Worksheet 1.2: Ionic Bonding & Giant Ionic Lattices ChemistrySheets

Specification: GCSE Chemistry (AQA 5.2.1.1 & 5.2.2.1 / Edexcel SC5 & SC6 / OCR Gateway C3.1a)

Core Concepts: Ionic bonds form between metals and non-metals by electron transfer. This creates oppositely charged ions which are held together by strong electrostatic forces in a giant ionic lattice structure.

Section A: Formation of Ions & Ionic Bonds

1. Figure 1 illustrates the formation of an ionic bond between a sodium atom and a chlorine atom.

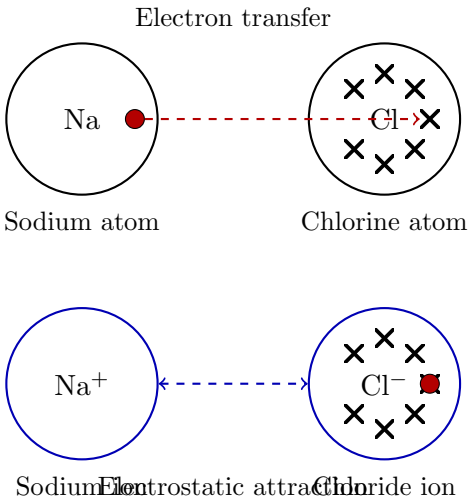

Figure 1: Formation of an ionic bond between sodium and chlorine.

2. Complete the following sentences about ionic bonding:

a) Atoms achieve a stable **full outer shell** by losing or gaining electrons to have the electron configuration of a **noble gas**.

b) Metals tend to **lose** electrons to form **positive** ions, also known as **cations**.

c) Non-metals tend to **gain** electrons to form **negative** ions, also known as **anions**.

d) The strong **electrostatic forces** of attraction between oppositely charged ions form an **ionic** bond.

Section B: Explaining Ionic Properties

1. Explain how a metal atom forms an ion.

Model Answer:
Metal atoms have 1, 2 or 3 electrons in their outer shell. They lose these outer shell electrons to achieve a stable full outer shell, forming a positively charged ion (cation).

2. Explain how a non-metal atom forms an ion.

Model Answer:
Non-metal atoms typically have 5, 6 or 7 electrons in their outer shell. They gain electrons to achieve a stable full outer shell, forming a negatively charged ion (anion).

3. Describe the nature of the electrostatic forces in an ionic bond.

Model Answer:
An ionic bond is formed by the strong electrostatic forces of attraction between the oppositely charged ions. These forces act in all directions throughout the entire structure.

4. Explain why ionic compounds typically have high melting and boiling points.

Model Answer:
Ionic compounds exist as giant ionic lattice structures. There are strong electrostatic forces of attraction between the oppositely charged ions throughout the lattice. A large amount of thermal energy is required to overcome these strong forces of attraction, hence they have high melting and boiling points.

Section C: Giant Ionic Lattices & Conductivity

1. Figure 2 shows a 2D representation of a giant ionic lattice.

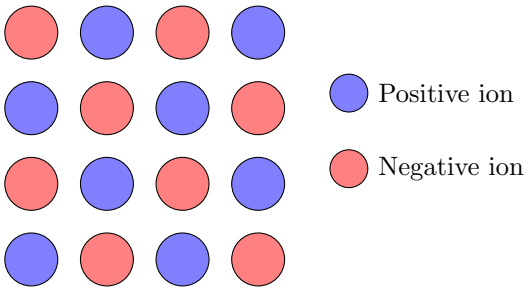

Figure 2: A 2D representation of a giant ionic lattice.

Describe the arrangement of ions in a giant ionic lattice.

Model Answer:
In a giant ionic lattice, ions are arranged in a regular, repeating three-dimensional structure. Each ion is surrounded by oppositely charged ions, forming a continuous network.

2. Explain why solid ionic compounds do not conduct electricity, but molten or dissolved ionic compounds do. (6 marks)

Model Answer:
In a solid ionic compound, the ions are held in fixed positions within the giant ionic lattice by strong electrostatic forces. They are not free to move and therefore cannot carry an electrical charge, meaning solid ionic compounds do not conduct electricity. When an ionic compound is molten (melted), the ions gain enough kinetic energy to overcome the strong electrostatic forces holding them in the lattice. This allows the ions to become mobile and free to move. Similarly, when an ionic compound is dissolved in water, the ions separate from the lattice and become surrounded by water molecules, making them free to move within the solution. In both the molten and dissolved states, the mobile ions are able to move and carry charge, thus allowing the ionic compound to conduct electricity.