REVISION
A. REACTION SEQUENCES  Aliphatic chemistry

(a) CHAIN LENGTHENING

\[ \text{ROH} \rightarrow \text{RCH}_2\text{OH} \]

1. Conc. HCl, heat
2. Mg, dry diethyl ether

\[ \text{RCl} \rightarrow \text{RMgCl} \]

1. Conc. HBr, heat
2. Mg, dry diethyl ether

\[ \text{RBr} \rightarrow \text{RMgBr} \]
(b) REMOVAL OF FUNCTIONAL GROUPS

\[ R-CH_2-CH_2-OH \xrightarrow{\text{hot conc. } H_2SO_4, \text{H}_2, \text{Pd}} R-CH=CH_2 \]

\[ R-CH_2-CH_2-I \xrightarrow{\text{Mg, dry diethyl ether}} R-CH_2-CH_2-MgI \]

(c) CHAIN BRANCHING (ALKENES)

\[ \text{OH} \xrightarrow{\text{Cr}_2\text{O}_7^{2-}, H^+} \text{K} \xrightarrow{1. \text{CH}_3-\text{MgBr}, 2. H^+, H_2O} \text{HOCH}_3 \]
(d) ISOMERISATION OF ALCOHOLS

\[ R\text{--CH}_{2}\text{--CH}_{2}\text{ OH} \xrightarrow{\text{hot conc. H}_2\text{SO}_4} \text{--CH=CH}_2 \]

\[ R\text{--CH}---\text{CH}_3 \xrightarrow{\text{dil. H}_2\text{SO}_4 \text{ heat}} \text{(Markovnikov's Rule)} \]

(e) INTERCONVERSION OF CARBOXYLIC ACID DERIVATIVES

\[ R\text{--C--NH}_2 \xrightarrow{\text{conc. H}^+ \text{ CH}_3\text{CH}_2\text{OH, heat}} \text{--C--OCH}_2\text{CH}_3 \]

\[ \text{--C--OH} \xrightarrow{\text{conc. H}^+ \text{ H}_2\text{O, heat}} \text{--C--Cl} \]

\[ \text{--C--Cl} \xrightarrow{\text{SOCl}_2} \text{--C--OCH}_2\text{CH}_3 \]
(f) CARBOXYLIC ACID DERIVATIVES AND ACID-BASE REACTIONS

\[
\text{OH} \quad \text{H}_3\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \quad \text{CH}_3 \\
\text{H}_3\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \\
\text{H}_3\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \\
\text{OH} \quad \text{H}_3\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \quad \text{CH}_3
\]

\[
\text{H}_2\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \\
\text{H}_2\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \\
\text{H}_2\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \\
\text{OH} \quad \text{H}_3\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \quad \text{CH}_3
\]

\[
\text{cold} \quad \text{dil. HCl} \\
\text{hot conc. HCl (eg. 5M)} \\
\text{hot conc. NaOH (eg. 6M)} \\
\text{dil. NaOH}
\]

\[
\text{H}_3\text{N} \quad \text{CH}_3 \\
\text{H}_3\text{N} \quad \text{CH}_3 \\
\text{H}_3\text{N} \quad \text{CH}_3 \\
\text{H}_2\text{N} \quad \text{CH}_3
\]

\[
\text{OH} \quad \text{H}_3\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \quad \text{CH}_3 \\
\text{H}_3\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \\
\text{H}_3\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \\
\text{OH} \quad \text{H}_3\text{N} \quad \text{C} \quad \text{H} \quad \text{N} \quad \text{O} \quad \text{CH}_3
\]

\[
\text{+} \quad \text{H}_3\text{N} \quad \text{CH}_3 \quad \text{Cl} \text{^-} \\
\text{+} \quad \text{H}_2\text{N} \quad \text{CH}_3
\]
Stereochemistry Revision Question

Compound (A) contains a stereogenic centre. Mark this clearly with an asterisk.

What is the stereochemistry at this stereocentre? Write (R) or (S).

Treatment of compound (A) with LiAlH₄ gives alcohols (X) and (Y), which are diastereomers. Draw the structures of (X) and (Y).

Carboxylic Acid Derivatives Revision Question

Question: Fill in the missing reagents
Carboxylic Acid Derivatives Revision

Question: Add partial charges (δ⁺, δ⁻) and curly arrows to the following reaction mechanism to explain the formation and breaking of bonds when ammonia (NH₃) reacts with acetyl chloride (CH₃COCl) to form acetamide (CH₃CONH₂). Add the terms nucleophile and electrophile to the reagents to describe their role in the reaction.

Revision Question

Fill in the missing reagents:

1. Mg, dry diethyl ether
2. O
3. H⁺, H₂O
Spectroscopy Summary

Spectroscopy (How to work out the structure of an organic compound)

- Know what conjugation is, recognise a conjugated structure and know that it will absorb light in the UV-visible region (and that a structure without conjugation will not absorb UV-visible light.

- Know that bonds bend and stretch by absorbing light in the IR region, and that different bonds (i.e., different functional groups) absorb at specific frequencies in the IR region. These are the ones which you need to know: (a) ~3300 cm\(^{-1}\) is either an O-H or an N-H bond; (b) ~3000 cm\(^{-1}\) is a C-H bond, (c) ~2200 cm\(^{-1}\) C= C or C≡N triple bond, (d) 1700 cm\(^{-1}\) is a C=O bond, (e) ~1600 cm\(^{-1}\) is a C=C bond.

- Know what a 'molecular ion' and a 'fragment ion' are, know that the atomic masses of C = 12, H = 1, O = 16 and N = 14.

- Know that halogen atoms (Cl and Br) have a high natural abundance of two isotopes (rather than one isotope, as in the case of C, H, O and N). Recognise that the upshot of this is that two molecular ions are seen in the mass spectra of organic halogen compounds.

- Be able to recognise different number of H environments in an organic molecule and know that each type will give a separate signal in its \(^1\)H NMR spectrum.

- Know that the area under each signal in an NMR spectrum is related to the number of H's which give rise to it.

- Understand the (n + 1) rule relating to the number of lines (multiplicity) contained in each signal in an NMR spectrum and be able to apply it.

NOTE: You don’t need to know any "chemical shifts" (types of H environments)!

Example questions on spectroscopy are in assignment 9.

Will compound (B) have a fragment ion at m/z = 43 in the mass spectrum?

\[ \text{H}_3\text{C} - \text{C} - \text{H} - \text{CH}_3 \quad \text{(B)} \quad \text{YES} \quad \text{H}_3\text{C} - \text{C} - \text{H}^\oplus - \text{CH}_3 \]