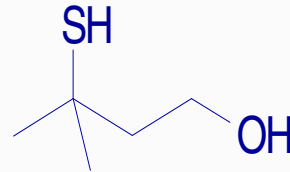




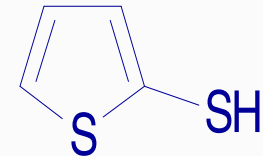
Sulphur Chemistry 2012

Sulphur Chemistry – Products

Aliphatic & Aromatic:



3-Mercapto-3-methyl-1-butanol



Thiophene-2-thiol

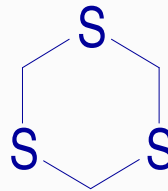
- Thiols

- Sulphides

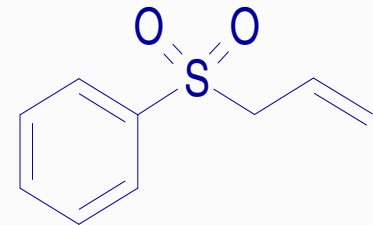
- Disulphides

- Sulphoxides

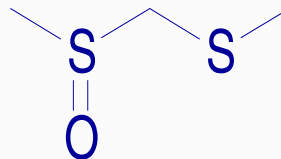
- Sulphones



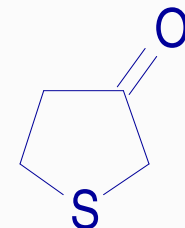
1,3,5-Trithiane



Allyl phenyl sulphone



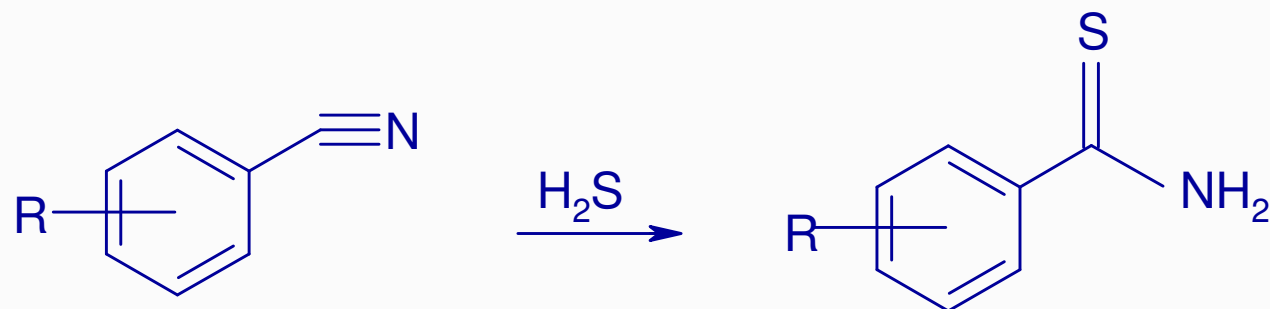
Methyl (methylsulphinyl)methyl sulphide



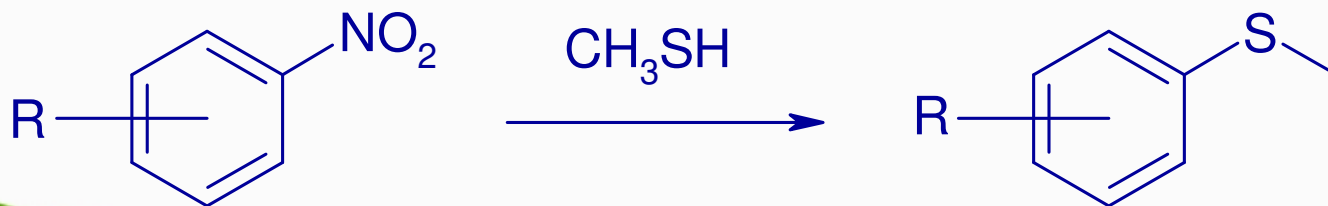
Tetrahydrothiophen-3-one

Sulphur Chemistry - Examples

Hydrogen Sulphide – Formation of Thioamides, Mercaptans, Trithianes and Dithiazines

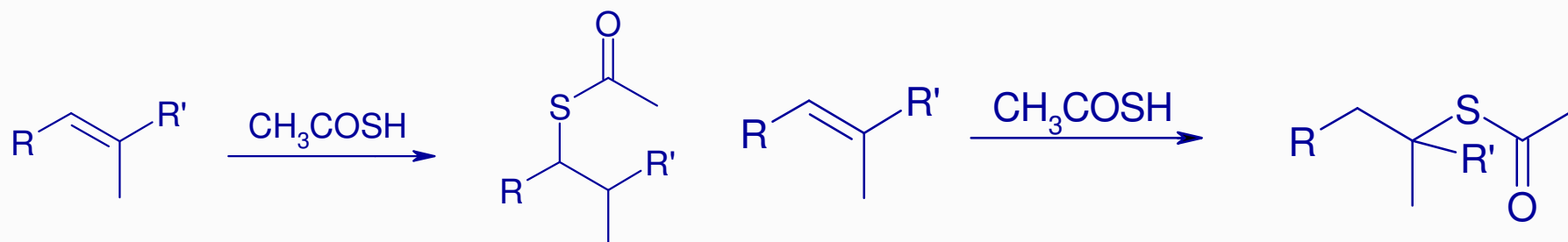


Methyl Mercaptan - Addition of (methylthio) group to alkenes, alkyl/aryl halides and aromatic nitro compounds

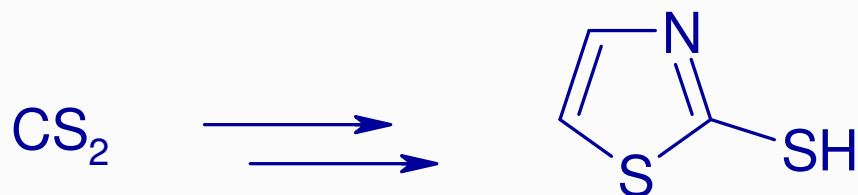


Sulphur Chemistry - Examples

Thioacetic acid - Addition of a Thioacetate group to alkenes



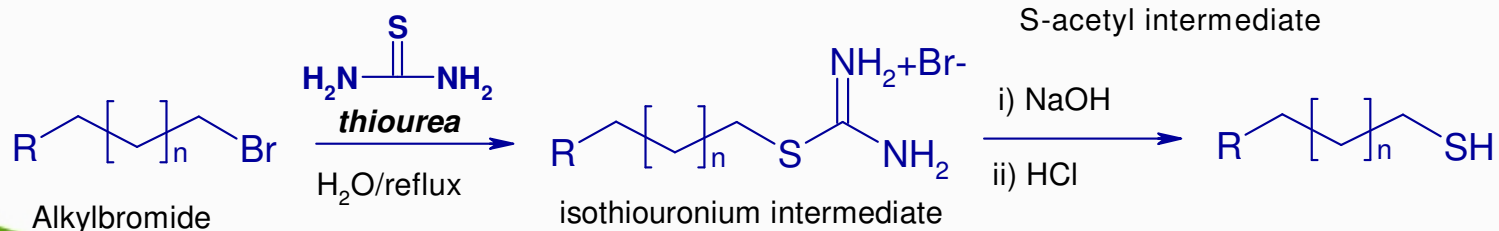
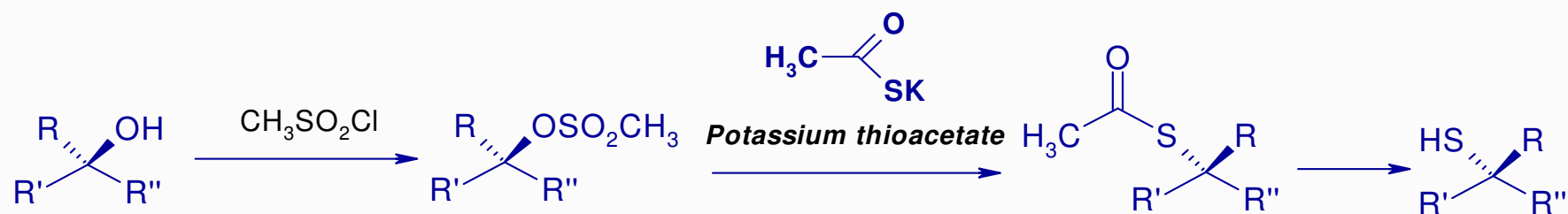
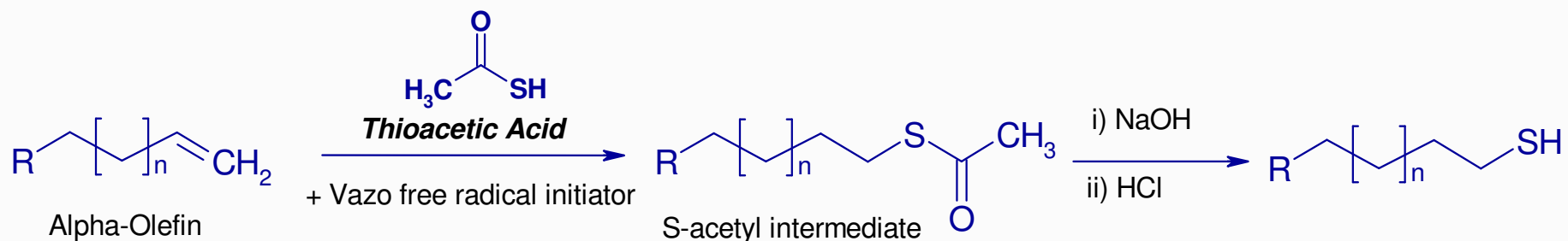
Carbon disulphide - Heterocycle formation



Thiolation Chemistry

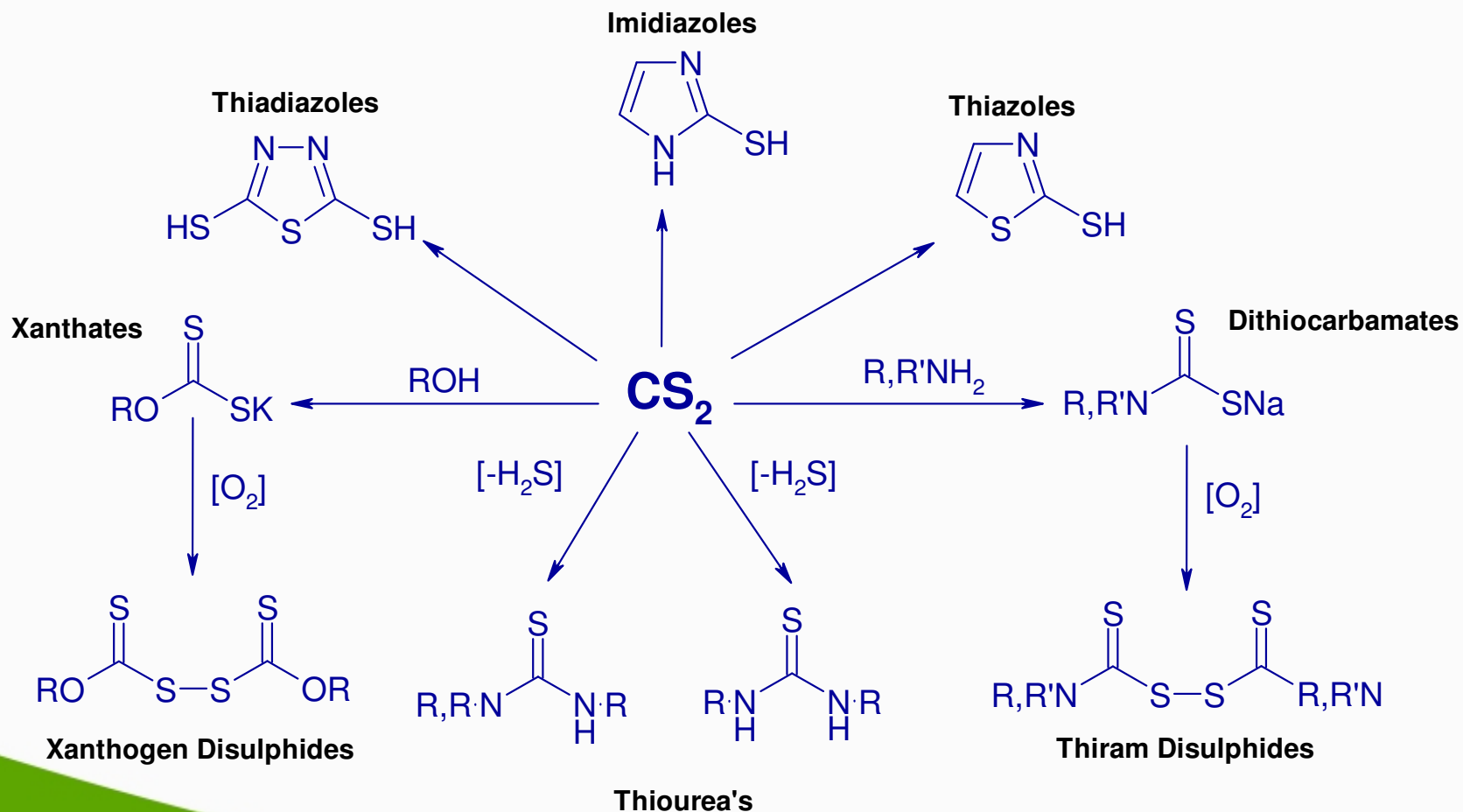
Variety of thiolating agents are used to introduce Sulphur moieties:

e.g S_2Cl_2 , P_2S_5 , H_2S , and particularly Thioacetic acid, Potassium thioacetate, Thiourea: -



Carbon Disulphide Chemistry

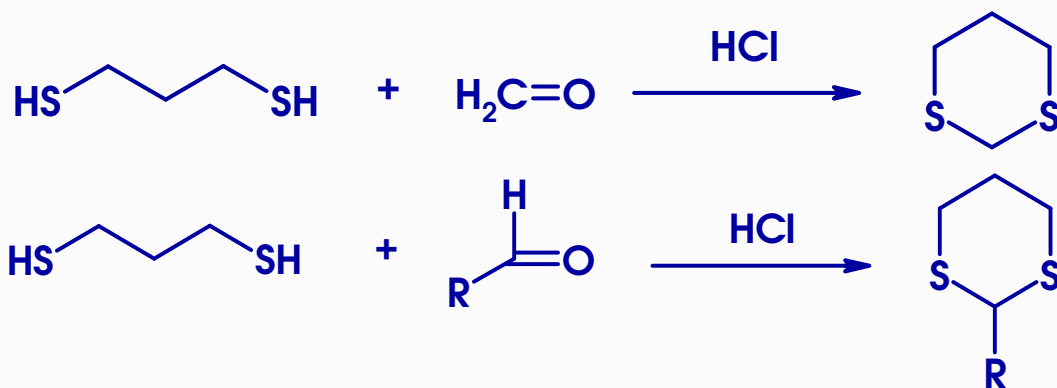
Thiocarbonylation from Kgs to large Tonnes



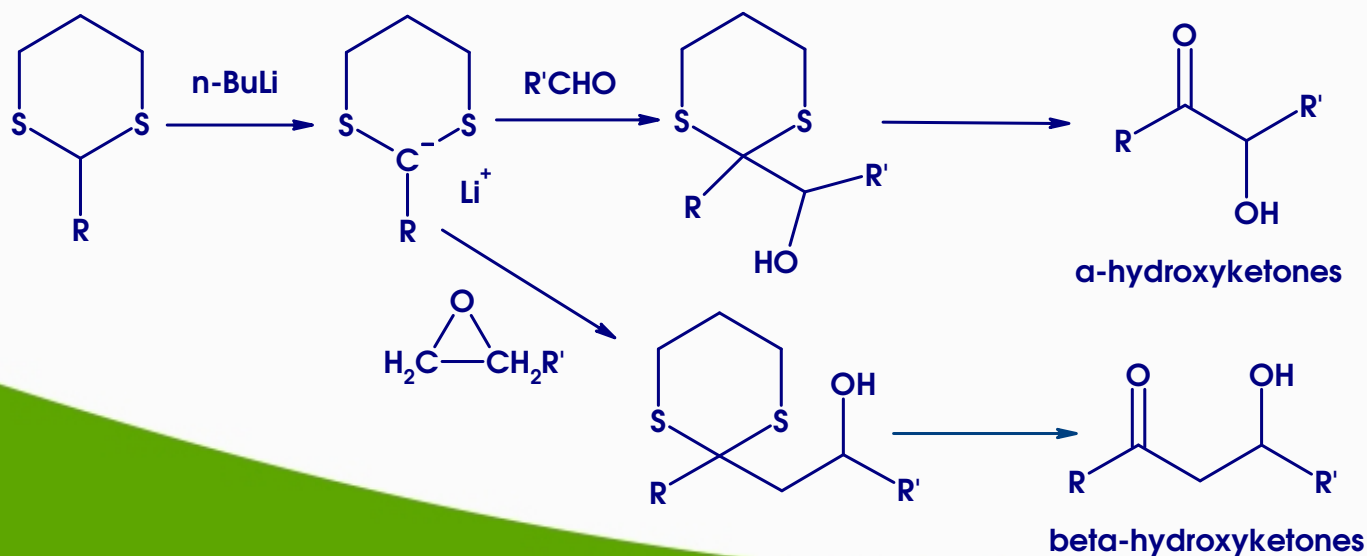
1,3-Propanedithiol and 1,3-Dithianes

New product from RBL:

1,3-Propanedithiol allows access to 1,3-Dithianes



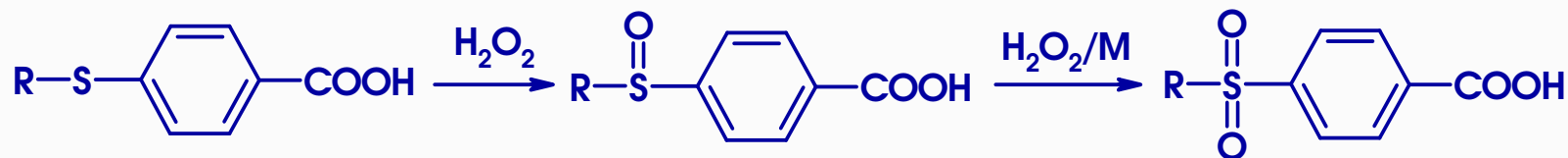
The 1,3-dithianyl anion provides a versatile intermediate for C-C bond formation



e.g. further reaction with aldehydes or epoxides provides a route to Alpha and Beta Hydroxyketones

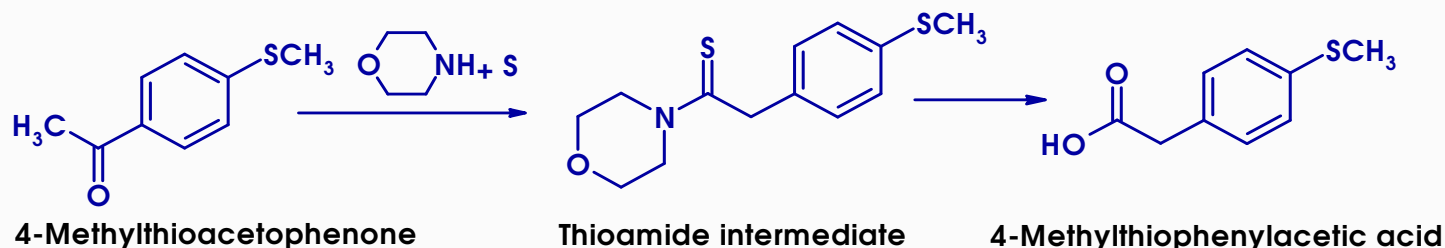
Sulphur Oxidation Chemistry

Oxidation with Hydrogen Peroxide + Transition Metal Catalysis
e.g Sulphide -> Sulphoxide -> Sulphone:

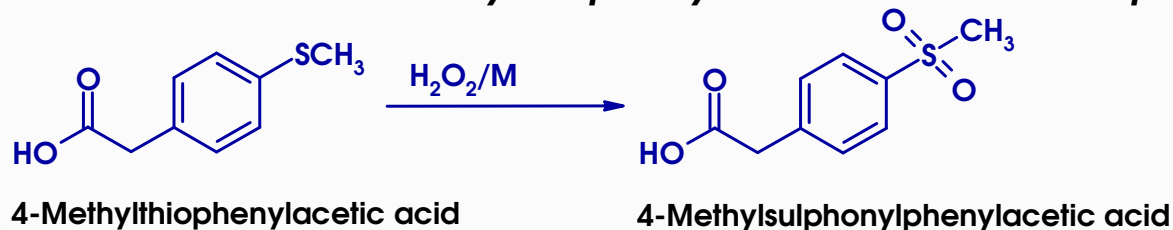


Case example: 4-Methylsulphonylphenylacetic acid...

Stage 1: Kindler-Willgerodt Acetophenone to Phenylacetic acids

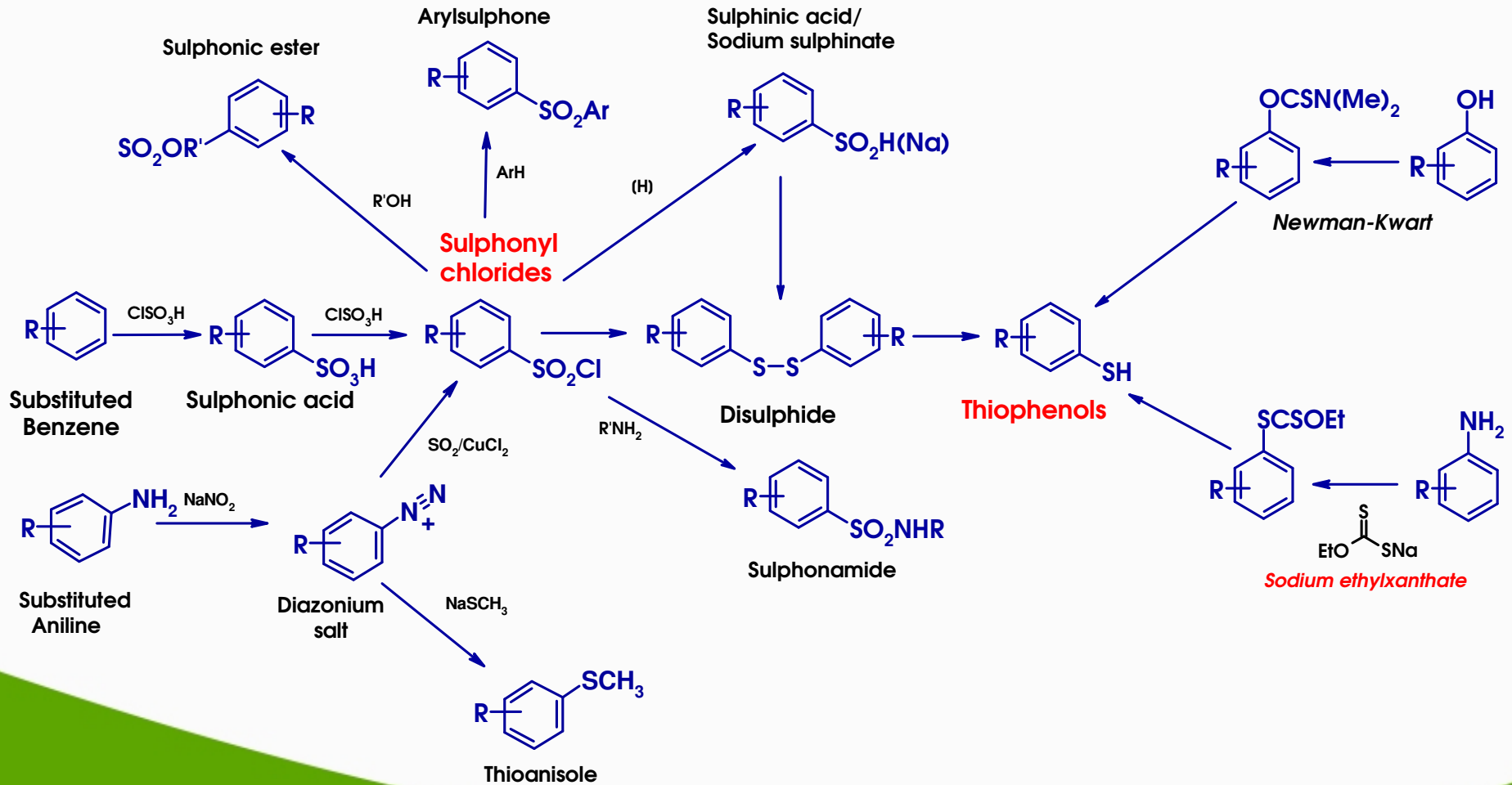


Stage 2: Peroxide oxidation 4-methylthiophenylacetic acid to the sulphone

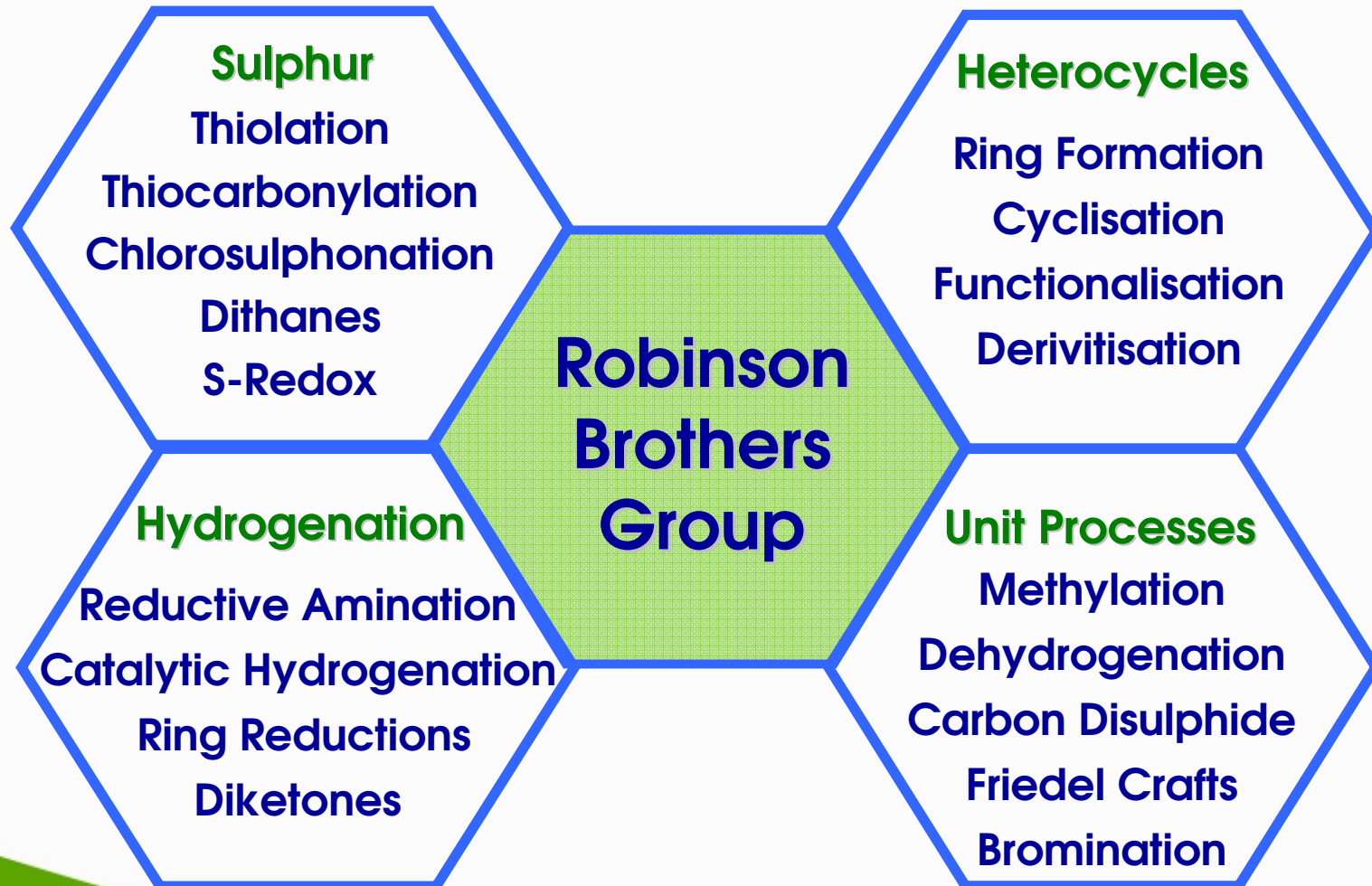


Sulphonylchloride & Thiophenol Chemistry

RBL Proprietary Chemistry:



Core Technologies - Examples



Regular Processes - Summary

- Acylation
- Alkylation
- Amination
- Bromination
- Carboxylation
- Chiral Synthesis
- Chlorosulphation
- Condensation
- Cyanation
- Dehydrogenation
- Diazotisation
- Diels Alder
- Esterification
- Friedel-Crafts Reaction
- Grignard Chemistry
- Hydrazine
- Hydrogenation
- Methylation
- Organolithium Chemistry
- Oxidation
- Reduction
- Sulphonation Chemistry
- Thiocarbonylation
- Thiolation

Wide range of chemistries allows multi-stage synthesis



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