C10 Learning Journey

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| 1 | Humans use the Earth’s resources to provide warmth, shelter, food, clothing, timber, and fuel for transport and electricity generation. **Finite resources** are those which are not replenished at the same rate as they are used so will run out**. Renewable resources** are replenished as we use them. **Sustainable development** is important as it ensures that the needs of current generations are met without compromising the ability of future generations to meet their own needs |
| 2 | **Pure** **water** contains only H₂O; **potable water** is not pure but has sufficiently low levels of dissolved salts and microbes to be safe to drink. Potable water in the UK comes from rain that collects in the ground, lakes, rivers and reservoirs; if no fresh water is available, drinking water must be taken from the sea but have the salt removed first. The water is then **filtered** and **sterilised** before it is fit to drink. |
| 3 | Required practical- **purification** of tap water using **distillation.** Tap water contains low levels of dissolved sodium chloride, this can be removed by distillation. |
| 4 | Domestic and industrial waste water (**sewage**) must be cleaned before being released into the environment to remove debris and organic matter, microbes and chemicals. Sewage treatment includes: **screening and removal of grit and debris**; **sedimentation** to allow smaller particles to sink to the bottom of the tank; **anaerobic digestion** of organic matter in sewage sludge and **aerobic biological treatment of effluent**. |
| 5 | Metal is a finite resource. **Low-grade ores** contain only small amounts of copper so new methods have been developed to mine low grade ores- **Phytomining** uses plants. The plants are grown on soil containing the copper compounds. They are harvested and then burned to produce ash that contains metal compounds. **Bioleaching** uses bacteria to extract metal compounds from a solution. |
| 6 | **Life Cycle Assessments (LCAs)** are carried out to assess the environmental impact of each stage of the product’s life: **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. Some things are hard to measure with a numerical value so LCA’s can be **subjective**. |
| 7 | The **reduction** in use, **reuse** and **recycling** of materials reduces the use of limited resources, energy consumption, waste and environmental impacts. Metals, glass, building materials, clay ceramics and most plastics are produced from limited raw materials. Some products, such as glass bottles, can be reused or recycled- glass bottles can be crushed and melted to make different glass products. Metals can be recycled by melting and recasting or reforming into different products. |
| 8 | **Corrosion** is the destruction of materials by chemical reactions with substances in the environment. **Rusting** is an example of corrosion that needs both air and water. Corrosion can be prevented by applying a coating that acts as a barrier, such as greasing or painting. Some coatings contain a more reactive metal to provide sacrificial protection, this means that the metal in the coat will react and corrode rather than the metal underneath. |
| 9 | An **alloy** is a mixture of a metal element with at least one other element. Alloys are designed with specific properties in mind, and the elements in the alloy are chosen to provide these properties. Students should be able to name some common alloys and describe the **composition, properties and uses** of these alloys. |
| 10 | Most of the glass we use is **soda-lime glass**, made by heating a mixture of sand, sodium carbonate and limestone. **Borosilicate glass** is made from sand and boron trioxide. Clay **ceramics**, such as pottery and bricks, are made by shaping wet clay and then heating in a furnace. Glass and ceramics are both **brittle** so break easily. |
| 11 | The properties of **polymers** depend on what **monomers** they are made from and the conditions under which they are made. **Thermosoftening** polymers melt when they are heated. Thermosetting polymers do not melt when they are heated. This is because in thermosetting plastics, there are strong **cross-links** between the polymer chains which are not disrupted by heating; these cross links are not found in thermosoftening polymers.  Most **composites** are made of two materials, a **binder** holding together fibres or fragments of the other material. The composite is made with specific properties in mind, and the materials chosen provide these properties. |
| 12 | The **Haber** **process** is used to manufacture **ammonia**, which can be used to produce nitrogen-based **fertilisers**. The raw materials needed are nitrogen (obtained from the air) and hydrogen (obtained from natural gas). The purified gases are passed over a catalyst of iron at a high temperature (about 450 °C) and a high pressure (about 200 atmospheres). Some of the hydrogen and nitrogen reacts to form ammonia. The reaction is reversible so some of the ammonia produced breaks down into nitrogen and hydrogen. On cooling, the ammonia liquefies and is removed. The remaining hydrogen and nitrogen are recycled |
| 13 | Be able to explain how changing the conditions (temperature, pressure, concentration of reactants, use of a catalyst) of the reaction for the Haber process will effect **yield** of product. |
| 14 | Compounds of nitrogen, phosphorus and potassium are used as **NPK fertilisers**. NPK fertilisers are formulations of various salts containing appropriate percentages of the elements. Ammonia can be used to manufacture ammonium salts and nitric acid. This supplies the nitrogen in the fertiliser. Potassium chloride, potassium sulfate and phosphate rock are obtained by mining, but phosphate rock cannot be used directly as a fertiliser- it is treated with nitric acid or sulfuric acid to produce soluble salts that can be used as fertilisers |