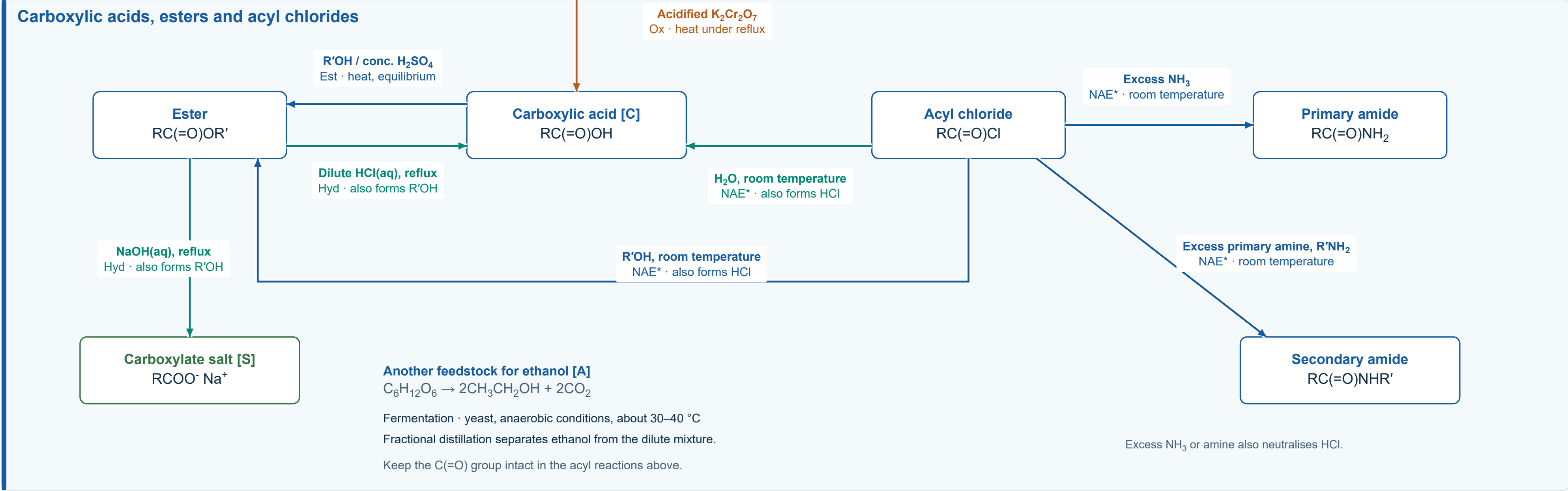
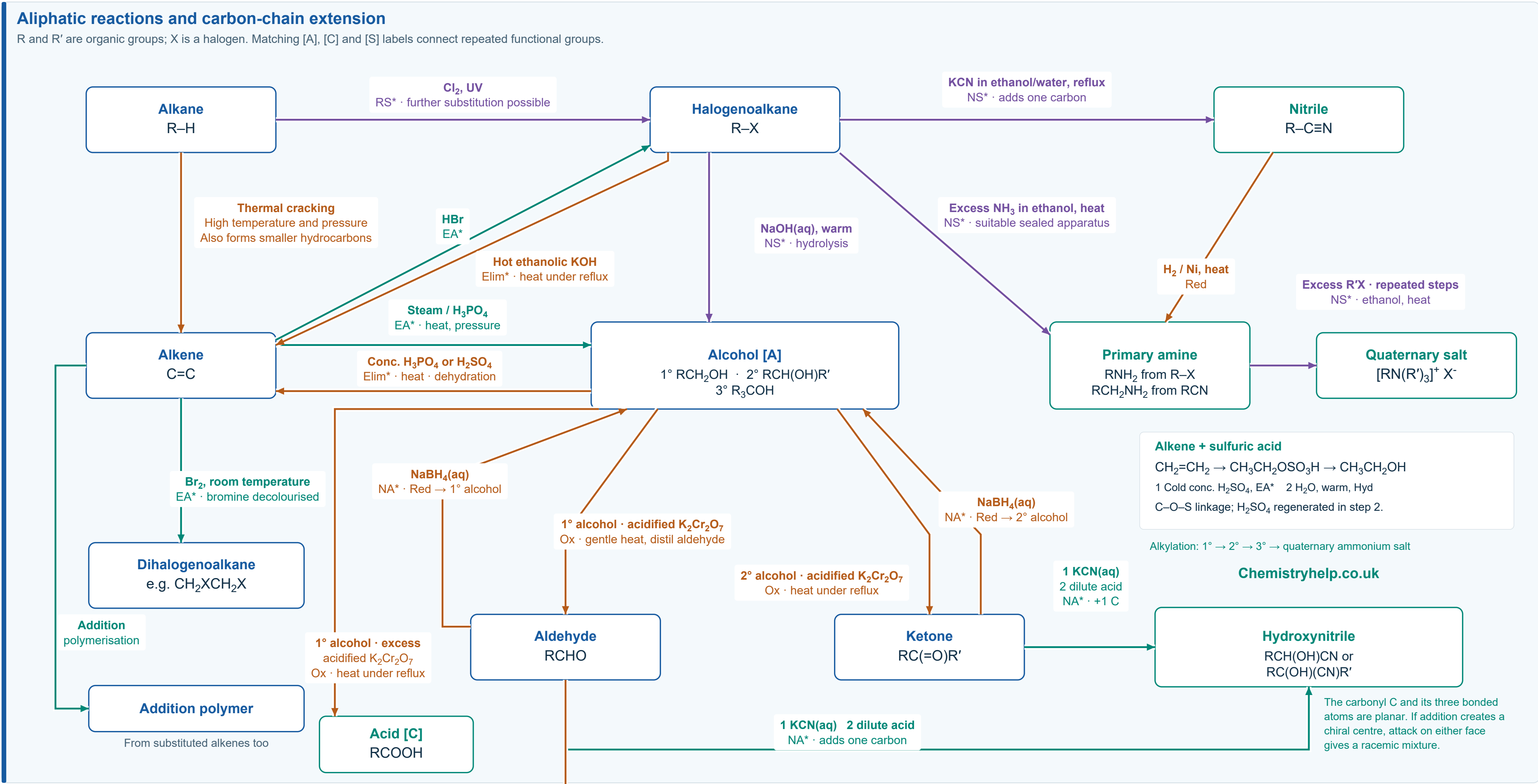


Follow each arrow and check the reagents, conditions and carbon skeleton. Use E/Z names for alkene stereoisomers.

RS Radical substitution EA Electrophilic addition NS Nucleophilic substitution NA Nucleophilic addition ES Electrophilic substitution

NAE Nucleophilic addition–elimination Ox Oxidation Red Reduction Hyd Hydrolysis Est Esterification Elim Elimination

* Practise the named AQA mechanism. RS uses balanced radical equations; the other starred routes use curly arrows. Unfamiliar applications can also be assessed.



Keep track of the carbon skeleton

Cyanide substitution or addition adds one carbon. RCN reduction gives RCH₂NH₂. Thermal cracking: e.g. C₁₀H₂₂ → C₈H₁₈ + C₂H₄. Catalytic cracking uses a zeolite, high temperature and slight pressure. Excess NH₃ favours a primary amine; excess halogenoalkane promotes further alkylation.

Salts and amino-acid ions

RCOOH + NaOH → RCOO⁻ Na⁺ + H₂O [S]. RNH₂ + HCl → RNH₃⁺ Cl⁻. Amino acid in acid: H₃N⁺CH(R)COOH; zwitterion: H₃N⁺CH(R)COO⁻; in alkali: H₂NCH(R)COO⁻. Here R is the side chain (H in glycine). Peptide hydrolysis breaks amide links; apply the correct charges.

Polymers, fats and oils

Diol + dicarboxylic acid → polyester; diamine + dicarboxylic acid, or amino acids → polyamide. Ester/amide links hydrolyse. Fat + NaOH(aq), heat → soap + glycerol. Fat + methanol / NaOH catalyst, warm → methyl esters (biodiesel) + glycerol.

Choose conditions for the intended reaction

Aqueous OH⁻ favours substitution; hot ethanolic OH⁻ favours elimination. They can compete. Unsymmetrical alkene + HBr: consider carbocation stability. 3° alcohols resist dichromate oxidation. NaBH₄ reduces carbonyls, not ordinary acids or nitriles.

