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**Knowledge Rich Curriculum Plan**

SCIENCE- Substances and Properties



| **Lesson/Learning Sequence** | **Intended Knowledge:**  *Students will know that…* | **Prior Knowledge:**  *In order to know this, students need to already know that…* | **Working Scientifically** | **Tiered Vocabulary and Reading Activity** | **Assessment** | **Support** |
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| ***The Atom*** | *Students will be able to state that atoms make up everything, that they are the smallest thing that can exist on its own. Students will be able to state the atom contains protons, neutrons and electrons. Students will be able to draw the atomic structure model.* | *Students will be able to recognise that materials are made of particles.* |  | *Proton- A positively charged subatomic particle*  *Neutron – A neutral subatomic particle*  *Electron- A negative subatomic particle* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  <https://www.bbc.co.uk/bitesize/guides/z6426yc/revision/1> |
| ***Atoms, Elements, compounds and mixtures.*** | *Students will be able to differentiate between atoms, elements and compounds. They will know that elements are made up form only 1 type of atom and they are the simplest substances in the universe. There are over a 100 different elements these can be located in the periodic table. A molecule is a group of two or more atoms, strongly joined together. Molecules can be elements or compounds. A compound is a substance that is made up of atoms of two or more elements, strongly joined together. A* ***mixture*** *contains two or more substances,*  *These may be elements or compounds.*  *The particles of the different substances are not chemically joined, just mixed up.*  *You can change the amounts of different substances in a mixture.* | *Students will recall the structure of an atom. They will recall that they are the smallest unit of matter and exist on their own.* | Analyse: students will draw conclusions. | *Pure substances- A substance that contains one element or compound*  *Molecules- A group of atoms bonded together*  *Compound- two or more elements chemically bonded together*  *Element- a substance made of one type of atom*  *Mixtures – two or more elements or compounds that are not chemically bonded* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/topics/zstp34j/articles/zngddp3*](https://www.bbc.co.uk/bitesize/topics/zstp34j/articles/zngddp3) |
| ***Properties of Materials*** | *Students will be able to predict the properties of a composite material based on the properties it is made from. For example; reinforced concrete has the properties of both steel and concrete. It is strong when stretched, squashed, heated and durable. Students will be able to select the appropriate materials for use, based on the structures of the composites. For example; making a floor ply wood, chip board, mdf, natural. Students will be able to evaluate the advantages and disadvantages of composite materials to make a specific object. For example; a cycle helmet.* | *Students will be able state the meaning of composite, properties and materials. Students need to already know how to identify the properties to make the object fit for purpose. Students need to already know how to identify 'good' and 'bad' properties for the specific use.* | *Analyse: Students will be able to analyse patterns*  *Communicate ideas: predict properties of materials in groups.*  *Enquire: Students can test their hypothesis* | *Property- A characteristic of something*  *Composite- made of several parts or elements*  *Durable- able to withstand* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/topics/zgvbkqt/articles/zyyfydm*](https://www.bbc.co.uk/bitesize/topics/zgvbkqt/articles/zyyfydm) |
| ***Classifying Materials*** | *Students will be able to identify a metal using its properties; shiny, hard, ductile, high density, malleable, sonorous, good conductor of heat/electricity, strong, high melting and boiling point. Students will be able to identify a ceramic identifying its properties; hard, brittle, low density, high melting/ boiling point, good insulator of electricity, dull. Students will be able to state what is meant by the term 'polymer' and recognise that polymers can have different properties; melting points/boiling points, elasticity, combustibility, strength.* | * *Students need to already know simple properties of metals; hard, shiny, good conductor of heat and electricity. Students need to already know to be state the difference between the properties of materials.* | *Enquire: Students can test their hypothesis*  *Analyse: Students will be able to draw conclusions from the results gained from the experiment* | *Malleable: Able to be hammered into shape*  *Ductile- Able to be drawn into a wire*  *Brittle: Easily broken*  *Sonorous- able to produce a ringing sound*  *Conductor- allows heat/electricity through it easily*  *Insulator- does not allow heat/electricity to pass through it* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  <https://www.bbc.co.uk/bitesize/topics/zgvbkqt> |
| ***Distinguishing Materials*** | *Students will know how to distinguish between a polymer and a ceramic by testing its mechanical properties and comparing their strength and malleability. Students will know how use physical properties to distinguish between a metal and polymer by comparing their densities and conductivity.* | * *Students need to already know how to conduct and lab experiment safety and record observation. Students need to be able to compare the properties of different metals, ceramics and polymers from previous lesson* | *Analyse: Students will collect data and draw conclusions from that data. Students will be able to identify any limitations to their practical.*  *Communicate: Students will be able to construct an explanation of their results* | *Ceramic- a material that is hard, brittle and heat-resistant*  *Polymer- A long chain of repeating units*  *Physical- changes affecting the form of a substance* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/topics/z6p6qp3/articles/zx8hhv4*](https://www.bbc.co.uk/bitesize/topics/z6p6qp3/articles/zx8hhv4) |
| ***Solids, Liquids and Gases*** | *Students will know that a substance exists in solid, liquid or gas states depending upon the temperature. Students will be able to match observations of melting/ cooling to the temperature at which they take place. For example; ice cube to water. Students will be able to match observations of boiling to the temperature at which they take place. For example; water to steam.* | * *Students need to know that there are three states of matter that substance can exist in; solid, liquids and gases. Students need to already know what the changes of state are called; melting, evaporation/boiling, freezing, condensing, sublimation. Students will be able to accurately take readings from a thermometer.* | *Analyse: Students will be able to draw conclusions from that data.* | *Melting – the process of turning a solid to a liquid*  *Boiling – the process of turning a liquid to a gas, that occurs at a fixed temperature and throughout the substance*  *Evaporation- the process that occurs on the surface of a liquid turning to a gas, occurs at any temperature*  *Condensation- the process of a gas turning to a liquid*  *Sublimation- the process of turning a solid to a gas.* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/topics/zkr4jxs*](https://www.bbc.co.uk/bitesize/topics/zkr4jxs) |
| ***Properties of solids, liquids and gases*** | *Students will be able to describe the physical characteristics of solids, liquids and gases. Solids cannot be compressed, don't take the shape of the container. Liquids cannot be compressed, take the shape of a container and flow. Gas can be compressed, can take the shape of a container and can flow. Students will identify if a substance is pure or impure based on its melting point and be able to identify such substances on a graph.* | * *Students need to already know the states of matter and how to observe the changes. Students need to already know the particle arrangement of solids, liquids and gases. Solids the particles are regular structure, tightly packed and can only vibrate. Liquids the particles are irregular but closely packed and can move freely. Gases the particles have no structure, are further apart and can move freely.* | *Communicate: Students will be able to justify opinions and communicate ideas* | *Compression- the decrease in volume of an object, the pushing together of particles*  *Flow- the ability to pour a substance* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/topics/zkr4jxs*](https://www.bbc.co.uk/bitesize/topics/zkr4jxs) |
| ***Changes of State*** | *Students will know the states of matter as solid, liquid and gas depending on the temperature. Students will know how to match the observations of melting to the temperature at which they take place. For example; ice melting above 0 degrees Celsius. Students will be able to describe the changes in energy; a solid having the least to a gas having the most.* | * *Students will already know the particle arrangement in a solid, liquid and gas. Students can already distinguish between the properties of a solid, liquid and gas.* | *Analyse: Students will be able to draw conclusions about the state change at different temperatures.* | *Observation- the changes that can be seen, heard or felt* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/topics/zkr4jxs*](https://www.bbc.co.uk/bitesize/topics/zkr4jxs) |
| ***What is pure?*** | *Students will be able to define the meaning of 'pure' something made from one element or compound. Students will identify if a substance is pure or impure based on its melting point and be able to identify such substances on a graph.* | * *Students need to already know the states of matter and how to observe the changes. Students need to already know how to measure the boiling points using a thermometer.* | *Enquire: Students will be able to hypothesise whether a substance is pure or impure by interpreting data.*  *Communicate: Students will be able to construct explanations* | *Pure- a substance containing one element or compound*  *Impure- a substance containing more than one element or compound*  *Justification- the action of showing something to be right* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/topics/zych6g8/articles/zhjptrd*](https://www.bbc.co.uk/bitesize/topics/zych6g8/articles/zhjptrd) |
| ***Soluble vs Insoluble*** | *Students will know the definition for soluble to be 'something that can dissolve to form a solution' and insoluble to be 'something that cannot dissolve to form a solution. Giving examples such as; sugar and salt in water. Students will know how to use evidence to suggest that the solute is still present in a solution. Students will be able to identify that the mass remains the same in a closed system. Students will be able to use appropriate terminology to describe the dissolving process.* | * *Students need to already know that some solids dissolve in liquids and some don't. Students need to already know how to measure the mass changes using a top-pan balance.* | *Communicate: Students will be able to construct explanations about why the mass remains the same in a closed system as nothing is allowed to escape or be added.* | *Soluble- able to be dissolved*  *Insoluble- unable to be dissolved*  *Solvent- the liquid that the solid dissolves into*  *Solute- a solid that dissolves in a liquid*  *Solution- a solute that has dissolved in a solvent*  *Closed system-a system that does not allow transfer of matter/energy in or out* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/guides/zc9q7ty/revision/6*](https://www.bbc.co.uk/bitesize/guides/zc9q7ty/revision/6) |
| ***Chromatography*** | *Students will know how to perform a paper chromatography investigation using; a beaker, chromatography paper, splint, ink/dye, solvent, pencil and ruler. Students will know how find out if a coloured dye includes a single substance or a mixture of substances looking at a chromatography. Single component shows one dot, mixture shows more than one dot.* | * *Students need to already know that a mixture is 'two or more elements/compounds that are not chemically combined', soluble 'substances that can be dissolved' and insoluble' substances that cannot be dissolved'. Students need to already know how mixtures can be separated. Students need to know that rulers are used to measure the distance accurately.* | *Enquire: Students will be able to plan variables in the practical to be independent: the type of ink. Dependent: the distance the components move. Control: the time taken in solvent.* | *Chromatography- the separation of components within a mixture based on their solubility*  *Component- an individual part of a mixture* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/guides/zgvc4wx/revision/5#:~:text=5%20of%205-,Separating%20dissolved%20solids%20%E2%80%93%20chromatography,food%20colourings%20and%20plant%20dyes*](https://www.bbc.co.uk/bitesize/guides/zgvc4wx/revision/5#:~:text=5%20of%205-,Separating%20dissolved%20solids%20%E2%80%93%20chromatography,food%20colourings%20and%20plant%20dyes)*.* |
| ***Interpreting a Chromatogram*** | *Students will know that chromatography separates substances based on their solubility. The higher up the chromatography paper, the more soluble the substance. Students will know how to make changes to a method to ensure an accurate result. Students will recognise that a substance may be soluble in some substances but not in others.* | * *Students need to already know how to conduct a paper chromatography experiment. Students need to already know how define solubility 'the ability to be dissolved'.* | *Analyse: Students will be able to calculate rf values using their data collected.* | *Rf value- the distance moved by the component/the distance moved by the solvent* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/guides/zgvc4wx/revision/5#:~:text=5%20of%205-,Separating%20dissolved%20solids%20%E2%80%93%20chromatography,food%20colourings%20and%20plant%20dyes*](https://www.bbc.co.uk/bitesize/guides/zgvc4wx/revision/5#:~:text=5%20of%205-,Separating%20dissolved%20solids%20%E2%80%93%20chromatography,food%20colourings%20and%20plant%20dyes)*.* |
| ***Separating Rock Salt*** | *Students will know how to explain observations such as a puddle drying in terms of evaporation 'the process by which water changes from a liquid to a gas or vapour. Students will know how to describe the changes in concentration of solution changes throughout the evaporation process. Students will know how to perform the separation of rock salt, using a Bunsen burner, heat proof mat, tripod, wire gauze, evaporating basin, spatula, stirring rod, splints, conical flask, filter funnel, filter paper.* | * *Students need to already know the changes of states from a solid to liquid to gas. Students need to already know the definition of a mixture and evaporation. Students will be able to identify the soluble and insoluble components in a mixture.* |  | *Concentration- the amount of substance in a fixed volume* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.google.com/search?q=separating+rock+salt&rlz=1C1GCEB\_enGB998GB998&oq=separating+rock+salt&aqs=chrome..69i57j0i512l3j0i22i30l6.6270j0j4&sourceid=chrome&ie=UTF-8*](https://www.google.com/search?q=separating+rock+salt&rlz=1C1GCEB_enGB998GB998&oq=separating+rock+salt&aqs=chrome..69i57j0i512l3j0i22i30l6.6270j0j4&sourceid=chrome&ie=UTF-8) |
| ***Simple and fractional distillation*** | *Students will be able to identify simple distillation equipment; round bottom flask, condensing tube, beaker, Bunsen burner, heat proof mat, clamp and stand and thermometer. Students will know how predict the distillate of a simple distillation process. Students will know how to use a thermometer reading to predict the distillate of a mixture of liquids. Students will know how that fractional distillation is the separating of multiple fractions in a mixture.* | * *Students need to already know that different solutions have different boiling points. Students need to already know that mixtures can be separated using separating techniques. Students need to know how to perform a practical experiment safely.* | *Communicate: Students will be able to construct explanations of simple and fractional distillation.* | *Simple distillation- A method of separating mixtures based on differences in their volatilities in a boiling/liquid mixture*  *Fractional distillation- separating of a liquid mixture into fractions differing in boiling point* | *Retrieval questions*  *Simple exam questions*  *Summative assessment 2* | *Knowledge organiser (provided on Teams and in class)*  [*https://www.bbc.co.uk/bitesize/guides/zwhfw6f/revision/3*](https://www.bbc.co.uk/bitesize/guides/zwhfw6f/revision/3) |