Definitions and Concepts for OCR (A) Chemistry GCSE

Topic 6 - Global Challenges

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*Definitions in **bold** are for higher tier only*

Definitions marked by '' are for separate sciences only*

Definitions have been taken, or modified from the OCR (A) Specification for GCSE Chemistry, J248, Version 3.3 May 2020

Acid rain: Rain that is acidic due to gases, such as sulfur dioxide, reacting with water vapour in the clouds. Sulfur dioxide is produced from the burning of fossil fuels which contain sulfur impurities.

***Addition polymerisation:** The reaction in which many small molecule monomers bond together to form a long chain polymer.

***Alcohols:** Organic compounds containing the functional group –OH. The first four members of a homologous series of alcohols are methanol, ethanol, propanol and butanol. Alcohols can be oxidised to carboxylic acids.

***Alloys:** A metal compound made by combining two or more metals together. This process is carried out to give the material greater strength or resistance to corrosion.

***Alkanes:** The most common hydrocarbon found in crude oil. Alkanes have the general formula C_nH_{2n+2}. The first four alkanes are methane, ethane, propane and butane.

***Alkenes:** Hydrocarbons with a double bond between two of the carbon atoms in their chain, causing them to be unsaturated. Alkenes have the general formula C_nH_{2n}. The first four alkenes are ethene, propene, butene and pentene.

Bacterial extraction: **A method of metal extraction which uses bacteria to extract metals from their ores. The bacteria breaks down low-grade ores to produce an acidic solution containing metal ions.**

***Carboxylic acids:** Organic compounds with the functional group –COOH. The first four members of a homologous series of carboxylic acids are methanoic acid, ethanoic acid, propanoic acid and butanoic acid. Carboxylic acids have typical acidic properties.

Catalytic cracking: Long-chain hydrocarbons are heated to turn them into a gas. The vapour is then passed over a hot powdered aluminium oxide catalyst. The long chain molecules split apart on the surface of the catalyst.

***Chemical cell:** A cell which converts chemical energy to electrical energy. They are made up of two metal electrodes connected by an electrolyte. The cell produces a voltage until one of the reactants is used up.

Chlorination: A process used in water treatment where chlorine gas is injected into the water to kill any microbes.

Climate change: A change in global climate patterns largely believed to be caused by the increase in concentration of carbon dioxide in the atmosphere.

***Combustion:** The burning of a substance in oxygen. Energy is transferred to the surroundings as heat and light.

***Complete combustion:** Combustion carried out in sufficient oxygen. Water and carbon dioxide are the only products of the complete combustion of a hydrocarbon.

***Condensation polymerisation:** **Reactions in which monomers join together and lose small molecules, such as water. These reactions involve monomers with two functional groups.**

***Contact process:** **The process used to make sulfuric acid from sulfur and water. The sulfur is burned in oxygen to produce sulfur dioxide. The sulfur dioxide then reacts with oxygen, in a reversible reaction, to produce sulfur trioxide. Water is reacted with the sulfur trioxide to finally produce sulfuric acid. The process requires vanadium(V) oxide as a catalyst and is carried out at 450°C temperature and 2 atm pressure.**

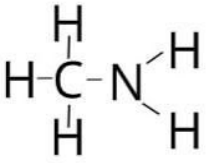
***Corrosion:** The destruction of materials by chemical reactions with substances in the environment. For example, iron rusts when in the presence of oxygen and water.

Cracking: A process that involves breaking down larger hydrocarbons to produce smaller more useful molecules. Cracking can be done by catalytic cracking or steam cracking.

Crude oil: A finite resource found in rocks. It is the remains of an ancient biomass consisting mainly of plankton that was buried in mud. Most of the compounds in crude oil are hydrocarbons.

Desalination: The process used to remove salts from seawater. This must be carried out when making sea water potable.

Displayed formula: A type of formula that shows all the bonds between every atom in the compound. E.g.



***DNA:** Molecule which encodes genetic instructions for the development and functioning of living organisms and viruses. Most DNA molecules are two polymer chains, made from four different nucleotides, in the form of a double helix.

Electrolysis: The splitting up of an ionic compound using electricity. The electric current is passed through a substance causing chemical reactions at the electrodes which lead to the decomposition of the materials. Electrolysis is used for metal extraction when the metal is more reactive than carbon.

Ferrous metal: A metal containing iron in its composition.

***Fertiliser:** A chemical added to soil to increase the fertility, allowing crops to grow more effectively. They generally contain compounds of nitrogen, potassium and phosphorus.

Filtration: A separation technique used to separate an insoluble solid from a solution. Used in the process of making water potable.

Finite resource: A resource which will one day run out.

Fossil fuel: Natural fuels, such as coal and gas, formed in the past from the remains of living organisms.

Fractional distillation: A process used to separate a mixture of liquids. The liquids have different boiling points so can be separated into different fractions within a fractionating column.

***Fuel cell:** An electrochemical cell which continuously produces a voltage when supplied with a fuel and oxygen. The fuel donates electrons at one electrode and oxygen gains electrons at the other electrode.

***Functional group:** The group of atoms responsible for how a particular compound reacts. All compounds in the same homologous series have the same functional group.

Greenhouse effect: The increase in the temperature of the Earth's atmosphere due to the greenhouse gases in the atmosphere trapping infra-red radiation from the surface.

Greenhouse gases: Gases in the atmosphere which maintain temperatures on Earth high enough to support life. Greenhouse gases include water vapour, carbon dioxide and methane.

Ground water: Water which collects in rocks that then trap the water underground.

***Haber process:** **An industrial process which produces ammonia from the reaction between nitrogen and hydrogen. The reaction conditions are 450°C, 200 atm and an iron catalyst.**

***Homologous series:** A series of compounds with the same functional group and similar chemical properties.

Hydrocarbons: Molecules that are made up of hydrogen and carbon atoms only.

***Hydrogen-oxygen fuel cell:** A fuel cell in which hydrogen and oxygen are the reactants used to produce a voltage. Water is the only product. The overall reaction for the hydrogen-oxygen fuel cell is: $2H_2 + O_2 \rightarrow 2H_2O$

***Incomplete combustion:** Combustion which is carried out with insufficient oxygen. It can lead to the production of toxic carbon monoxide and carbon particulates.

Life-cycle assessment: The analysis of the impact a product has on the environment. It considers the raw materials, manufacturing, packaging, transportation, product use and disposal.

***Monomer:** Small short chain molecules which can join together to form a long chain polymer.

***Nucleotides:** The monomers which make up DNA.

Ore: A type of rock which contains metal compounds. The metals or metal compounds are present in sufficient amounts to make it worth extracting them.

Particulates: Particles which cause global dimming and health problems for humans. Carbon particulates (soot) are a product of incomplete combustion.

Phytoextraction: **A method of metal extraction which uses plants to absorb the metal compounds through their roots. The plants are then burned so that the metal compound can be removed from the ash.**

***Polyamide:** **A category of polymers which contain the amide functional group in their main chain. Formed by a condensation reaction usually between a diamine and a dicarboxylic acid.**

***Polyester:** **A category of polymers which contain the ester functional group in their main chain. Formed by a condensation reaction usually between a diol and a dicarboxylic acid.**

***Polymer:** Large long-chain molecule made up of lots of small monomers joined together by covalent bonds.

Potable water: Water that is safe for humans to drink.

Reactivity series: A series in which metals are arranged in order of their reactivity. This can be used to predict products from reactions.

Reduction with carbon: A process used to extract metals from their oxides when the metal is less reactive than carbon. The metal oxide is heated with carbon so that carbon reduces the metal oxide to the metallic element.

***Repeating unit:** The part of a polymer whose repetition would produce the complete polymer chain.

***Sacrificial protection:** The protection of iron or steel against corrosion by using a more reactive metal. Zinc is often used as a sacrificial metal. Sacrificial protection creates a physical barrier to oxygen and water, preventing corrosion of the metal.

Sedimentation: A process used in water treatment to remove solids from the water. Suspended solids will fall to the bottom of the container and form a sediment, allowing them to be easily removed.

Steam cracking: Long-chain hydrocarbons are heated to turn them into a gas. The hydrocarbon vapour is then mixed with steam and heated to a very high temperature which caused them to split into smaller molecules.

***Structural formula:** A formula which shows the arrangement of atoms in the molecule of a compound but does not show all the bonds between them. For example, $CH_3CH_2COCH_3$.

Waste water: Water from industrial, domestic, agricultural and commercial activity. It requires treatment before it is potable.