Key ideas in GCSE Chemistry

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Sometimes it's worth stepping back from the detail of specification points to think about the **key ideas** that link everything together. This will help you make sense of Chemistry, understand each topic in context – and do better in the GCSE exams!

Key idea 1: Matter is made of particles called atoms

Everything is made up of atoms, which are made up of protons and neutrons (in the nucleus) and electrons (orbiting in shells). There are about 100 different types of naturally-occurring atoms called elements. Atoms of different elements have specific numbers of protons, neutrons and electrons, and this is what makes each element unique.

Key idea 2: Elements show periodic relationships in their chemical and physical properties

Periodic relationships are the repeating patterns of properties based on *where* elements are found on the periodic table. Chemical properties are about how elements react with other elements. Physical properties are to do with melting and boiling points, mass and density. For example, Group 1 elements are solid metals which become *more* reactive down the group. Group 7 elements

become *less* reactive down the group, while their melting and boiling points *increase*– they are gases at the top of the group and solid at the bottom! Understanding these relationships will help you to predict what reactions may happen in topics throughout Chemistry.

Key idea 3: Periodic relationships can be explained by atomic structure

You can understand almost everything you need to know about periodic properties by getting to grips with how electrons are arranged in shells. The further down a group, the more shells an element has, and the further away the outer electrons are from the nucleus. Metals become *more* reactive as it becomes easier to *lose electrons* from the outer shell, while non-metals become *less* reactive down a group as it become harder to *gain electrons*.

Key idea 4: Atoms bond by either transferring electrons or by sharing electrons

In ionic bonding, electrons are *transferred* from metals to non-metals. Metals *lose* electrons becoming positively charged ions, and non-metals *gain* electrons becoming negatively charged ions. In covalent bonding, electrons are *shared* between two non-metal atoms. The number of electrons shared depends on how many electrons each atom needs to have a full outer shell, and this can create single, double or even triple bonds!

Key idea 5: The shapes of molecules and the way giant structures are arranged explains the way they behave

Think about the differences between diamond and graphite. Both are made up of carbon atoms only, but those carbon atoms are bonded and arranged in very different ways: this means that diamond is very hard and does not conduct electricity, while graphite is soft and is a good conductor. This key idea also comes up in organic Chemistry where we find that larger molecules result in higher boiling points.

Key idea 6: Barriers to reaction mean reactions occur at different rates

In order for a reaction to happen, particles must collide with enough energy: this is called collision theory. Particles with more energy move faster and different reactant particles need different amounts of energy to make them react. That's why some reactions happen spontaneously while others need high temperatures to occur. When you understand what makes reactions happen, and what affects their rates, you'll be ready to answer lots of the questions in the GCSE exams!

Key idea 7: Chemical reactions take place via proton (H+) transfer, electron transfer, or electron sharing

Proton transfer means the release of H^+ ions when *acids* react (H^+ ions are actually just protons). Reactions involving *electron transfer* are normally reactions between metals and non-metals to create ionic compounds. And reactions involving *electron sharing* will be reactions between two or more non-metals to create covalent compounds.

Key idea 8: Energy is conserved in chemical reactions

Energy cannot be created, nor can it be destroyed, in chemical reactions. It is always conserved. Any energy that is released by a reaction will be absorbed by the surroundings (e.g. the water in a solution) and vice versa. This is closely linked to the idea that mass is conserved in chemical reactions. Understanding these concepts will help you *balance equations* as well as work out *mass changes* in reactions involving gases.