L103 - 104 Using resources 2 (CHEM ONLY)

Using materials

Corrosion and its prevention

Corrosion	*The destruction of materials by chemical reactions with substances in the environment*	An example of this is iron rusting; iron reacts with oxygen from the air to form iron oxide (rust) water needs to be present for iron to rust.
Preventing corrosion	*Coatings can be added to metals to act as a barrier*	Examples of this are greasing, painting and electroplating. Aluminium has an oxide coating that protects the metal from further corrosion.
Sacrificial corrosion	*When a more reactive metal is used to coat a less reactive metal*	This means that the coating will react with the air and not the underlying metal. An example of this is zinc used to galvanise iron.

Alloys are useful materials

Alloys	*A mixture of two elements, one of which must be a metal e.g. Bronze is an alloy of copper and tin and Brass is an alloy of copper and zinc.*
Gold carats	*Gold jewellery is usually an alloy with silver, copper and zinc. The carat of the jewellery is a measure of the amount of gold in it e.g. 18 carat is 75% gold, 24 carat is 100% gold.*
Steels	*Alloys of iron, carbon and other metals.*
	High carbon steel is strong but brittle.
	Low carbon steel is softer and easily shaped.
	Steel containing chromium and nickel (stainless) are hard and corrosion resistant.
	Aluminium alloys are low density.

Ceramics, polymers and composites

Polymers	*Thermosetting*	polymers that do not melt when they are heated.
	Thermosoftening	polymers that melt when they are heated.

Production and uses of NPK fertilisers

NPK fertilisers	*These contain nitrogen, phosphorous and potassium*	Formulations of various salts containing appropriate percentages of the elements.
Fertiliser examples	*Potassium chloride, potassium sulfate and phosphate rock are obtained by mining*	Phosphate rock needs to be treated with an acid to produce a soluble salt which is then used as a fertiliser. Ammonia can be used to manufacture ammonium salts and nitric acid.

Phosphate rock	
Treatment	*Products*
Nitric acid	*The acid is neutralised with ammonia to produce ammonium phosphate, a NPK fertiliser.*
Sulfuric acid	*Calcium phosphate and calcium sulfate (a single superphosphate).*
Phosphoric acid	*Calcium phosphate (a triple superphosphate).*

The Haber process and the use of NPK fertilisers

The Haber process

Composite materials	*A mixture of materials put together for a specific purpose e.g. strength*	Soda-lime glass, made by heating sand, sodium carbonate and limestone.
		Borosilicate glass, made from sand and boron trioxide, melts at higher temperatures than soda-lime glass.
		MDF wood (woodchips, shavings, sawdust and resin)
		Concrete (cement, sand and gravel)
Ceramic materials	*Made from clay*	Made by shaping wet clay and then heating in a furnace, common examples include pottery and bricks.
Polymers	*Many monomers can make polymers*	These factors affect the properties of the polymer. Low density (LD) polymers and high density (HD) polymers are produced from ethene. These are formed under different conditions.

The Haber process – conditions and equilibrium	
Pressure	*The reactants side of the equation has more molecules of gas. This means that if pressure is increased, equilibrium shifts towards the production of ammonia (Le Chatelier's principle). The pressure needs to be as high as possible.*
Temperature	*The forward reaction is exothermic. Decreasing temperature increases ammonia production at equilibrium. The exothermic reaction that occurs releases energy to surrounding, opposing the temperature decreases. Too low though and collisions would be too infrequent to be financially viable.*

The Haber process	*Used to manufacture ammonia*	***Ammonia is used to produce fertilisers*** Nitrogen + hydrogen $\rightleftharpoons$ ammonia
Raw materials	*Nitrogen from the air while hydrogen from natural gas*	Both of these gases are purified before being passed over an iron catalyst. This is completed under high temperature (about 450°C) and pressure (about 200 atmospheres).
Catalyst	*Iron*	The catalyst speeds up **both** directions of the reaction, therefore not actually increasing the amount of valuable product.

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