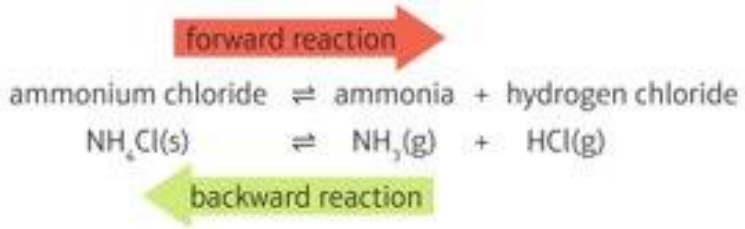
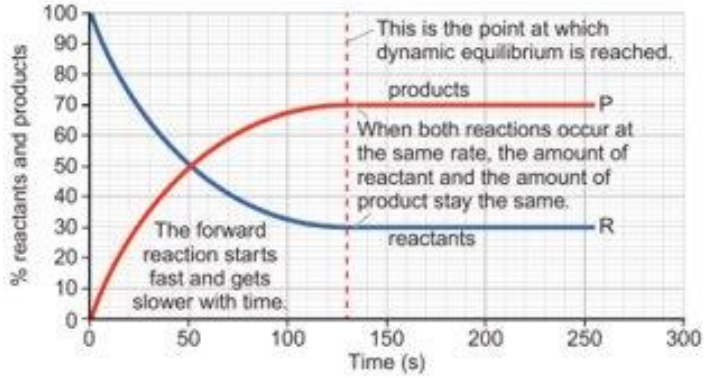
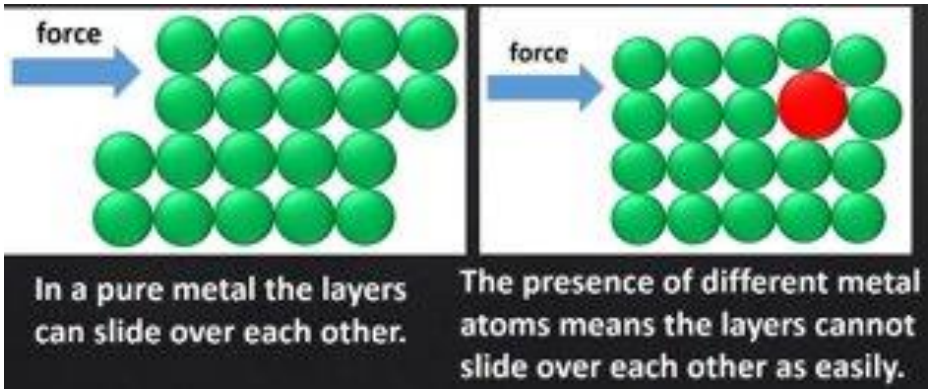
1	Chemical reactions where the **products** react to reform the **reactants** are called a **reversible reactions.** These are represented by two half arrows. The top half arrow represents the forward reaction, the bottom half arrow the backward reaction .
2	When the proportions of products and reactants becomes fixed (even though reactions are still happening) it's called **dynamic equilibrium**. This can only occur in **closed systems** where no reactants or products can be lost.
3	**Ammonia** needed for fertilizer, explosives and stock chemicals is produced by the **Haber process** this involves a a reversible reaction.
4	**Compromise conditions** of **450^{o}C, 200atm** get the most product for reasonable amount of cost and time taken. An iron **catalyst** is used to speed up the reaction.
5	Equilibrium positon can be changed by temperature, pressure and concentration. The **equilibrium position** shifts to **reduce** the effects of any changes: **Increasing temperature** - shifts in the **endothermic direction**, decreasing - exothermic direction **Increase pressure** gas pressure shifts in the direction of fewer gas molecules , decreasing pressure in the direction where there are more gas molecules **Increasing concentration** shifts in that uses up the substance that has been added, decreasing in the direction that forms more of the substance that has been removed.

6	Transition metals are in the central block of the periodic table
7	Transition metals have the physical properties of metals in general; **malleable**, **ductile**, good **conductors** of electricity and **shiny** when polished. They have higher densities and melting points compared to group 1 and 2 and Aluminium.
8	Mercury is an exception it has a high density but is liquid at room temperature.
9	Chemical properties of Transition metals: Form coloured compounds e.g. iron (III) oxide Fe2O3 is red-brown, Tungsten oxide WO is yellow. Often act as catalyst Iron for the Haber process, Iron (III) chloride for making PVC.





1	Most metals react with oxygen in the air, they oxidise to form metal oxides. A metal oxide layer that prevents further oxidation is called a tarnish. Copper and aluminium tarnish.
2	Metals oxidise when they lose electrons this can happen by reacting with oxygen or other substances e.g. silver is oxidised by hydrogen sulphide $2Ag + H_2S \quad Ag_2S + H_2$
3	Corrosion is when a metal continues to oxidise weakening the metal over time. **Corrosion** of **iron** needs **water** and is called **rusting. Rust prevention;** storing in an **unreactive atmosphere, desiccant** (removes water), **painting, coating with plastic, oiling** and **greasing.**
4	**Sacrificial protection** uses a metal that will oxidise more easily than iron or steel it is attached to. E.g. zinc or magnesium blocks bolted onto a ships hull.
5	More reactive metals lose electrons more easily e.g. Zinc will lose electrons before iron.
6	**Electroplating** coats a surface of one metal with a thin layer of another metal. E.g. silver plating for **jewellery**, gold or chromium–plating for **corrosion resistance**.
7	Electroplating happens by **electrolysis**: **anode** is the **plating metal**, **electrolyte** contains **ions** of the **plating metal** and the **cathode** is the **metal object** to be electroplated.
8	**Galvanising** and **tin plating** are forms of sacrificial protection, the more reactive zinc or tin protects steel underneath.
9	Alloys are a mixture of a metal element with another element, changing it's properties. E.g. stainless steel contain chromium which stops corrosion, mild steel has carbon and manganese increasing strength.
10	Use of metal and alloys depends on their properties and where it will be used: gold and copper resist corrosion and very good conductors. Copper is used for most electrical wiring as it costs less. Aluminium is used for overhead electrical cables rather than better conducting copper as it stronger, cheaper and less dense.
11	Magnalium is an alloy containing 95% aluminium and 5% magnesium it used of aircraft parts as it is less dense than aluminium but four times stronger than pure aluminium.



1	A theoretical yield is the maximum yield (amount of product you can make) from a reactant
2	The actual yield is the amount of product obtained when you carry out an experiment. (Its usually much les than the theoretical yield).
3	Percentage yield compares the theoretical land actual yield. Its calculate using the equation: $$\text{percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$
4	Reasons why actual yields re less than theoretical yields are: 1. Reaction may be incomplete and all the reactants may not be used up. 2. Some of the product may be lost 3. There may be other unwanted side reactions taking place
5	The higher the percentage yield of a reaction the more useful a reaction is. Higher yields mean fewer raw materials are needed to make the same amount of product and there is less waste and more profit.
6	Atom economy is a method of showing how efficiently a particular reaction makes use of the atoms in the reactants.
7	The atom economy shows, the percentage by mass, of useful products and is calculated using: atom economy = relative formula mass (Mr) of the useful product x 100 $$\text{atom economy} = \frac{\text{relative formula mass } (M_r) \text{ of the useful product}}{\text{sum of relative formula masses of all the reactants}} \times 100\%$$
8	HT- A reaction pathway describes the sequence of reactions needed to produce a desired product
9	HT- The pathway chosen for a product depends on factors such as: 1. Percentage yield 2. Atom economy 3. rate of reaction 4.Equilibrium position 5. usefulness of by-products
10	The manufacture of ethanol, used as a fuel, provides a useful example for choosing reaction pathways. Ethanol is manufactured in two ways: 1. Fermentation— glucose → ethanol + carbon dioxide $C_6H_{12}O_6(aq) \rightarrow 2C_2H_5OH(aq) + 2CO_2(g$ 2. Reaction of ethene with steam— $$C_2H_4(g) + H_2O(g) \rightarrow C_2H_5OH(l)$$
11	A summary of the key features of the 2 processes used to make ethanol:

Process	Yield	Atom economy	Reaction rate
Fermentation of sugars	15%	51.1%	Low
Hydration of ethene	95%	100%	High

12	The concentration of a solution is the amount of solute dissolved in a stated volume of solution
13	The concentration of a solution can be calculated using the equation: $$\text{concentration in g dm}^{-3} = \frac{\text{mass of solute in g}}{\text{volume of solution in dm}^3}$$
14	The concentration of a solution can also be given in mol dm^{-3}. This described the number of moles of a solute dissolved in $1dm^3$ of solution. It can be calculated using this equation: $$\text{concentration in mol dm}^{-3} = \frac{\text{number of moles of solute}}{\text{volume of solution in dm}^3}$$

15	Acid-alkali titrations are used to find the exact volume of an acid that neutralises a specific volume of an alkali or vice versa
16	The concertation of one of the solutions in a titration can be calculated if the concentration of the other solution is known: $\text{concentration in mol dm}^{-3} = \frac{\text{number of moles of solute}}{\text{volume of solution in dm}^3}$
17	Volumetric flasks are used to make up solutions with an accurate concentration.  A A volumetric flask is used for making an accurate solution.  B Fill the flask so the bottom of the meniscus is on the graduation mark.
18	The mole ratio is the ratio of the moles of the substances in the balanced equation.
19	Avogadro's law states that equal volumes of different gases contain an equal number of molecules. This is when the temperature and pressure stay the same.
20	The molar gas volume is the volume occupied by one mole of molecules of any gas. Its is 24dm³ or 24000cm³ at room temperature and pressure (rtp): $\text{volume of gas} = \text{amount of gas (mol)} \times \text{molar volume}$