

KS4 Chemistry – Elements, Mixtures and Compounds

In this module students will learn that matter is composed of tiny particles called atoms. Students will understand that when these atoms are joined together in different ways which gives them different properties such as solids, liquids and gases. They will investigate how mixtures can be separated using filtration, evaporation or chromatography. Students will learn how the periodic table shows us all the elements and that it can be split into metals and non-metals.

Students will ‘work scientifically’ to achieve these goals, learning the key features of scientific enquiry; observing over time, pattern seeking, identifying, classifying, investigating (fair tests) and researching.

Subject curriculum intent:	To develop in our students: <ul style="list-style-type: none"> • An enjoyment of Science by providing relevant, interesting and challenging experiences and activities. • Observational skills, by looking for patterns and contrasts. • An inquiring mind and a logical approach to problem solving. • The ability to draw conclusions from simple experiments and, where appropriate, to devise suitable experiments for further investigations. • Communication skills in speaking and listening, written, diagrammatic and symbolic forms. • Co-operation and a respect for others by being able to work as part of a team – the development of appropriate social skills. • Confidence in their own abilities. • A respect for the environment and a careful use of resources. • An interest in the world about them and a greater understanding of it. 		
End of KS3 intent/outcome	End of KS4 intent/outcome	End of KS5 intent/outcome	
Students will build on their knowledge of science through the different areas – biology chemistry and physics. Students will ‘work scientifically’ to achieve the goals of each topic area they encounter.	Students will continue to develop their scientific knowledge through the different areas – biology, chemistry and physics. Students will ‘work scientifically’ to achieve the goals of each topic area they encounter. Students will be able to relate their scientific experiences to everyday life and have an understanding that science is all around them.	N/A	
Intent for this topic:	In this topic, students will learn about different elements and the periodic table. Students will be able to identify and sort materials into solids, liquids and gases. Students will learn the properties of solids, liquids and gases and will have the opportunity to explore how water can change state and observe the changes. Students will learn how the particles in solids, liquids and gases are different. They will be given opportunities to explore, identify and observe reversible and irreversible changes. Students will mix different materials together and		

	<p>identify if they are soluble or insoluble. They will also learn how materials that have been mixed together can be separated.</p> <p>Students will 'work scientifically' to achieve these goals, learning the key features of scientific enquiry; observing over time, pattern seeking, identifying, classifying, investigating (fair tests) and researching.</p>
Core vocabulary needed for this subject/topic:	<p><u>Subject:</u> Biology, Chemistry, Physics Observe, pattern, identifying, classifying, investigating, fair test, researching.</p> <p><u>Topic:</u> Periodic table, elements States of matter, solids, liquids, gas, particles Evaporate, condensate, precipitation Heating, boiling, cooling, melting, freezing Particles, solution, reversible and irreversible changes, soluble, insoluble, mixing, separating Magnetism, filtering, sieving, decanting</p>
Vocabulary pupils will have accessed in other topics or subject areas:	Solids, liquids, gases, mixtures, separate, materials, heating, cooling, freezing
Key vocabulary taught within this topic:	Periodic table, elements States of matter, solids, liquids, gas, particles Evaporate, condensate, precipitation Heating, boiling, cooling, melting, freezing Particles, solution, reversible and irreversible changes, soluble, insoluble, mixing, separating Magnetism, filtering, sieving, decanting
Big Questions	What are elements? What are states of matter? How do you separate mixtures?
Prior knowledge: what pupils may already have studied	

Key stage	Subject	Topic title	Term/year taught	Content/What might pupils already know?
KS3	Science	Properties of Materials	Spring 1/Year 2	Pupils will have explored different materials and identified their properties.
KS3	Science	Solids, liquids and gases.	Spring 1/Year 3	Pupils will have explored and identified solids, liquids and gases. They may have looked at the particle model to help them identify a solid, liquid and gas. They may have looked at water and learnt how to change water from a solid, liquid and gas and back again.
KS3	Science	Changing Materials	Spring 2/Year 3	Pupils will have looked at different materials and food and explored how they change state.
KS3	Geography	The Water Cycle	Spring 2/Year 1	The pupils will have learnt about the water cycle and may be familiar with key words such as evaporate, condensate and precipitate.
Links to other subjects: Maths, geography, cooking				
Links to equality and diversity: Key Scientist – Dmitri Mendeleev (created the periodic table)				

	<u>OU P Steps 5-6</u>	<u>OU P Steps 7-8</u>	<u>OU Step 1</u>	<u>OU Step 2</u>	<u>OU Step 3</u>
<u>Subject specific knowledge</u>					
Elements and the periodic table	<p>Explores common elements from the periodic table e.g. gold, tin, silver, copper</p> <p>Sorts metals and non-metals using concrete resources.</p>	<p>Names some common elements using a choice of 2 with concrete prompts e.g. gold, oxygen, helium, tin.</p> <p>Identifies metals and non-metals using a colour coded periodic table.</p> <p>Can identify that the periodic table was created by Dmitri Mendeleev using a choice of 2 symbols.</p>	<p>Names some common elements using images.</p> <p>States some metals and non-metals using a colour coded periodic table.</p> <p>Knows that periodic table was created by Dmitri Mendeleev.</p> <p>Knows that elements are made of the same type of atom and compounds are made of different types of atoms.</p>	<p>Knows some common elements.</p> <p>Knows that that the periodic table shows all the known elements.</p> <p>Can describe the difference between atoms, elements, compounds and mixtures using a bank of key words.</p>	<p>Knows some common elements and their uses.</p> <p>Explains that all substances are made of atoms and that you cannot see them as they are very small.</p> <p>Knows that that the periodic table contains about 100 elements.</p> <p>States the difference between atoms, elements, compounds and mixtures using examples.</p>

		Knows that elements are made of the <u>same</u> type of atom.	Understands that <u>mixtures</u> are not chemically combined.		
Solids, liquids, gases and changing state	<p>Explores what happens when ice is warmed up.</p> <p>Knows how to sort materials different groups.</p> <p>Knows that solids, liquids and gases are different.</p> <p>Explores the heating and cooling/freezing can change the state of water.</p> <p>Explores how to use a thermometer.</p>	<p>Knows that all materials can be sorted into solids, liquids and gases.</p> <p>Knows that the atoms are arranged differently in solids, liquids and gases.</p> <p>Lists common liquids and solids.</p> <p>Knows that solids, liquids and gases have properties.</p> <p>Knows that solids, liquids and gases move differently.</p> <p>Knows that water can change state through heating/cooling/freezing.</p> <p>Explains the differences between a substance that is a solid and liquid.</p> <p>Describes the role of a thermometer using key words.</p>	<p>Knows that all materials can be sorted into solids, liquids and gases.</p> <p>Knows that solids, liquids and gases have different properties.</p> <p>Knows that solids, liquids and gases move differently.</p> <p>Differentiates between the arrangement of atoms in solids, liquids and gases.</p> <p>Knows that water can change state through heating/cooling/freezing.</p> <p>Is able to describe objects using the terms solid, liquid or gas.</p> <p>Names properties of solids and liquids.</p> <p>Describes the role of key lab equipment using key words e.g.</p>	<p>Knows the names of solids, liquids and gases.</p> <p>Knows that solids, liquids and gases have different properties.</p> <p>Names properties of solids, liquids and gases.</p> <p>Knows that solids, liquids and gases have a different arrangement of particles.</p> <p>Describes how atoms are arranged in a solid, liquid and gas using key words.</p> <p>Knows that water can change state through heating/cooling/freezing.</p> <p>Identifies how to change a solid to a liquid or liquid to a solid.</p> <p>Describes the role of key lab equipment using key words e.g. thermometer, goggles, Bunsen burner, tripod,</p>	<p>Knows the names of different solids, liquids and gases.</p> <p>Knows that solids, liquids and gases have different properties.</p> <p>Knows that solids, liquids and gases have a different arrangement of particles and can draw and explain the arrangements.</p> <p>Links properties to a particle diagram.</p> <p>Knows that water can change state through heating/cooling/freezing.</p> <p>Is able to explain what happens to particles when you heat them up.</p> <p>Understands the terms evaporation, condensation, melting and freezing.</p>

			thermometer, goggles, funnel and beaker.	evaporating dish and gauze.	Explains the role of key lab equipment using key words e.g. thermometer, goggles, Bunsen burner, tripod, evaporating dish and gauze.
Separating mixtures	<p>Knows how to mix materials together.</p> <p>Explores changes in water.</p> <p>Explores how materials can be separated.</p> <p>Explores how to filter different sized objects using appropriate equipment e.g. colander, sieve, filter paper.</p>	<p>Knows that materials can be mixed together.</p> <p>Knows that some materials dissolve in water and some don't.</p> <p>Knows that materials can be separated in different ways.</p> <p>Knows at least 1 way to separate materials.</p> <p>Understands the term filter.</p> <p>Identifies some lab equipment using images.</p>	<p>Knows that materials can be mixed together.</p> <p>Knows that some materials dissolve in water and some don't.</p> <p>Knows that materials can be separated in different ways.</p> <p>Knows at least 2 way to separate materials.</p> <p>Knows how to separate a given substance by following a method.</p> <p>Identifies lab equipment correctly using a word bank.</p>	<p>Knows that burning is an irreversible change.</p> <p>Knows that materials can be mixed together.</p> <p>Knows that materials that are soluble dissolve in water.</p> <p>Knows that materials that are insoluble do not dissolve in water.</p> <p>Knows at least 3 ways how to separate materials.</p> <p>Explains how filtering and evaporating separates substances using the term dissolved.</p> <p>Identifies which separation technique to use when obvious.</p> <p>Identifies lab equipment correctly.</p>	<p>Knows that burning is an irreversible change.</p> <p>Knows that burning materials can create energy.</p> <p>Knows that materials can be mixed together.</p> <p>Knows the meaning of soluble and insoluble.</p> <p>Knows different ways to separate materials.</p> <p>Describes the process of separating a salt from a salt mixture.</p> <p>Knows what each separation technique is used for.</p> <p>Identifies what lab equipment is needed to separate a mixture.</p>

Subject specific skills

<p>Elements and the periodic table</p>	<p>Is able to classify metals and non-metals.</p> <p>Can participate in observations.</p>	<p>Is able to observe key elements.</p> <p>Work in a group to find metals or non-metals on the periodic table using a simple key.</p>	<p>Is able to use the periodic table to find common elements using a simple key with verbal guidance.</p> <p>Is able to predict how a substance will react based on its position in a group having observed multiple examples of other elements in order.</p>	<p>Is able to use the periodic table to find common elements using knowledge of the groups.</p> <p>Is able to predict how a substance will react based on its position in a group having observed the previous element.</p>	<p>Is able to use the periodic table to find common elements and identify the atomic symbol independently.</p> <p>Is able to predict how a substance will react based on its position in a group.</p>
<p>Solids, liquids, gases and changing state</p>	<p>Is able to mix materials together.</p> <p>Is able to classify solids, liquids and gases.</p> <p>Is able to turn ice to liquid (water).</p> <p>Is able to turn water into ice.</p>	<p>Is able to classify solids liquids and gases.</p> <p>Is able to give one example of a solid, liquid and gas.</p> <p>Is able to identify a property of a solid, a liquid and a gas.</p> <p>Is able to change the state of water to a solid (ice) and a gas (water vapour) and back.</p> <p>Observes freezing, boiling and melting and identifies when the change occurs.</p>	<p>Is able to classify solids, liquids and gases.</p> <p>Is able to name several solids, liquids and gases.</p> <p>Is able to label different properties as a solid, liquid or a gas.</p> <p>Is able to change the state of water to a solid (ice) and a gas (water vapour) and back.</p> <p>Can observe differences between freezing, boiling and melting.</p> <p>Creates diagrams of solids and liquids using concrete resources.</p>	<p>Is able to name solids, liquids and gases.</p> <p>Is able to identify different properties of solids, liquids and gases.</p> <p>Is able to label a particle diagram as solids, liquids and gases.</p> <p>Is able to observe changes of state.</p> <p>Is able to explain how water changes state.</p> <p>Draws diagrams of solids, liquids and gases.</p> <p>Can represent changes of state using diagrams.</p>	<p>Is able to explain the differences between solids, liquids and gases by their properties.</p> <p>Is able to draw and label a diagram of the arrangement of particles in a solid, liquid and gas.</p> <p>Is able to explain how the particles are different in solids, liquids and gases.</p> <p>Is able to explain how water changes state.</p> <p>Is able to observe changes of state.</p>

		<p>Able to read a thermometer to within 10 measured increments with verbal and gestural guidance.</p>	<p>Is able to sequence pictures of changes of state.</p> <p>Is able to explain the process of changing the state of water.</p> <p>Is able to read a thermometer to within 5 measured increments with some verbal guidance.</p>	<p>Can investigate the freezing, boiling and melting of water.</p> <p>Is able to read a thermometer to within 1 measured increment with some verbal guidance.</p>	<p>Can identify the change of state taking place by using diagrams.</p> <p>Can investigate the freezing, boiling and melting of a range of substances.</p> <p>Is able to independently read a thermometer accurately to 1 measured increment.</p>
<p>Separating materials</p>	<p>Can sort objects according to size.</p> <p>Is able to mix materials together.</p> <p>Is able to separate materials following demonstrations.</p> <p>Can filter a range of mixtures using appropriate equipment e.g. colander, sieve, filter paper.</p>	<p>Is able to separate materials following picture methods.</p> <p>Is able to identify if a material has dissolved.</p> <p>Follows a picture method to carry out a simple investigation.</p> <p>Is able to name 1 way to separate a material.</p> <p>Separates mixtures using filter paper with a simple method.</p>	<p>Is able to classify changes of materials into irreversible and reversible.</p> <p>Is able to mix materials together.</p> <p>Is able to separate materials following picture and written methods.</p> <p>Is able to identify if a material has dissolved.</p> <p>Is able to name 2 ways to separate a material.</p> <p>Sets up apparatus and separates mixtures using filter paper with a simple</p>	<p>Is able to classify changes of materials into irreversible and reversible.</p> <p>Is able to mix materials together.</p> <p>Is able to separate materials following a written method.</p> <p>Is able to identify if a material is soluble or insoluble.</p> <p>Is able to name 3 ways to separate materials.</p> <p>Is able to independently set up filtering</p>	<p>Is able to mix and separate materials.</p> <p>Is able to name different ways to separate materials.</p> <p>Is able to explain why a material is soluble or insoluble.</p> <p>Is able to suggest how to separate 3 materials.</p> <p>Is able to suggest how to separate substances from a sand and stones mixture.</p> <p>Can set up apparatus using a diagram follow a</p>

			method and verbal prompts from staff.	equipment and fold filter paper correctly. Is able to follow a method to evaporate a substance.	method to evaporate a substance. Can inspect the set up for a filtering investigation and correct any errors.
Working Scientifically	<p>Is able to follow a set of demonstrations to make models.</p> <p>Is able to follow a set of demonstrations to carry out a simple investigation.</p>	<p>Is able to research different scientists using the internet.</p> <p>Is able to label diagrams using symbols.</p> <p>Is able to make models following a picture method.</p> <p>Is able to label diagrams using symbols.</p> <p>Is able to make a prediction from a choice of 3 using symbols.</p> <p>Is able to follow a picture method to carry out a simple investigation.</p> <p>Is able to identify one thing that has changed when completing a fair test.</p>	<p>Is able to research different scientists using the internet.</p> <p>Is able to collate their research.</p> <p>Is able to label diagrams using a word bank.</p> <p>Is able to make models following a word and picture method.</p> <p>Is able to link their model to a concept.</p> <p>Is able to select an appropriate prediction from a given choice.</p> <p>Is able to follow a word and picture method to carry out a simple investigation.</p>	<p>Is able to research different scientists using the internet.</p> <p>Is able to present their research to a member of staff or peer.</p> <p>Is able to make models following a written set of instructions.</p> <p>Is able to use their model to explain a concept.</p> <p>Is beginning to draw and label diagrams.</p> <p>Is able to make a prediction linked to their investigation.</p> <p>Is able to follow a written set of instructions to carry out a simple investigation.</p>	<p>Is able to research different scientists using the internet.</p> <p>Is able to present their findings to a group.</p> <p>Is able to draw and label diagrams.</p> <p>Is able to make models following a written set of instructions.</p> <p>Is able to suggest improvements to their model.</p> <p>Is able to use their model to explain a concept.</p> <p>Is able to use their model to explain a concept.</p>

		<p>Identifies the correct result in a table.</p>	<p>Is able to suggest what to change when completing a fair test.</p> <p>Is able to record results in a simple table.</p> <p>Analyses results in the form of tables, simple bar graphs and a brief descriptions using key words or sentence blanks.</p>	<p>Is able to explain why their investigation included a fair test.</p> <p>Is able to record results in a suitable table.</p> <p>Is able to record results in the form of a simple bar graph.</p> <p>Analyses results in the form of tables, simple bar graphs and a brief description.</p>	<p>Is able to make predictions.</p> <p>Is able to follow a written set of instructions to carry out a simple investigation.</p> <p>Is able to design an experiment to include a fair test.</p> <p>Is able to record results in a suitable table.</p> <p>Analyses results in the form of tables, simple bar graphs and a brief description.</p> <p>Is able to draw conclusions from their results.</p>
<p><u>Personal development</u></p>	<p><u>Problem solving</u> Investigations and matching exercises</p> <p><u>Communication skills</u> Working as pairs in investigations, asking and answering questions</p> <p><u>Self-belief</u> Learning new skills, practising them and demonstrating them.</p> <p><u>Self-management</u> Working with new equipment</p> <p><u>Teamwork</u> Working as groups to solve problems or find out new information</p>				

Suggested Activities

- Element treasure hunt.
- Separate metals and non-metals; colour code the periodic table.
- Watch demonstrations of alkali metals and make predictions on the reactions of next one down the group.
- Explore familiar elements and their uses e.g. gold, helium, chlorine, oxygen, neon, nickel, tin... watching videos and handling concrete resources.
- Build model elements using the same type or 'atom' e.g. with the same colour bricks / 2D shapes / threading the same colour beads.
- Look at the chemical formula of familiar items e.g. water and salt.
- Make model compounds and mixtures using different colours of Lego.
- Make molecular models by reading formula (moly-mod kits available in the lab).
- Collect information on diamonds and graphite.
- Identify what elements are needed to build everyday things.
- Sort elements and compounds (concrete / images / symbols / written formula / molecular models).
- List all of the elements in a compound by using the periodic table / simplified symbol key.
- Exploring examples of solid, liquid and gas.
- Identify familiar solids, liquids and gases e.g. wood, juice, steam / sort them into groups using images, symbols or words.
- Match the particle model to familiar items e.g. pencil matched to the solid particle model.
- Active learning to represent particle models: pupils stood in fixed positions as a solid, moving slightly in a confined space as a liquid, and lots of room to walk / run around as a gas. Staff to change state using Simon says.
- Active learning to show how materials change state.
- Make particle models using concrete resources e.g. coloured cones in the hall / MUGA / using balls or plates.
- Sorting objects using properties (solid and liquid, metal and non-metal, element and compound ect.)
- Change the state of water from ice to liquid to steam, draw and annotate how the particle model changes.
- Make jelly / melt chocolate and describe how the particle model changes.
- Play informative games on spellzone, legends of learning or BBC bitesize on the iPads or laptops.
- Equipment bingo
- Setting up equipment exercises.
- Filtering different mixtures e.g. using a colander, sieve, and filter paper for sand/water.
- Explore materials that dissolve in water and records observations (DOES: sugar, salt, baking powder, coffee granules, oxo cube. DOES NOT: rice, sand, glitter, tea leaves).
- Watch demonstration on separating the colours in the coatings of skittles.
- Separate mixtures in different ways - filtration, sieving, magnetic attraction and evaporation.

Possible Investigations/ Working Scientifically

- Show the changes of state of water through heating and cooling- ice, water, gas
- Does the colour of an ice-cube make a difference to how fast it melts?
- Can you stop an ice-cube melting?
- Does the shape of the container affect evaporation?
- Separating rock salt investigation using Bunsen burners.
- Investigate irreversible changes.

- Investigate reversible changes.
- Explore soluble and insoluble materials.
- Explore how to separate materials.

Online resources

twinkl

CLEAPPS for risk assessments

BBC bitesize for video resources.

Evidencing Work

All work / evidence sheets need to be printed off, annotated by staff, self-assessed by pupils and stored in student folders.

RRS Articles:

This unit of work is linked to Articles of the UN Convention on the Rights of the Child.

Article 13 (freedom of expression)

Article 17 (find out information)

Article 29 (goals of education)