atom?

Complete the sentence.

Choose the answer from the box.

|  |  |  |
| --- | --- | --- |
| **bigger than** | **the same size as** | **smaller than** |

A chlorine atom is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a bromine atom.

**(1)**

(g)  Give a reason for your answer to part **(f)**

Reason \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(h)  Fluorine reacts with chlorine to produce ClF3

Balance the chemical equation for the reaction.

Cl2 + \_\_\_\_\_\_\_\_F2 ⟶ 2 ClF3

**(1)**

(i)   Explain why fluorine is a gas at room temperature.

Use the following words in your answer:

**energy**    **forces**    **molecules**    **weak**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(3)**

**(Total 13 marks)**

**Q3.**

This question is about sodium and chlorine.

**Figure 1** shows the positions of sodium and chlorine in the periodic table.

**Figure 1**

****

(a)  State **one** difference and **one** similarity in the electronic structure of sodium and of chlorine.

Difference \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Similarity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(b)  Sodium atoms react with chlorine atoms to produce sodium chloride (NaCl).

Describe what happens when a sodium atom reacts with a chlorine atom.

Write about electron transfer in your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(4)**

(c)  The reaction between sodium and chlorine is an exothermic reaction.

Complete the reaction profile for the reaction between sodium and chlorine.

**Figure 2**

****

**(2)**

**(Total 8 marks)**

**Q4.**

This question is about structure and bonding.

(a)  **Figure 1** shows part of the structure and bonding in diamond.

**Figure 1**

****

Explain why diamond has a high melting point.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(3)**

(b)  **Figure 2** shows part of the structure and bonding in sodium chloride (NaCl).

**Figure 2**

****

Explain the conditions needed for sodium chloride to conduct electricity.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(3)**

(c)  **Figure 3** shows the structure of sodium.

**Figure 3**

****

Describe how sodium conducts thermal energy.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(3)**

**(Total 9 marks)**