

## Organic Reactions in CH1020

Below is a list of the general reactions that you must know. You should look up each of these reactions and translate each into a general chemical equation with appropriate catalyst (if needed) and write several examples.

### Reactions of Alkanes

1. Combustion: alkane + oxygen  $\rightarrow$  carbon dioxide + water + energy
2. Halogenation: alkane + halogen  $\rightarrow$  alkyl halide + hydrogen halide

### Reactions of Alkenes

1. Addition of hydrogen  $\rightarrow$  alkane
2. Addition of halogen  $\rightarrow$  dihaloalkane
3. Addition of hydrogen halide  $\rightarrow$  alkyl halide
4. Addition of water  $\rightarrow$  alcohol
5. Polymerization of alkenes

### Reactions of Alkynes

1. Hydrogenation (1 or 2 moles)  $\rightarrow$  alkene or alkane
2. Halogenation (1 or 2 moles)  $\rightarrow$  dihalo alkene or tetrahaloalkane
3. Addition of hydrogen halide (1 or 2 moles)  $\rightarrow$  alkenylhalide or dihaloalkane.

### Reactions of Benzene

1. Halogenation  $\rightarrow$  halobenzene
2. Nitration  $\rightarrow$  nitrobenzene
3. Sulfonation  $\rightarrow$  benzenesulfonic acid
4. Alkylation  $\rightarrow$  alkylbenzene

### Reactions of Alcohols

1. Dehydration  $\rightarrow$  alkene
2. Dehydration  $\rightarrow$  ether
3. Oxidation  $\rightarrow$  aldehyde
4. Oxidation  $\rightarrow$  ketone
5. Oxidation  $\rightarrow$  carboxylic acid

### Reactions of Aldehydes and Ketones

1. Oxidation of aldehyde  $\rightarrow$  carboxylic acid
2. Reductions of aldehydes and ketones  $\rightarrow$  alcohol
3. Hemiacetal and acetal formation

### Reactions of carboxylic acids

1. Ionization of carboxylic acids
2. Carboxylic acid + alcohol  $\rightarrow$  ester
3. Hydrolysis of esters  $\rightarrow$  carboxylic acid salt and alcohol
4. Formation of esters from alcohol and acid chloride
5. Formation of esters from alcohol and acid anhydride
6. Carboxylic acid + amine  $\rightarrow$  amide
7. Formation of esters from amine and acid chloride
8. Formation of esters from amine and acid anhydride
9. Hydrolysis of esters  $\rightarrow$  carboxylic acid and amine

## Reactions of Amines and Amides

1. Basicity of amines
2. Synthesis of amides from carboxylic acids and amines
3. Synthesis of amides from acid chlorides and amines
4. Hydrolysis of amides --> carboxylic acid and amine

## Reactions of Carbohydrates

1. Hemiacetal formation
2. Reaction with alcohols --> glycosides
3. Hydrolysis of di and polysaccharides --> monosaccharides

## Reactions of Lipids

1. Acid catalysed hydrolysis --> fatty acids and glycerol
2. Base catalysed hydrolysis --> fatty acid salts and glycerol

## Other things you must know for the final exam

1. **Nomenclature** of alkanes, alkenes, alkynes, alcohols, thiols, aldehydes, ketones, aromatic compounds, carboxylic acids, acid chlorides, amides, and amines.

2. **Stereochemistry:** Recognize and draw enantiomers, naming enantiomers using R and S, understand and draw diastereomers, understand chiral cyclic compounds (You should be able to do both 3 dimensional drawings and Fischer projections).

3. **Carbohydrates:** Classification and nomenclature of carbohydrates, draw cyclic hemiacetal structures from Fischer projections, structure of monosaccharides, disaccharides, polysaccharides, difference between  $\alpha$  and  $\beta$  forms and linkages.

4. **Lipids:** Difference between hydrolyzable and nonhydrolyzable lipids, Draw a fat and a wax, identify tetrahedral stereocenters, recognize a steroid, draw a phospholipid, understand action of soaps, understand lipid bilayers.

5. **Proteins:** Draw amino acids and their zwitterionic forms, draw and name peptides, understand factors that give proteins 3 dimensional structure, understand basic biological functions of proteins.

6. **Nucleic acids:** Draw and name nucleosides and nucleotides, draw and name polynucleotides, have a basic understanding of the structure of DNA and RNA, understand base pairing in nucleic acids, have a basic understanding of: DNA replication, the synthesis of m-RNA by transcription, protein synthesis by translation.