The Periodic Table and Reaction Rates! Year 10 Science at Home

You can help! Your child is learning why the periodic table is organised the way it is, how atoms bond together to form compounds, and what factors control how fast or slow chemical reactions proceed. This is the science behind everything from medicines to cooking to mining.

Why are we learning this? Chemistry and life in remote communities

Chemistry is embedded in daily life in remote northern Australia. Water quality monitoring — checking that bore water, tanks and rivers are safe — uses chemical analysis. Traditional food preparation often uses chemical reactions: cooking changes the chemistry of starch and protein, some traditional plant foods require processing to remove toxins through chemical reactions. Mining and resource extraction — a major employer in remote Queensland and the Northern Territory — is entirely based on chemistry: extracting metals from ore, processing minerals, managing chemical waste. Understanding reaction rates and chemical processes helps your family understand safety warnings on chemicals, why medicines must be stored correctly (heat speeds up degradation reactions), and how the natural world works at a molecular level.

My child will learn to:

✓ Navigate the periodic table
Explain how elements are organised by atomic number and how periodic trends (reactivity, atomic size) relate to position in the table.

✓ Understand chemical bonding
Describe ionic bonds (electron transfer) and covalent bonds (electron sharing), and predict which type a compound will form.

✓ Explain reaction rates
Identify the factors that affect the rate of a chemical reaction: concentration, temperature, surface area, and the role of catalysts.

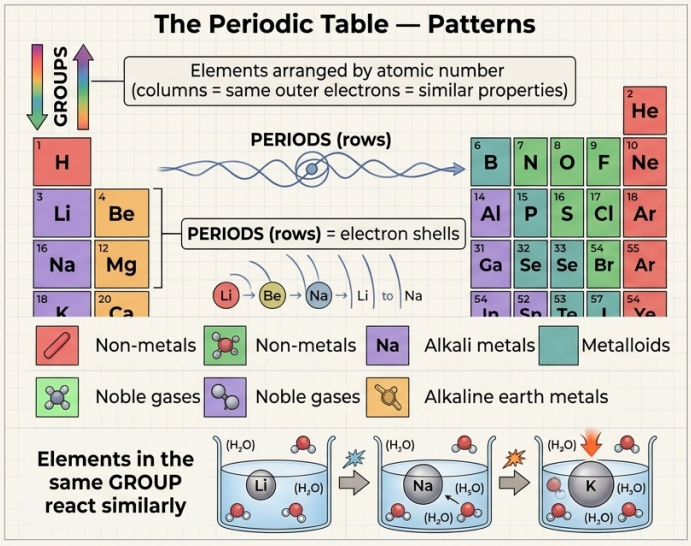
✓ Represent reactions
Write balanced chemical equations and explain what they show about mass conservation and atom rearrangement.

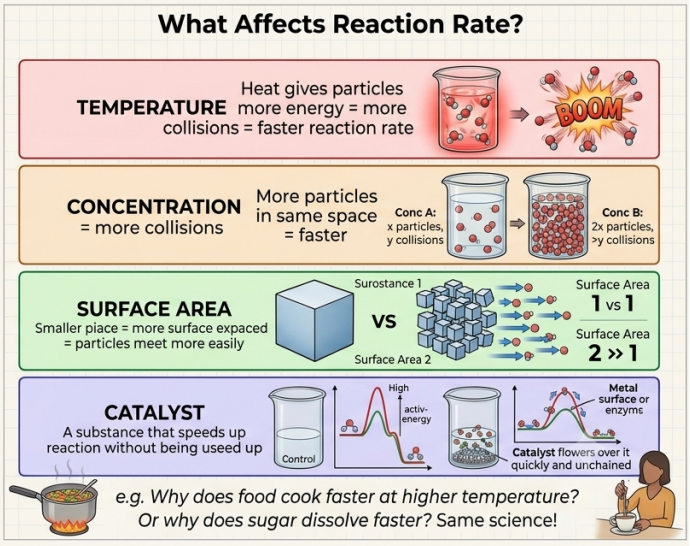
Big ideas to know:

The periodic table — organised by atomic number
Elements are arranged in the periodic table in order of increasing atomic number (number of protons). The rows (periods) represent electron shells — Period 1 has elements whose electrons fill the first shell (hydrogen, helium). The columns (groups) contain elements with the same number of outer-shell electrons — which is why they behave similarly. Group 1 (alkali metals: lithium, sodium, potassium) are all highly reactive. Group 18 (noble gases: helium, neon, argon) are all unreactive. The table predicts properties — if you know where an element sits, you can predict how it will react.

Ionic and covalent bonding
Atoms bond together to form stable molecules and compounds. In ionic bonding, one atom gives an electron to another — this creates oppositely charged ions that attract each other. Salt (NaCl) is ionic: sodium gives an electron to chlorine, forming Na+ and Cl-. In covalent bonding, atoms share electrons — this is how water (H2O) and carbon dioxide (CO2) are formed. Metals typically form ionic bonds with non-metals. Non-metals bond covalently with each other. Understanding bonding helps predict the properties of substances: ionic compounds dissolve in water; many covalent compounds do not.

Factors that control reaction rates
Chemical reactions involve breaking existing bonds and forming new ones. The rate at which this happens depends on how frequently and how hard particles collide. Four key factors affect rate: 1) Temperature — more heat = particles move faster = more frequent, energetic collisions = faster reaction. 2) Concentration — more particles per volume = more frequent collisions = faster reaction. 3) Surface area — smaller particles/more surface exposed = more reaction sites = faster. 4) Catalysts — substances that speed up a reaction without being used up, by providing an alternative pathway that requires less energy.





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Factors affecting reaction rate — examples

Factor	Effect on rate	How it works	Real-world example
Temperature	Higher temperature = faster reaction	Particles have more kinetic energy, collide more frequently and with more force	Food spoils faster in the heat; this is why we refrigerate food to slow reactions
Concentration	Higher concentration = faster reaction	More particles in the same space means collisions are more frequent	A strong bleach solution cleans faster than a diluted one
Surface area	Greater surface area = faster reaction	More surface exposed means more particles available for reactions at once	Powdered iron rusts far faster than an iron bar of the same mass
Catalyst	Catalyst = faster reaction without being consumed	Provides an alternative reaction pathway with lower activation energy	Enzymes in your body are biological catalysts — speeding up thousands of chemical reactions in your cells
Nature of reactants	Some substances react faster than others	Bond strengths and molecular structure affect how easily bonds break	Sodium reacts explosively with water; copper is very slow to react

Think Like a Scientist — Reaction Rate Investigator

Test the effect of temperature on a chemical reaction. Use effervescent (fizzing) vitamins or bicarb soda and vinegar. Place equal amounts in three cups of water at different temperatures: cold water (with ice), room temperature water, and warm water. Time how long the reaction takes to stop in each. What do you notice?

Ask: "Why does the same amount of material react faster in warmer water? What is happening at the particle level? If we doubled the amount of bicarb soda in the same amount of vinegar, would it go faster or just for longer?" These are exactly the kinds of questions chemists ask when designing reactions for medicines and industry.

Rate of reaction experiments to try:

1. Bicarb + vinegar in ice water vs hot water — time each one, compare rates
2. Whole sugar cube vs crushed sugar in warm water — which dissolves faster? (Surface area)
3. Tea bag vs loose tea leaves in the same hot water — which brews faster? (Surface area)
4. Yeast + sugar + warm water vs cold water — which produces CO2 bubbles faster? (Temperature + catalyst — yeast is the catalyst)
5. Ask: what household catalyst might help clean a drain faster?

Questions to ask your child

1. Why are elements in the same group (column) of the periodic table chemically similar?
2. What is the difference between an ionic bond and a covalent bond? Give an example of each.
3. Explain why a fire burns faster when you blow on it. Which reaction-rate factor does this demonstrate?
4. Why do hospitals store medicines and vaccines in refrigerators?
5. What is a catalyst? Give a biological example of a catalyst and explain why it is important.
6. Balance this equation: $H_2 + O_2 \rightarrow H_2O$. How many molecules of each substance are needed?
7. Why does powdered iron rust much faster than an iron nail of the same mass?

Cooking is chemistry! Baking involves chemical reactions — the bicarb soda in a cake reacts with acidic ingredients to produce CO2 bubbles, which make the cake rise. If you bake together, experiment: what happens if you double the bicarb soda? What if you use cold vs warm milk? You are investigating reaction rates and stoichiometry in your own kitchen!

Key words to know:

Atomic number	The number of protons in an atom's nucleus — unique to each element and determines its position in the periodic table
Periodic table	The organised arrangement of all known elements in order of atomic number, revealing patterns in chemical properties
Ionic bond	A chemical bond formed by the transfer of an electron from one atom to another, creating oppositely charged ions
Covalent bond	A chemical bond formed by the sharing of electrons between atoms
Reaction rate	How fast a chemical reaction proceeds — affected by temperature, concentration, surface area and catalysts
Catalyst	A substance that increases the rate of a chemical reaction without being consumed in the process
Activation energy	The minimum energy needed for a chemical reaction to occur — catalysts lower this energy requirement

Key words to look up

Atomic number · Periodic table · Ionic bond · Covalent bond · Reaction rate · Catalyst · Activation energy

What school will check

By the end of Year 10, your child needs to explain the organisation of the periodic table and periodic trends, distinguish between ionic and covalent bonding, and use the collision model to explain how concentration, temperature, surface area and catalysts affect reaction rates.

Try it at home!

Look at the ingredients of a common household chemical — dish soap, bleach, or laundry detergent. Identify any chemical names and try to find them on the periodic table or in a compound formula. Ask: which elements are in this substance? Is it ionic or covalent? Would it be safe to mix with other household chemicals? (Warning: NEVER mix bleach with ammonia — they react to produce toxic chloramine gas!)