The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Chemistry Year 11

Using Resources

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
Lesson: Using Resources	• Students will know humans use the Earth's resources to provide warmth, shelter, food and transport • Students will know that natural resources, supplemented by agriculture, provide food, timber, clothing and fuels. • Students will know that finite resources from the Earth, oceans and atmosphere are processed to provide energy and materials. • Students will know that sustainable development is development that meets the needs of current generations without compromising the ability of future generations to meet their own needs • Students will know that chemistry plays an important role in improving agricultural and industrial processes to provide new products and in sustainable development. Students need to know how to distinguish between finite and renewable resources given appropriate information.	• ***Students need to already know that finite resources are resources that will eventually run out*** ***Students need to already know that renewable resources are resources that will naturally replenish faster than they are being used***		Tier 2 Agriculture: the practice of farming Tier 3 *Natural resources- These are resources formed without any human input.* *Synthetic resources- These are resources formed with human input (man made).* *Finite resources- These aren't formed fast enough to be considered replaceable (being used up faster than they are being made).* *Renewable resources- These form at a similar rate, or faster, than they are used so they can be replaced before they are used up.* *Ore-a naturally occurring solid material from which a metal or valuable mineral can be extracted profitably.*
Lesson: Potable Water	• Students will know that water of appropriate quality is essential for life • Students will know that potable water is water that is safe for drinking.	• ***Students will already know that sea water contains salt*** ***Students will already know that filtering removes solid particles from a liquid***	Required practical: producing potable water	Tier 2 *Sterilisation- Any process that removes, kills, or deactivates all forms of life.*

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	• Students will know that drinking water should have sufficiently low levels of dissolved salts and microbes. • Students will know that the methods used to produce potable water depends on available supplies of water and local conditions. • Students will know that in the UK rain provides water with low levels of dissolved salts (fresh water) that collects in the ground and in lakes and rivers. • Students will know that most potable water is produced by: -choosing an appropriate source of fresh water -passing the water through filter beds -sterilising • Students will know that water is sterilised by using chlorine, ozone and ultraviolet light. • Students will know that if fresh water supplies are limited then desalination of sea water or salty water. • Students will know that desalination is carried out through either distillation or by reverse osmosis. • Students will know that distillation and reverse osmosis require large amounts of energy • Students will know how to distinguish between potable water and pure water • Students will know how to analyse water samples			Tier 3 *Potable water - treated to levels that that meet state and federal standards for consumption (safe to drink).* *Desalination: Removal of salt from sea water*

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	Students will know how to purify water samples			
Lesson: Waste Water Treatment	• Students will know that urban lifestyles and industrial processes produce large amounts of waste water that require treatment before being released to the environment. • Students will know that sewage and agricultural waste water require removal of organic matter and harmful microbes. • Students will know that industrial waste water may require removal of organic matter and harmful chemicals. • Students will know that treatment of sewage includes: -screening and grit removal -sedimentation to produce sewage sludge and effluent -anaerobic digestion of sewage sludge -aerobic biological treatment of effluent	• ***Students will already know that filtration is used to remove solids***		Tier 2 *Effluent: liquid waste or sewage discharged into a river or the sea* Tier 3 *Organic Matter: Waste that has come from a living organism.* *Microbes: A microorganism, especially a bacterium causing disease or fermentation*
Lesson: Alternative Methods of Extracting Metals	• Students will know that Earth's resources of metal ores are limited • Students will know that copper ores are becoming scarce and new ways of extracting copper from low-grade ores including Phyto mining and bioleaching. • Students will know that Phyto mining uses plants to absorb metal compounds. • Students will know that once plants have absorbed metal compounds			Tier 2 Tier 3 Phytomining: using plants to extract metals from low grade ores Bioleaching: using bacteria to extract metals from their ores or waste

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	they are burned to produce ash that contains metal compounds • Students will know that bioleaching uses bacteria to produce leachate solutions that contain metal compounds. • Students will know that the metal compounds that are produced during bioleaching are processed to obtain the metal. Students will know how to evaluate alternative biological methods of metal extraction Students will already know that metals are extracted from ores.			
Lesson: Life Cycle Assessment	• Students will know that life cycle assessments are carried out to assess the environmental impact of products • Students will know that the stages of life cycle assessments are: -extracting and processing raw materials -manufacturing and packaging -use and operation during its lifetime -disposal at the end of its useful life, including transport and distribution at each stage • Students will know that some things are easily quantified, such as the use of water, resources, energy sources and production of some wastes. • Students will know how that pollutant effects are difficult to quantitatively measure Students will know how to carry out simple comparative LCAs for shopping bags made from plastic and paper	*Students need to already know that energy production can release pollutants into the atmosphere*		Tier 2 Raw Material: The basic material from which a product is made Disposal: Getting rid of something Tier 3

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Lesson: Reducing the Use of Resources	• Students will know that metals, glass, building materials, clay ceramics and most plastics are produced from limited raw materials. • Students will know that much of the energy from processes comes from limited resources. • Students will know that obtaining raw materials from the Earth by quarrying and mining causes environmental impacts. • Students will know that some products can be reused. • Students will know that some products can be recycled. • Students will know that metals can be recycled by melting and recasting or reforming into different products. • Students will know that the amount of separation required for recycling depends on the material and the properties required of the final product. Students will know how to evaluate ways of reducing the use of limited resources.	***Students will already know that recycling is the process of converting waste into reusable material.***		Tier 2 *Recycling: the action or process of converting waste into reusable material.* *Advantage: put in a favourable or superior position* Tier 3
Lesson: Corrosion and its Prevention (TRIPLE ONLY)	• Students will know that corrosion is the destruction of materials by chemical reactions with substance in the environment. • Students will know that rusting is an example of corrosion. • Students will know that rusting only occurs in iron • Students will know that air and water are necessary for iron to rust • Students will know that corrosion can be prevented by applying a coating that acts as a barrier, such	***Students will already know that metals have different reactivity.***		

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	as greasing, painting or electroplating. • Students will know that aluminium has an oxide coating that protects the metal from further corrosion. • Students will know that some coatings are reactive and contain a more reactive metal to provide sacrificial protection • Students will know how to describe experiments to show that air and water are necessary for rusting Students will know how to explain sacrificial protection in terms of relative reactivity.			
Lesson: Alloys (TRIPLE ONLY)	• Students will know that alloys are mixtures of metals. • Students will know that bronze is an alloy of copper and tin. • Students will know that brass is an alloy of copper and zinc • Students will know that the gold that is used in jewellery is usually an alloy with silver, copper and zinc. • Students will know that the proportion of gold in the alloy is measured in carats. • Students will know that 24 carats are pure gold and 18 carats is 75% gold. • Students will know that steels are alloys of iron that contain specific amounts of carbon and other metals. • Students will know that high carbon steel is strong but brittle. • Students will know that low carbon steel is softer and more easily shaped. • Students will know that steels containing chromium and nickel	*Students will know that mixtures contain 2 or more substances not bonded together.*		

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	(stainless steels) are hard and resistant to corrosion. Students will know how to interpret and evaluate composition and uses of alloys			
Lesson: Ceramics, Polymers and Composites (TRIPLE ONLY)	• Students will know that soda-lime glass is made by heating a mixture of sand, sodium carbonate and limestone. • Students will know that borosilicate glass is made from sand and boron trioxide • Students will know that borosilicate glass melts at a higher temperature than soda-lime glass • Students will know that pottery and bricks are examples of clay ceramics • Students will know that clay ceramics are made by shaping wet clay and then heating in a furnace • Students will know that the properties of polymers depend on what monomers they are made from and the conditions they are made in. • Students will know that thermosoftening polymers melt when they are heated • Students will know that thermosetting polymers do not melt when they are heated • Students will know that low density poly(ethene) and high-density poly(ethene) are formed from the same monomer (ethene) • Students will know that low density poly(ethene) has a structure where the polymer chains are branched,	• *Students need to already know that polymers are made up of many monomers joined together* • *Students need to already know that covalent bonds are strong* *Students need to already know that the melting point is the temperature a substance melts at.*		Tier 2 *Property: is how something behaves or what it looks like.* *Materials: a substance or mixture of substances that make up an object.* Tier 3 *Composite: A material that is made from different materials and has properties in common with each that it is made from.* Polymer- A large molecule composed of many repeating subunits. Monomer-small molecules that can join with other similar molecules to form very large molecules. Subunit-A distinct component of something. Polymerisation – The joining of monomers to form a polymer. Plasticiser- A plasticiser is a substance that is

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	which means that the molecules are arranged randomly. • Students will know that high density poly(ethene) has less branching in its structure, so the molecules are able to line up closely • Students will know that thermosoftening polymers don't have covalent bonds between neighbouring polymer molecules, so the molecules can move over each other when heated • Students will know that most composite materials have two components, the reinforcement (which makes the material stronger) and the matrix (which binds the reinforcement together) • Students will know how to quantitatively compare the physical properties of glass and clay ceramics, polymers and composites • Students will know how to explain the properties of materials, and relate the properties of materials to their uses. • Students will know that thermosetting polymers have covalent bonds between neighbouring polymer molecules, which means that the molecules are unable to move Students will know that a composite material consists of two or more materials with different properties.			added to a material to make it softer and more flexible Intermolecular bonds- Weak forces of attraction between DIFFERENT molecules.

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Lesson: The Haber Process	• Students will know that ammonia is NH3 • Students will know that ammonia is manufactured through the Haber process • Students will know that ammonia is used to produce nitrogen-based fertilisers • Students will know that the raw materials for the Haber process are nitrogen (obtained from air) and hydrogen (from natural gas) • Students will know that the reaction to produce ammonia from nitrogen and hydrogen is reversible: • N2 + 3H2 ⇌ 2NH3 • Students will know that during the Haber process the gases are passed over a catalyst of iron at a temperature of 450 degrees Celsius and a pressure of 200 atm • Students will know that liquid ammonia is removed from the reaction vessel after cooling, and the remaining hydrogen and nitrogen is recycled • Students will know how to apply ideas of dynamic equilibria to the conditions used in the Haber Process • Students will know how to explain the trade-off between rate of production and position of the equilibrium Students will know how to interpret graphs of reaction conditions vs reaction rate	• *Students need to already know that some reactions are reversible* • *Students need to already know that when a dynamic equilibrium is reached the position of the equilibrium will shift to counteract any changes in conditions.* *Students need to already know that the conditions that can lead to a shift in equilibrium include temperature, pressure and concentration*		Tier 2 *Yield: produce or provide* *Compressed: squeezed or pressed together* Tier 3

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Lesson: Production and uses of NPK Fertilisers (TRIPLE ONLY)	• Students will know that fertilisers used to improve agricultural productivity often contain compounds of nitrogen, phosphorus and potassium • Students will know that NPK fertilisers contain compounds that contain all three of nitrogen, phosphorus and potassium • Students will know that NPK fertilisers are formulations • Students will know that ammonia can be used to manufacture ammonium salts and nitric acid, which are compounds that contain nitrogen • Students will know that potassium chloride, potassium sulfate and phosphate rock are obtained by mining • Students will know that phosphate rock can't be used directly as a fertiliser, so needs to be treated with nitric acid or sulfuric acid to produce soluble salts. Students will know how to compare the production of fertilisers in industry and in laboratories.	• ***Students need to already know how to name salts*** ***Students need to already know that a formulation is a mixture of substances that have been carefully mixed to have certain properties.***		Tier 2 *Fertiliser: a chemical or natural substance added to soil or land to increase its fertility* *Agricultural productivity: the science or practice of farming, including cultivation of the soil for the growing of crops* Tier 3