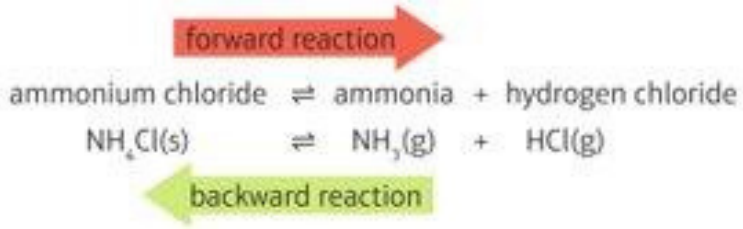
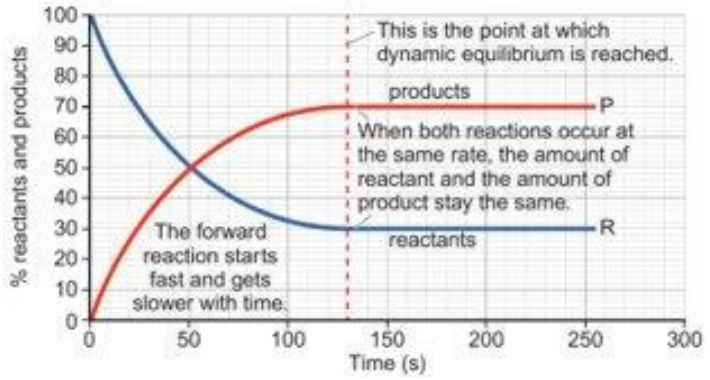
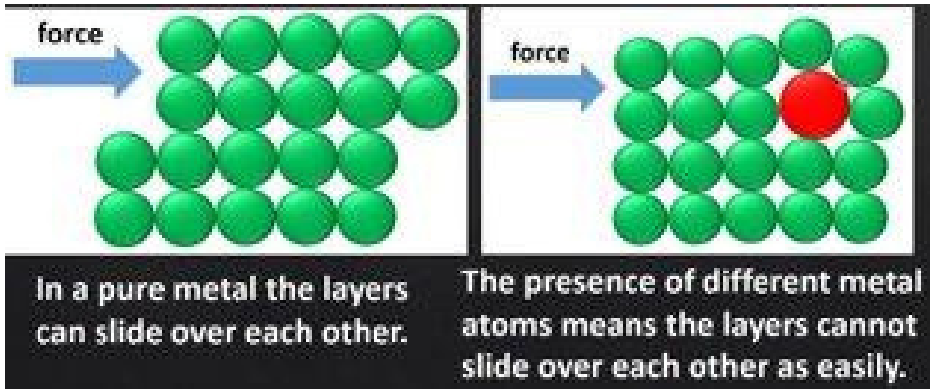
1	Chemicalreactions where the**products**react to reform the**reactants**arecalled a**reversible reactions.**These arerepresented by two half arrows.The top halfarrow represents the forward reaction, the bottom halfarrow the backward reaction .
2	When the proportions of products and reactants becomes fixed (eventhough reactions are still happening)it's called**dynamic equilibrium**. This can only occur in**closed systems**where no reactants or products canbe lost.
3	**Ammonia**needed for fertilizer, explosives and stock chemicals isproduced by the**Haberprocess**this involves aa reversible reaction.
4	**Compromise conditions**of**450oC, 200atm**get themost product forreasonable amount of cost and time taken.An iron**catalyst**is used tospeed up the reaction.
5	Equilibrium positoncan be changed by temperature, pressure andconcentration.The**equilibrium position**shifts to**reduce**the effects ofany changes: **Increasing temperature**-shifts in the**endothermic direction**, decreasing-exothermic direction **Increase pressure**gas pressure shifts in the direction of fewer gasmolecules , decreasing pressure in the direction where there aremoregas molecules **Increasing concentration**shifts inthat uses up the substance that hasbeen added, decreasing in the direction that forms moreof thesubstance 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**whenpolished.They have higher densities and melting points compared togroup 1 and 2 and Aluminium.
8	Mercury is an exception it has a high density but is liquid at roomtemperature.
9	Chemical properties of Transition metals:Form coloured compoundse.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 formaking PVC.





1	Most metals react with oxygen in the air, they oxidise to form metaloxides.A metal oxide layer that prevents further oxidation is called atarnish. Copper and aluminium tarnish.
2	Metals oxidise when they lose electrons this can happen byreacting withoxygen or other substances e.g. silver is oxidised by hydrogen sulphide2Ag + H2S Ag2S + H2
3	Corrosion is when a metal continues to oxidise weakening the metal overtime.**Corrosion**of**iron**needs**water**and is called**rusting.Rustprevention;**storing in an**unreactive atmosphere, desiccant**(removeswater),**painting, coating with plastic, oiling**and**greasing.**
4	**Sacrificial protection**uses a metal that will oxidise more easily than ironor steel it is attached to.E.g. zinc or magnesium blocks bolted onto aships hull.
5	More reactive metals lose electrons more easily e.g. Zinc will loseelectrons before iron.
6	**Electroplating**coats a surface of one metal with a thin layer of anothermetal.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 morereactive zinc or tin protects steel underneath.
9	Alloys are a mixture of a metal element with another element, changingit's properties. E.g. stainless steel contain chromium which stopscorrosion, mild steel has carbon and manganese increasing strength.
10	Use of metal and alloys depends on their properties and where it willbe used:gold and copper resist corrosion and very good conductors.Copper is used for most electrical wiring as it costs less. Aluminium isused for overhead electrical cables rather than better conductingcopper as it stronger, cheaper and less dense.
11	Magnaliumis an alloy containing 95% aluminium and 5% magnesiumit used of aircraft parts as it is less dense than aluminium but fourtimes 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	Reasonswhyactualyieldsrelessthantheoreticalyieldsare: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:
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: $$\text{concentration in mol dm}^{-3} = \frac{\text{number of moles of solute}}{\text{volume of solution in dm}^3}$$

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

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	Theconcertationofoneofthesolutionsinatitrationcanbecalculated 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): $\text{volume of gas} = \text{amount of gas (mol)} \times \text{molar volume}$