Learning Journey – C2 Bonding, Structure and Properties of Matter – Chemical Bonds

What have I done previously in my learning journey?	
Previously….	You have learnt previously about atoms, elements and compounds. This has involved learning about: • a simple (Dalton) atomic model • differences between atoms, elements and compounds • chemical symbols and formulae for elements and compounds
In this topic…	You will learn about how chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies.

We will develop our learning by studying the following each lesson:	RAG	Skills in Science checklist
C2.01 Chemical Bonds • State the three types of strong chemical bonds. • Describe how the different types of bonds join particles together. • State the types of elements that ionic bonding occurs between. • State the types of elements that covalent bonding occurs between. • State the types of elements that metallic bonding occurs between. • Explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons.		☐ Scientific Method ☐ Practical ☐ Number skills ☐ Application ☐ Communication
C2.02 Ionic Bonding • Describe what happens to the atoms involved when ionic bonds are formed. • Draw dot and cross diagrams to represent the electron transfer during the formation of ionic compounds by metals in Groups 1 and 2 with non-metals in Groups 6 and 7. • Deduce the charge on the ions of metals and non-metals from the group number of the element, limited to the metals in Groups 1 and 2, and non-metals in Groups 6 and 7.		☐ Scientific Method ☐ Practical ☐ Number skills ☐ Application ☐ Communication
C2.03 Ionic Compounds • Describe how ionic compounds are held together. • Deduce that a compound is ionic from a diagram of its structure. • Describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure. • Deduce the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure.		☐ Scientific Method ☐ Practical ☐ Number skills ☐ Application ☐ Communication
C2.04 Covalent Bonding • Describe how covalent bonds are formed. • Recognise common substances that consist of small molecules from their chemical formula. • Recognise substances as small molecules, polymers or giant structures from diagrams showing their bonding. • Draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane. • Represent the covalent bonds in a small molecule, using a line to represent a single bond. • Represent the covalent bonds in the repeating units of a polymer, using a line to represent a single bond. • Represent the covalent bonds in a part of a giant covalent structure, using a line to represent a single bond. • Describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent molecules or giant structures. • Deduce the molecular formula of a substance from a given model or diagram in these forms showing the atoms and bonds in the molecule.		☐ Scientific Method ☐ Practical ☐ Number skills ☐ Application ☐ Communication
C2.05 Metallic Bonding • Describe how the atoms are arranged in a metal. • Explain how the sharing of delocalised electrons gives rise to strong metallic bonds. • Recognise substances as metallic giant structures from diagrams showing their bonding.		☐ Scientific Method ☐ Practical ☐ Number skills ☐ Application ☐ Communication

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Key Vocabulary								
Ion	**Cation**	**Anion**	**Ionic bond**	**Ionic compound**	**Giant ionic lattice**	**Electrostatic attraction**	**Group 1 metals**	**Group 7 non-metals**
Dot and cross diagram	**Covalent bond**	**Molecule**	**Simple molecular substance**	**Giant covalent structure**	**Polymer**	**Intermolecular forces**	**Metallic bond**	**Delocalised electrons**
Positive metal ions	**Giant metallic lattice**							

Future Learning	Learning about bonding and structure at GCSE is the foundation for much more advanced ideas in A Level Chemistry. At GCSE you meet ionic, covalent and metallic bonding, simple molecules, giant structures and nanoparticles. At A Level, these ideas deepen into detailed electron-pair repulsion theory, shapes of molecules, electronegativity, polar and non-polar bonds, intermolecular forces, and how bonding affects enthalpy changes, reaction mechanisms and physical properties. Understanding the basics now makes it much easier to explain and predict chemical behaviour later, from why molecules have particular shapes to how substances react, dissolve, or change state.
In careers	Learning about bonding and structure isn't just for passing exams — it's the science behind how materials behave in the real world. From designing new medicines to creating stronger alloys and developing cutting-edge nanotechnology, understanding how atoms bond and how structures form helps solve real engineering and scientific challenges and opens the door to a wide range of exciting careers. Here's how it links to careers: • **Materials Science** Materials scientists use knowledge of bonding, structure, and particle behaviour to design and test new materials such as polymers, composites, alloys, and nanomaterials used in medicine, construction, electronics, and aerospace. *Average UK salary: £30,000–£50,000 (can rise to £70,000+ in specialist or research roles)* • **Chemical Engineering** Chemical engineers apply understanding of ionic, covalent, and metallic bonding, as well as intermolecular forces and states of matter, to develop industrial processes for fuels, pharmaceuticals, food production, and clean energy technologies. *Average UK salary: £35,000–£55,000 (can rise to £80,000+ in senior or chartered roles)* • **Pharmaceutical Science** Pharmaceutical scientists use knowledge of molecular structure, bonding, and particle interactions to design and test new medicines, understand drug solubility, and control how medicines are absorbed and delivered in the body. *Average UK salary: £28,000–£45,000 (can rise to £60,000+ in advanced research roles)* • **Nanotechnology** Nanotechnologists rely on understanding nanoparticles, surface area to volume ratios, and atomic-scale bonding to create innovative products such as targeted drug delivery systems, smart coatings, and advanced electronics. *Average UK salary: £30,000–£50,000 (can rise to £70,000+ in specialist roles)* • **Forensic Science** Forensic scientists use knowledge of chemical bonding, molecular structure, and material properties to analyse fibres, paints, residues, and unknown substances in criminal investigations. *Average UK salary: £26,000–£40,000* • **Engineering (Mechanical, Civil, Aerospace)** Engineers apply understanding of metallic bonding, alloys, and material properties such as strength, conductivity, and melting point to design safe, efficient structures, vehicles, and machinery. *Average UK salary: £30,000–£50,000 (can rise to £70,000+ in senior roles)*