KESTEVEN AND SLEAFORD HIGH SCHOOL

Chemistry Scheme of Learning

Year 11 – Term 3 & 4 Topic 10 Earth's Resources

Intent – Rationale

Pupils complete the Earth's Resources Topic which involves using their knowledge from all previous units and applying them to real -life applications. They will covering water treatment, metal extraction, alloys, life cycle assessments, recycling, materials science and fertilisers. This links back to chemical calculations, bonding, quantitative chemistry and equilibria. They will also be completing their final required practical in the water treatment topic, which links back to topic 1 and organic chemistry.

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
• **Year 7 Topic 5 Chemical reactions and 6 Compounds** • **Year 8 Topic 8 Extracting Metals, Topic 9 Reactions of Acids, Topic 10 Chemical Reactions, Topic 11 Earth and Atmosphere and Topic 12 Innovative Materials** • **GCSE Topics 1-9 (topic is very synoptic)**	• A level Topic 2 Amount of Substance, Topic 3 Bonding, Topic 6 Equilibria and Topic 12 Alkanes
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• Base the content here on what you already know but there will be time in future to liaise further as part of our collaborative work	• SP2 Learning about the world around them • M3 Haber Process and Fritz Haber • GB4 a,b,c,d,e,f,g,h,i
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**
• FROM THE LIBRARY	• Orders of magnitude • % composition • Reacting mass calculations • Interpreting data presented in graphs • Titration calculations

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Chemistry Scheme of Learning

Year 11 Term 3 & 4

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?

Know

- I know that humans use the Earth's resources to provide warmth, shelter, food and transport
- I know that natural resources, supplemented by agriculture, provide food, timber, clothing and fuels
- I know that finite resources from the Earth, oceans and atmosphere are processed to provide energy and materials
- I can state examples of natural products that are supplemented or replaced by agricultural and synthetic products
- I know that for humans, drinking water should have sufficiently low levels of dissolved salts and microbes. Water that is safe to drink is called potable water. Potable water is not pure water in the chemical sense because it contains dissolved substances
- I know that sterilising agents used for potable water include chlorine, ozone or ultraviolet light
- I can describe the differences in treatment of ground water and salty water
- I can describe the steps in sewage treatment
- I know that he Earth's resources of metal ores are limited. Copper ores are becoming scarce and new ways of extracting copper from low-grade ores include phytomining, and bioleaching. These methods avoid traditional mining methods of digging, moving and disposing of large amounts of rock
- I know that the metal compounds can be processed to obtain the metal. For example, copper can be obtained from solutions of copper compounds by displacement using scrap iron or by electrolysis
- I know that life cycle assessments (LCAs) are carried out to assess the environmental impact of products
- I know that he reduction in use, reuse and recycling of materials by end users reduces the use of limited resources, use of energy sources, waste and environmental impacts
- I know that metals, glass, building materials, clay ceramics and most plastics are produced from limited raw materials. Much of the energy for the processes comes from limited resources. Obtaining raw materials from the Earth by quarrying and mining causes environmental impacts
- *I know that both air and water are necessary for iron to rust*
- *I know that most metals in everyday use are alloys. Bronze is an alloy of copper and tin. Brass is an alloy of copper and zinc. Aluminium alloys are low density*
- *I know examples of specific alloys and their uses*
- *I can describe how glass and ceramics are formed*
- *I know that thermosoftening polymers melt when they are heated. Thermosetting polymers do not melt when they are heated.*
- *I can describe and give examples of composites*
- *I know that the Haber process is used to manufacture ammonia, which can be used to produce nitrogen-based fertilisers.*
- *I know the conditions for the Haber Process*
- *I know that industrial production of NPK fertilisers can be achieved using a variety of raw materials in several integrated processes. NPK fertilisers are formulations of various salts containing appropriate percentages of the elements.*
- *I know how the raw materials for NPK fertilisers are obtained*
- *I can recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid*

Apply

- I can distinguish between finite and renewable resources given appropriate information
- I can extract and interpret information about resources from charts, graphs and tables
- I can explain how rain water is made potable
- I can explain desalination
- I can distinguish between potable water and pure water

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- I can give reasons for the steps used to produce potable water
- I can comment on the relative ease of obtaining potable water from waste, ground and salt water
- I can explain how phytomining and bioleaching can be used to extract metals
- I can carry out simple comparative LCAs for shopping bags made from plastic and paper
- I can explain how glass and metals can be recycled
- *I know that corrosion can be prevented by applying a coating that acts as a barrier, such as greasing, painting or electroplating. Aluminium has an oxide coating that protects the metal from further corrosion.*
- *I know that some coatings are reactive and contain a more reactive metal to provide sacrificial protection, eg zinc is used to galvanise iron*
- *I can calculate the percentage of gold in gold alloys using carats*
- *I know the properties of polymers depend on what monomers they are made from and the conditions under which they are made. For example, low density (LD) and high density (HD) poly(ethene) are produced from ethene.*
- *I can interpret graphs of reaction conditions versus rate*
- *I can apply the principles of dynamic equilibrium in Reversible reactions and dynamic equilibrium to the Haber process*
- *I can apply my knowledge of titrations to produce an ammonium salt fertiliser*

Extend

- I can use orders of magnitude to evaluate the significance of data
- I can compare the energy requirements of treating water
- I can evaluate alternative biological methods of metal extraction, given appropriate information
- I know that selective or abbreviated LCAs can be devised to evaluate a product but these can be misused to reach pre-determined conclusions, eg in support of claims for advertising purposes
- I can evaluate ways of reducing the use of limited resources, given appropriate information
- *I can evaluate the best method to protect a metal from corrosion*
- *I can interpret and evaluate the composition and uses of alloys other than those specified given appropriate information*
- *I can compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals*
- *I can explain how the properties of materials are related to their uses and select appropriate materials*
- *I can explain the trade-off between rate of production and position of equilibrium*
- *I can compare the industrial production of fertilisers with laboratory preparations of the same compounds, given appropriate information*

What subject specific language will be used and developed in this topic?	What opportunities are available for assessing the progress of students?

Alloy	A mixture of two or more elements, at least one of which is a metal. This gives the metal different properties
Bioleaching	Bacteria feed on low grade metal ores to form leachate (a solution of copper ions). Copper can then be extracted from this solution
Ceramic	Material made by heating clay to high temperatures to make hard but brittle materials which make excellent electrical insulators

- Test After Lesson 6 and 12
- Long answer questions after lesson 2, 4, 7, 10 and 11
- Required practical 8

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Composite	Materials made from two or more different materials, containing a matrix or binder surrounding and binding together fragments or fibres of another material to act as reinforcement
Corrosion	Chemical reactions between a metal and substances in the environment
Crude Oil	A non-renewable fossil fuel that is the starting material for several useful products, such as fuels and plastics
Finite resource	Resources that are being used at a faster rate than they can be replaced e.g. *crude oil, limestone, metal ores*
Galvanising	Iron or steel objects being protected from rusting by a thin layer of zinc
Glass	A material made by heating sand and other substances to high temperatures to make a clear, brittle materials
Life Cycle Assessment	Carried out to assess the environmental impact of products, processes or services at different stages in their lifecycle
Non-renewable	Something that cannot be replaced once it is used up
NPK Fertiliser	A formulation containing nitrogen, phosphorous and potassium which are necessary nutrients for plant growth
Phytomining	Plants grown in soil containing low grade copper ore. The plants are burned and the ash reacted with sulphuric acid to form leachate (solution of copper ions). Copper can be extracted from this solution
Polymer	A substance made from very large molecules made up of many repeating units (monomers)

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Potable water	Water that is safe to drink, but is not necessary pure
Pure water	Water with nothing else added containing ONLY H_2O molecules
Recycle	The process in which waste materials are processed to be used again
Renewable resource	Resources can be replaced at the same rate they are used up
Sacrificial protection	A metal more reactive than iron (e.g. zinc) is attached to or coated on an object to prevent the iron from rusting. The more reactive metal is oxidised instead of the zinc
Steel	An alloy of iron containing carbon and/or other elements. The properties can be changed for different uses
The Haber Process	A process by which ammonia is produced from nitrogen and hydrogen under specific conditions
Thermosetting	Polymer that can form extensive cross-linking resulting in a rigid material that is heat resistant. It cannot be melted and remoulded into different shapes
Thermosoftening	Polymer that forms plastics that can be softened by heating and remoulded into different shapes as they cool and set

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Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
Lesson 1 Finite and renewable resources	• I know that humans use the Earth's resources to provide warmth, shelter, food and transport • I know that natural resources, supplemented by agriculture, provide food, timber, clothing and fuels • I know that finite resources from the Earth, oceans and atmosphere	• I can distinguish between finite and renewable resources given appropriate information • I can extract and interpret information about resources from charts, graphs and tables • I can use orders of magnitude to evaluate	

	are processed to provide energy and materials • I can state examples of natural products that are supplemented or replaced by agricultural and synthetic products	the significance of data	
Lesson 2 Water safe to drink	• I know that for humans, drinking water should have sufficiently low levels of dissolved salts and	• I can explain how rain water is made potable • I can explain desalination	

	microbes. Water that is safe to drink is called potable water. Potable water is not pure water in the chemical sense because it contains dissolved substances • I know that sterilising agents used for potable water include chlorine, ozone or ultraviolet light • I can describe the	• I can distinguish between potable water and pure water	

	differences in treatment of ground water and salty water		
Lesson 3 Treating waste water	• I can describe the steps in sewage treatment • I can give reasons for the steps used to produce potable water	• I can comment on the relative ease of obtaining potable water from waste, ground and salt water • I can compare the energy requirements of treating water	
Lesson 4	• I know that he Earth's	• I can explain	

Extracting metals from ores	resources of metal ores are limited. Copper ores are becoming scarce and new ways of extracting copper from low-grade ores include phyto mining, and bioleaching. These methods avoid traditional mining methods of digging, moving and disposing of large amounts of rock	how phytomining and bioleaching can be used to extract metals • I can evaluate alternative biological methods of metal extraction, given appropriate information	

	• I know that the metal compounds can be processed to obtain the metal. For example, copper can be obtained from solutions of copper compounds by displacement using scrap iron or by electrolysis		
Lesson 5 Life Cycle Assessments	• I know that life cycle assessments (LCAs) are carried out to assess the environmental impact	• I can carry out simple comparative LCAs for shopping bags made from plasti	

	of products	c and paper • I can explain how glass and metals can be recycled • I know that selective or abbreviated LCAs can be devised to evaluate a product but these can be misused to reach pre-determined conclusions, eg in support of claims for	

		advertising purposes	
Lesson 6 Reduce, reuse recycle	• I know that he reduction in use, reuse and recycling of materials by end users reduces the use of limited resources, use of energy sources, waste and environmental impacts • I know that metals, glass, building materials, clay ceramics and most plastics are produced	• I can evaluate ways of reducing the use of limited resources, given appropriate information	

	from limited raw materials. Much of the energy for the processes comes from limited resources. Obtaining raw materials from the Earth by quarrying and mining causes environmental impacts		
Lesson 7 Rusting (chem only)	• *I know that both air and water are necessary for iron to rust*	• *I know that corrosion can be prevented by applying a coating that*	

		acts as a barrier, such as greasing, painting or electroplating. Aluminium has an oxide coating that protects the metal from further corrosion. • *I know that some coatings are reactive and contain a more reactive metal to provide sacrificial*	

		protection, eg zinc is used to galvanise iron • *I can evaluate the best method to protect a metal from corrosion*	
Lesson 8 Alloys (chem only)	• *I know that most metals in everyday use are alloys. Bronze is an alloy of copper and tin. Brass is an alloy of copper and zinc. Aluminium*	• *I can calculate the percentage of gold in gold alloys using carats* • *I can interpret and evaluate the comp*	

	alloys are low density • *I know examples of specific alloys and their uses*	*osition and uses of alloys other than those specified given appropriate information*	
Lesson 9 -10 Polymers, Glass ceramics and composites (chem only)	• *I can describe how glass and ceramics are formed* • *I know that thermosoftening polymers melt when they are heated. Thermosetting polymers do not melt when*	• *I know the properties of polymers depend on what monomers they are made from and the conditions under which they are made. For example, low density*	

	they are heated. • *I can describe and give examples of composites*	*(LD) and high density (HD) poly(ethene) are produced from ethene.* • *I can compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals* • *I can explain how the properties of materials are related to*	

		their uses and select appropriate materials	
Lesson 11 Haber process (chem only)	• *I know that the Haber process is used to manufacture ammonia, which can be used to produce nitrogen-based fertilisers.* • *I know the conditions for the Haber Process*	• *I can interpret graphs of reaction conditions versus rate* • *I can apply the principles of dynamic equilibrium in Reversible reactions and dynamic equilibrium to the Haber process* • *I can explain the trade-off*	

		between rate of production and position of equilibrium	
Lesson 12 Fertilisers (chem only)	• *I know that industrial production of NPK fertilisers can be achieved using a variety of raw materials in several integrated processes. NPK fertilisers are formulations of various salts containing appropriate percentages*	• *I can apply my knowledge of titrations to produce an ammonium salt fertiliser* • *I can compare the industrial production of fertilisers with laboratory preparations of the*	

	of the elements. • *I know how the raw materials for NPK fertilisers are obtained* • *I can recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid*	*same compounds, given appropriate information*	