Definitions and Concepts for Edexcel Chemistry A-level

Topic 18: Organic Chemistry 3

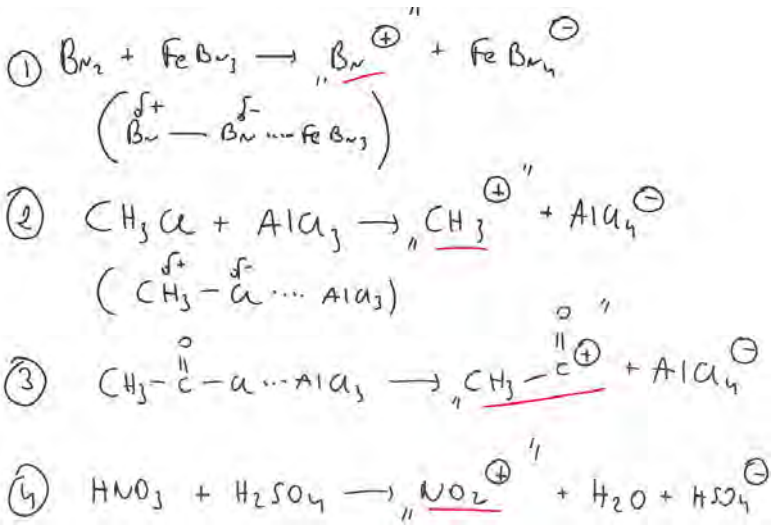
Aromatic: Refers to a hydrocarbon ring having delocalised electrons in a π-framework. Aromatic hydrocarbons are called *arenes*.

Kekule model: Benzene is made up of planar ring of six carbon atoms with alternating single and double bonds between them.

Delocalised model: Two ring shaped electron clouds above and below the plane of six carbon atoms due to the presence of extended π-framework arising from the overlap of six *p* orbitals.

Delocalisation energy: Extra stability gained from the delocalised π-system in benzene.

Halogen carrier: A Catalyst (a Lewis Acid) which helps to introduce the halogen to the aromatic ring by rendering the formation of the electrophile, e.g. $FeBr_3$ polarises the Br-Br bond making one bromine slightly positive and the other slightly negative. This helps the benzene ring attack the bromine.



Amines: Derivatives of ammonia, NH_3. In amines, consecutive hydrogens are replaced by a carbon group; for instance, CH_3NH_2 is methylamine, a primary amine. Secondary amines have a general formula R_2NH, and tertiary amines R_3N, where R = the carbon group. R_4N+ is called a quaternary ammonium salt.

Basicity: Refers to the extent to which a basic molecule/ion can donate its electron pair to a proton/hydrogen of a water molecule. Structure of a base can dictate basicity, e.g. in ammonia, the lone pair is localised on nitrogen atom. In aniline ($C_6H_5NH_2$), the lone pair on nitrogen atom can be delocalised to the benzene ring - this reduces its ability to accept a proton and hence aniline is a weaker base than ammonia.

Amino acids: Organic compounds containing a carboxylic acid group (COOH) and an amine group ($-NH_2$).

Zwitterion: A molecule that contains a positively charged site and a negative charged site, the overall charge being zero.

Amphoteric: Displaying both basic and acidic properties; amino acids can react with acids, as they contain a basic site, the amino group, but also can react with bases, as they contain the acidic site, the carboxylic acid group.

Isoelectric point: pH at which an amino acid exists as a zwitterion.

Amide: A derivative of a carboxylic acid, whereby the -OH group is replaced by a nitrogen-based group. Can be prepared *via* the reaction of an appropriate acyl chloride with ammonia/requisite amine (nucleophilic addition-elimination mechanism).

Peptide link/bond: Covalent chemical bond linking two consecutive amino acid monomers. Essentially, an *amide* bond found in peptides.

Grignard reagent: Organometallic reagent of general formula RMgX, where R = carbon part of the molecule, X = halogen. Used for increasing the length of the carbon chain in a molecule. Reacts *via* a nucleophilic addition mechanism. Forms alcohols with aldehydes/ketones and carboxylic acids when subjected to CO_2. Grignards require dry conditions (dry ether as a solvent), as they react with H_2O (they deprotonate water), e.g.

$$C_2H_5Br + Mg \rightarrow C_2H_5MgBr \text{ (reaction in dry ether; formation of a Grignard reagent)}$$

$$C_2H_5MgBr + CH_3CHO \rightarrow CH_3CH(OMgBr)C_2H_5 \text{ (nucleophilic addition)} \rightarrow CH_3CH(OH)C_2H_5 \text{ (acidic hydrolysis)}$$

$$C_2H_5MgBr + CO_2 \rightarrow C_2H_5COOMgBr \text{ (nucleophilic addition)} \rightarrow C_2H_5COOH \text{ (acidic hydrolysis).}$$

Hazard: A property of a chemical that could cause damage to the user.

Risk: A possible effect a chemical may have on a user. This is dependent on factors such as concentration of the chemical. *Control measures* are used to restrict the risk.

Reflux: A method for heating a reaction mixture at temperatures above the boiling point of the solvent used in the reaction. It employs a condenser attached to the RB flask. Cold water flows through the glass tubing of the condenser, hence cooling down the solvent vapour. The condensed vapour returns to the flask where it boils again and so on.

Anti-bumping granules: Added to a heated flask to prevent vigorous & uneven boiling.

Miscible: Refers to the substances that can mix together, i.e. ethanol and water, but not oil and water.

Recrystallisation: A purification method that utilises the difference in solubilities of the desired compound and its impurities. An impure compound is dissolved in a minimum amount of the boiling hot solvent. The mixture is then cooled down (e.g. using an ice bath). The assumptions are that (1) the compound dissolves well at high temperatures, but has a poor solubility at low temperatures, hence will crystallise upon cooling and (2) impurities dissolve well at all temperatures. Hence requires a careful selection of the solvent.