Topic 2: Combining Atoms

Knowledge	Application

Subtopic 2.1: Types of Materials

Materials can be classified according to their structure and bonding into four types of substances. Melting points can be used to classify materials into molecular and non-molecular lattices. Electrical conductivity of non-molecular materials provides evidence for three types of primary bonding: metallic, ionic, and covalent.	Classify materials as molecular, metallic, ionic, and covalent network, given relevant conductivity and melting point data.

Subtopic 2.2: Bonding Between Atoms

The formation of bonds between atoms results in stable valence-shell configurations. Energy is released when bonds are formed. Energy is required to break bonds. Metallic, ionic, and covalent bonds are the strong forces of attraction (primary bonds) between particles.	
Metallic Bonding Metallic bonding is the force of attraction between metal cations and their delocalised valence electrons. The physical properties of metallic elements can be explained using the model for metallic bonding.	Explain the melting and boiling points, and electrical conductivities of metallic elements.
Ionic Bonding Valence electrons are transferred from a metallic atom to a non-metallic atom to form ions. Ionic bonding is the force of attraction between the oppositely charged ions. Ionic compounds are continuous and are represented by empirical formulae. The properties of ionic compounds can be explained using the model for ionic bonding.	Predict the charge on the monatomic ion formed by an element, using its position in the periodic table. Write the electron configuration, using subshell notation of the monatomic ion of any of the first 38 elements of the periodic table. Write formulae for ionic compounds given the charges on the ions. Explain the melting and boiling points, and electrical conductivities of ionic compounds.
Covalent Bonding Non-metallic atoms share electrons to form covalent bonds. A covalent bond may be polar or non-polar. Covalent bonding is found in molecular and non-molecular (continuous) substances. A molecule can be represented by a molecular formula. A continuous covalent substance is represented by an empirical formula. The physical properties of continuous covalent substances can be explained using the model for covalent bonding.	Use electron-dot diagrams and structural formulae to show covalent bonds between non-metallic atoms. Use electronegativity values, or the position of atoms in the periodic table, to predict and explain the polarity of a covalent bond. Indicate the polarity of a covalent bond, using the appropriate convention. Explain the melting point, hardness, and electrical conductivity of continuous covalent substances.

Subtopic 2.3: Quantities of Molecules and Ions

The percentage composition of elements in compounds can be determined from the molar masses of the atoms.	Undertake calculations of percentage composition, by mass, of elements in compounds.
The number of moles of particles (molecules, ions) in a sample can be determined from the mass of the sample and the molar masses of the particles.	Undertake calculations using the relationship $n = \frac{m}{M}$ and its rearrangements for molecules, and for ions and their compounds.