



C2 - Pure and Impure Substances

Number of weeks (between 6&8)	Content of the unit	Assumed prior learning (tested at the beginning of the unit)
6 weeks 24 lessons	<ul style="list-style-type: none"> • elements, compounds and mixtures • solutions • separation techniques • pure and impure substances • diffusion 	<ul style="list-style-type: none"> • Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets • Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution • Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating • Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic • Demonstrate that dissolving, mixing and changes of state are reversible changes • Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.
Assessment points and tasks	Written feedback points	Learning Outcomes (tested at the end and related to subject competences)
<ul style="list-style-type: none"> - Pre-unit test (baseline) - C2 GAT (formative) - 6 mark question (formative) - Scientific skills investigation (formative) - End of unit test (summative) 	<ul style="list-style-type: none"> - diagnostic marking on GAT - diagnostic marking on 6 mark question - diagnostic marking on skills investigation - feedback on progress after end of topic test <p>(*these opportunities in AfL column)</p>	<ul style="list-style-type: none"> I can describe what a pure substance is I can list some mixtures I can identify simple techniques for separating mixtures I can state that particles may move through a fluid by diffusion (H) I can select appropriate simple techniques for separating given mixtures (G) I can describe how impurities may affect boiling and melting points of impure substance (G) I can describe diffusion in terms of the particle model (F) I can describe a mixture, including dissolved substances (F) I can describe how to carry out simple techniques for separating mixtures (E) I can explain how mixtures are different from elements and compounds (E) I can describe dissolving, with reference to particles (D) I can identify pure and impure substances from data (D) I can explain how diffusion happens in terms of the particle model (D) I can suggest some applications for making substances impure (C) I can explain how simple techniques for separating mixtures work (C) I can suggest how the rate diffusion may be affected (B)



C2 - Pure and Impure Substances

Lesson	Clear learning intentions (KQ)	Clear success criteria (Bands) (Keywords)	Hook (starter)	Presentation of content (teacher input)	Guided practice (pupil activities)	Requisition (per group)	Independent practice (homework)	Closure (AFL)
1. Pre unit test	How much do I know from KS2?	To complete exam	Word-search on keywords from KS2	Mind map of what pupils remember from KS2 as refreshers before exam	Pupils complete baseline test in silence		Homework 1 set	Pupil complete sentences: <i>One thing I know about this topic is...</i> <i>One thing I don't understand is...</i> <i>One question I have is...</i>
2. Particles in action	What is matter?	I can name 3 solids, 3 liquids and 3 gases (G) I can state that matter is made of tiny particles known as atoms (F) I can describe how to sort out matter (E)	Odd one out Show pupils four pictures: a coin, a log, a rock and a stream (water). Ask them to choose the odd one out, giving a reason. Allow open responses, but eventually guide them to considering the way the materials behave.	Ask pupils whether something obvious in the room, such as a table or a wall, is a solid a liquid or a gas. Ask them to try to explain why they think so, in order to see if they can explain their ideas.	Introduce the practical activity 'Sorting out matter'. Pupils complete table based on their observations (Fusion 1 pg.81)	'Sorting out matter' (Fusion 1 – pg.81) 6 samples labelled A-F 2 examples of solids 2 examples of liquids 2 examples of gas		Pupils write a description of a solid, liquid and gas in their own words.
3. Solids	How are the particles arranged in a solid?	I can state some simple solids (F) I can describe the properties of a solid (E) I can explain the particle arrangement in a solid (D)	Pupils to write out as many solids as they see in the room. Longest list wins!	Introduce the idea that matter is made of tiny particles. Introduce the term 'atom'. Show a tray with a layer of marbles (2/3 covered). Tilt tray in one corner to show how particles in a solid are packed tightly together. Gently shake tray to show particles can vibrate but not move. Emphasise that they vibrate whilst remaining in contact.	Practical 'Investigating Solids'. Gather results after practical – solids cannot be compressed, when heated expand etc...	'Investigating Solids' (Fusion 1 – pg.82) Compression – wood in syringe Bar and Gauge – require Bunsen burner Ball and Ring – require Bunsen burner Mass – 3 blocks of same size but different mass		Pupils to write a description of solids to help explain to a Year 6 pupil.
4. Liquids	How are the particles arranged in a liquid?	I can state some simple liquids (F) I can describe the properties of a liquid (E) I can explain the particle arrangement in a liquid (D)	Give pupils a list of statements that may apply to the way liquids behave. They must decide which ones are true.	Refer back to the particle model. Use the tray with marbles. This time shake a little harder to emphasise particles can vibrate and slide past each other, but remain touching most of the time.	Practical 'Investigating Liquids'.	'Investigating Liquids' (Fusion 1 – pg.84) Compression – compress liquid in a syringe Home-made Thermometer – conical flask and hot water bath Density – oil and water in a test tube with bung		Ask pupils to group up and demonstrate how liquids behave (acting).



C2 - Pure and Impure Substances

5. Gases	How are the particles arranged in a gas?	I can state some simple gases (F) I can describe the properties of a gas (E) I can explain the particle arrangement in a gas (D)	Pupils to write out as many gases as they can think of. Longest list wins!	Refer back to solids and liquids – pupils to describe how gases are different. Tray with marbles (1/10 covered). Use this to demo how gas particles behave.	Practical 'Investigating Gases'.	'Investigating Gases' (Fusion 1 – pg.86) Compression – Syringe Appearance – 4 different gas samples (different colours) Mass – beaker, electric scale	Homework 1 due Homework 2 set	Pupils to write a description of gases to help explain to a Year 6 pupil.
6. Gases in action	How do gases spread out?	I can state that particles may move through a fluid by diffusion (H) I can describe diffusion in terms of the particle model (F) I can explain how diffusion happens in terms of the particle model (D) I can suggest how the rate diffusion may be affected (B)	Show pupils an inflated balloon. Ask them to explain what holds the balloon stretched.	Demo 'Diffusion in Gases Experiment'	Carry out practical 'Air Pressure'	'Diffusion in Gases' (Fusion 1 – pg.88) x2 gas jars bromine gas 'Air Pressure' (Fusion 1 – pg.89) empty drinks cans clamp stand trough filled with water		Ask pupils to group up and demonstrate gas pressure and diffusion (acting).
7. Changing State	What happens when we heat a solid or a liquid? What happens when we cool a liquid or a gas?	I can state the 3 types of physical change (F) I can describe the methods of changing state (E) I can explain how state changes happen using scientific terms (D)	Give pupils a list of substances and ask them to tell you how many different types there are e.g. ice, water, steam (all water) or cooking oil and margarine (both oil) or lava and rock (both rocks)	Go through the 'Particle Model' and have pupils make notes on the 3 different diagrams to represent the 3 states.	Pupils must have 3 different diagrams to represent the different states and how they change to those states.			Show a flow chart linking words solid, liquid and gas. Pupils to add the words melting, freezing, boiling, condensing and even sublimation to the flow chart.
8. 6 Mark Q	<i>How do I answer a 6 mark question?</i>	Can I give a brief description of advantages or disadvantages? (D) Can I give a description of one advantage and one disadvantage? (C) Can I give a description of 2 advantages and 2 disadvantages? (B)	Show pupils 2 6MQ responses. Decide which is best and why.	Silver: Describe what happens when we heat a solid or a liquid and when we cool a liquid or a gas. Gold: Explain using particle theory what happens when we heat a solid or a liquid and when we cool a liquid or a gas. Look at success criteria for this question. Talk through planning of answers.	Pupils plan and answer 6MQ.			



C2 - Pure and Impure Substances

9. Mixtures	How are the particles arranged in a mixture?	I can list some mixtures (G) I can identify simple techniques for separating mixtures (F) I can explain how mixtures are different from elements and compounds (E)	What is pure? Ask pupils to write a definition for the word 'pure'. Allow open responses. You may wish to tell them afterwards that the chemical meaning is 'to describe a single substance'.	Explain that when you have more than one substance at a time, you have a mixture. Most materials are mixtures. You could show them a piece of granite at this point; pupils should easily be able to see the different minerals in it.	Pupils will have made notes on mixtures. Introduce the practical. - Pupils make a prediction - Record results in a table - Use evidence to see if prediction is correct	'Investigating Mixtures' (Fusion 1 – pg.93) Class Sets Electronic balance Salt (NaCl) Distilled water 1L (100cm ³ – per group)	Homework 2 due Homework 3 set	What does it mean? Ask pupils to match up the solution key words to their meanings
10. Separating Mixtures: Sieving and Filtering	How can we separate different-sized pieces of solid? How can we separate solids from liquids?	I can describe a mixture, including dissolved substances (E) I can describe dissolving, with reference to particles (D) I can explain how simple techniques for separating mixtures work (C)	What's the question? Give pupils key terms about solutions, such as 'solute', 'solvent' and 'solution'. Tell them that these words are the answers, but that they must write the questions.	Demonstrate how to separate a mixture of gravel and sand using a sieve, i.e. separating solids. Explain that the sand passes through as the grains are smaller than the holes but the stones of the gravel cannot.	Ask the pupils to carry out the 'Separating mixtures'. Pupils will probably need to be shown how to fold a filter paper properly.	DEMO (Fusion 1 – pg.94) Simple Separation Sand, Filter Paper, Funnel 'Separating Mixtures' (Fusion 1 – pg.95) Lead Nitrate, Sodium Iodide, Funnel, Filter Paper		It's a 'thingymajig' Draw diagrams of the equipment used in this lesson and met so far in Year 7. Ask the pupils to label the items.
11. Chromatography	What is Chromatography?	I can state what chromatography is used for (G) I can make a chromatogram (F) I can describe how to carry out chromatography (E) I can explain how chromatography works (D) I can analyse different samples using chromatography (C)	Odd one out Show pupils four pictures: a bottle of cola, some orange juice, a cup of tea and a glass of water. Ask them to decide which is the odd one out and why.	Discuss with pupils how, in an Art lesson, they can make colours they don't have by mixing others together. Explain that many paints, inks and dyes are actually a mixture of colours. Blacks in particular are rarely, if ever, pure.	Pupils make notes on how to make a chromatogram. Pupils to think of any situations where separating colours like this might be useful.	DEMO How to make a Chromatogram (Fusion 1 – pg.96) Chromatography paper, paper clip, splint		Past paper exam style question.
13. Investigating Chromatography*	Who shot Mr Burns?	I can carry out appropriate types of scientific enquiries to test predictions (H) I can select and carry out appropriate types of scientific enquiries to test predictions (F) I can identify the control variables in an investigation (E) I can plan and carry out appropriate types of scientific enquiries to test predictions (D)	Practice GCSE style exam question to recap how chromatography is carried out and why.	Who 'dunnit'? Show pupils a chromatogram 'prepared by the police' showing the traces produced by two known substances and another unknown. Set the scene by telling the class that the chromatogram was prepared from samples taken at a murder scene.	A note was left in the room and the police have identified two suspects, both of whom were arrested shortly after the incident and pens were found in their pockets. Ask pupils to carry out the investigation. Pupils plan investigation.	'Chromatography' (Fusion 1 – pg.97) Chromatography paper, paper clips, splints, samples X, Y, Z	Homework 3 due Homework 4 set	Ask the pupils whether either person could have committed the crime.



C2 - Pure and Impure Substances

14. Investigating Chromatography*	Who shot Mr Burns?	I can follow instructions and use appropriate techniques, apparatus and materials to conduct a safe scientific investigation (G) I can draw simple conclusions from the interpretation of data (F) I can draw more complex conclusions from the interpretation of data (E)	SPAG each other's methods from last lesson.	Discuss the concept of irrefutable evidence (reliable). Demo experiment.	Pupils carry out investigation and discuss results.	'Chromatography' (Fusion 1 – pg.97) Chromatography paper, paper clips, splints, samples X, Y, Z		Pupils say who they think shot Mr Burns and explain why.
15. Investigating Chromatography*	Who shot Mr Burns?	I can describe random and systematic error (F) I can evaluate the reliability of methods (E) I can suggest further questions that may arise from results of investigations and data analysis and evaluation (C)	What do you need to find someone guilty of a crime?	Model a 'good' police report to present to court.	Pupils write a police report to submit their evidence to court.			Mini-trial where pupils act as forensic scientists and present their evidence.
16. GAT	What do I need to include in my GAT?	*see level ladder on GAT	True/false recap of everything learnt so far.	Show examples of GAT completed by previous year Use the level ladder to check understanding.	Teacher to model on whiteboard from the level ladder the content and skills needed for certain bullet points.			Pupils write a plan of what to include and how to start their badger assessment
17. GAT	How can I complete a GAT?	*see level ladder on GAT	Use the example of badger assessment and read the feedback given by peers	Use plan to start writing the badger assessment. Differentiation writing frame needed of starting sentences.	Pupils complete GAT.			Peer mark the writing so far using green pen. WWW and EBI.
18. Evaporation	How can we separate a solid dissolved in a liquid?	I can state what is evaporation (F) I can describe how liquids can evaporate (E) I can explain the importance of evaporation (D)	Shipwreck Ask pupils how they could obtain fresh drinking water from seawater. They have a fire and some basic equipment, such as cloth which can be used as a filter.	Set up the 'Evaporation' experiment described in the pupil book at least 24 hours in advance. Look at the results of the 'Evaporation' experiment.	Get pupils to carry out 'Evaporation' experiment. Invite pupils to try to explain what has happened.	'Evaporation' (Fusion 1 – pg.98) Bunsen burners, Brine, evaporating basin	Homework 4 due Homework 5 set	Shipwreck 2 Invite pupils to re-plan their method of gaining fresh water from seawater based on what they have learned from the lesson.



C2 - Pure and Impure Substances

19. Distillation	How can we separate a mixture of liquids?	I can state what is distillation (F) I can describe the equipment used to carry out distillation (E) I can explain the importance of distillation (D)	Shipwreck - extended Ask pupils how they could obtain fresh drinking water from seawater (which also contains some sand, picked up as the water is scooped into a bucket). They have a fire and some basic equipment, such as cloth which can be used as a filter.	Explain the concept of distillation. Go through the history of how distillation came to be. [Filter the water to remove the sand. Boil the water and collect and condense the steam.]	Get pupils to carry out the 'Distillation' experiment described in the pupil book. After the practical, establish that only the water transfers from the test tube. Any impurities are left behind.	'Distillation' (Fusion 1 – pg.99) Boiling tubes, delivery tubes, receiving tubes, ice, sample to distil (food colouring and water)		Exam style question on process of distillation. Ideally use a question with images of the process.
20. Grouping Chemicals 1	How can we decide if something is a solid, liquid or a gas?	I can state named examples of solids, liquids and gases (F) I can describe the properties of solids, liquids and gases (E) I can explain how we classify chemicals based on their state (D)	Word challenge Ask pupils to come up with as many words as they can, using only letters from the word 'chromatography'. Longest list wins.	Establish that it is not always easy to decide whether something is a solid, liquid or gas. Explain the process of fractional distillation as a method of separating substances based on boiling points.	Get pupils to carry out 'Grouping chemicals by their state'. Allow open responses here, as all the substances exhibit properties of more than one state. The important aspect here is the reasoning behind the answers.	'Grouping chemicals by their state' (Fusion 1 – pg.100)		I've got the key Ask pupils to prepare a key to guide someone into deciding whether a substance is a solid, a liquid, a gas or a mixture. [The key could start with the question, 'Does it flow?' No – it's a solid; Yes – next question ...]
21. Grouping Chemicals 2	How can we decide if something is pure or a mixture?	I can describe what a pure substance is (E) I can identify pure and impure substances from data (D) I can suggest some applications for making substances impure (C)	Definition Recap Pupils to define the words 'pure' and 'impure'	Explain to pupils the importance of planning experiments. Go through how to plan an experiment: Aim, Prediction, Method etc...	Get the pupils to carry out the 'Grouping chemicals as pure or impure' activity. The main focus of this is on the planning of the experiment. Pupils will need advice on what to include in their method.	'Grouping chemicals as pure or impure' (Fusion 1 – pg.101)		Peer Assessment Give an example of an experiment. Pupils to write out a method to carry it out. Have pupils peer assess the methods using a model answer.
22. Grouping Chemicals 3	Can I devise a method to solve a problem?	I can describe how impurities may affect boiling and melting points of impure substance (G) I can select appropriate simple techniques for separating given mixtures (G) I can describe how to carry out simple techniques for separating mixtures (E)	What is the image? Show pupils images of all the different separation methods taught so far. Pupils to label each method used. Ext – how is each method carried out?	Have different scenarios on the board. e.g. Ship wrecked with only salt water available. How would you obtain drinking water?	Pupils to explain which separation method they would use per scenario and why.		Homework 5 due Revision set	Mixed Q's Circus Have lots of questions available on all the separation techniques covered in the topic.



C2 - Pure and Impure Substances

23. Revision	How can I revise for this topic on pure and impure substances?	I can state that particles may move through a fluid by diffusion (F) I can describe how to carry out simple techniques for separating mixtures (E) I can explain how diffusion happens in terms of the particle model (D)	Word search quick quiz hot seating on keywords for the topic.	Hot seating leads to a quick test on the meanings of keywords. Pupils given the task to write their own questions and answers on the topic				Swap questions for peer answering. Then peer mark using the answers created by the pupils.
24. End of Unit Test	How much have I learnt about the periodic table?	I can apply my knowledge from this unit in the test?	Purpose of test	Brainstorm all the keywords learnt from this topic as a warm up to the exam.	Pupils have a quick 5 minute reflection on revision for the topic.	Request class set of C2 Test Papers		