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### Product Class 2: Cyclobutanones and Their Precursors

**J. Salaün**

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Variation 2: In \( \alpha \)-Diazo Ketones

Method 2: Oxidation of Active Methylene Compounds

Variation 1: Of Ketones

Variation 2: Of \( \alpha \)-Sulfanyl Ketones

Method 3: Addition

Variation 1: Of Thionyl Chloride to Silyl Enol Ethers

Variation 2: Of Sulfur Ylides to Carboxylic Acid Derivatives

Method 4: Rearrangements

Variation 1: Retro-Diels–Alder Reactions

Variation 2: Rearrangement of Thiirene or Thiirane S-Oxides

Applications of Product Subclass 2 in Organic Synthesis

Product Subclass 3: \( \alpha \)-Selenoxo Ketones

Synthesis of Product Subclass 3

Method 1: Substitution of Heteroatoms

Variation 1: In \( \alpha \)-Diazo Ketones

Variation 2: From \( \alpha \)-Oxo Sulfonium Ylides

Method 2: Oxidation of Active Methylene Compounds

Method 3: Addition of Selenoxides to Activated Alkynes

Methods 4: Additional Methods

Applications of Product Subclass 3 in Organic Synthesis

Product Subclass 4: \( \alpha \)-Imino, \( \alpha \)-Hydroxyimino, and \( \alpha \)-Hydrazono Ketones

Synthesis of Product Subclass 4

Method 1: Coupling Reactions between Carboxylic Acid Derivatives and Imine Derivatives

Method 2: Substitution of Heteroatoms in 1,2-Diketones

Method 3: Oxidation

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Variation 3: Nitrosation of Phenols

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Methods 5: Additional Methods

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Synthesis of Product Subclass 5

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Variation 1: Of Acyl Halides

Variation 2: Of Hydrazones

Method 2: Oxidation

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Applications of Product Subclass 5 in Organic Synthesis
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J.-L. Parrain and J. Thibonnet

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Product Class 8: Aryl Ketones
J. M. Campagne and Y. Six

Product Subclass 1: Nonsubstituted and Carbon-Substituted Aryl Ketones

Synthesis of Product Subclass 1

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Method 2: Oxidation
Variation 1: Oxidation of Benzylic Halides
Variation 2: Oxidation of Benzylic Alcohols and Ethers
Variation 3: Oxidation of Benzylic Sulfur Compounds
Variation 4: Oxidation of Benzylic Nitrogen Compounds
Variation 5: Oxidative Decyanation
Variation 6: Benzyl Oxidation
Variation 7: Wacker Oxidation
Method 3: Acylation of Organometallic Reagents
Variation 1: Arylstannyl Reagents
Variation 2: Arylboryl Reagents
Variation 3: Aryl Grignard Reagents
Variation 4: Aryllithium Reagents
Variation 5: Miscellaneous Aryl Organometallic Reagents
Method 4: Transition-Metal-Catalyzed Carbonylation of Aryl Halides and Pseudohalides
Method 5: Hydration of Arylalkynes
Method 6: Oxidation of Arylalkynes to 1,2-Diketones
Method 7: Oxidative Cleavage of \textit{gem}-Disubstituted Arylalkenes
Variation 1: Ionic \([2 + 2 + 2]\) Benzannulation
Variation 2: Transition-Metal-Catalyzed \([2 + 2 + 2]\) Benzannulation
Method 8: Synthesis by Aromatic Ring Formation
Method 9: Aryl Ketones by Aromatization of Diels–Alder Adducts
Method 10: Aryl Ketones by Electrocyclization and Aromatization
Method 11: Transition-Metal-Catalyzed \textit{ortho} Alkylation of Aryl Ketones
Method 12: Transition-Metal-Catalyzed \textit{ortho} Vinylation of Aryl Ketones
Method 13: Transition-Metal-Catalyzed \textit{ortho} Arylation of Aryl Ketones

Applications of Product Subclass 1 in Organic Synthesis

Method 1: Asymmetric Reduction
Method 2: Photochemistry
Method 3: Willgerodt Reaction
Method 4: 1,2-Aryl Shift
Method 5: Haller–Bauer Reaction

Product Subclass 2: Heteroatom-Substituted Aryl Ketones

Synthesis of Product Subclass 2

Method 1: Friedel–Crafts Acylation
Variation 1: Halogen-Substituted Aryl Ketones
### 26.8.2.1.2 Variation 2: Oxygen-Substituted Aryl Ketones

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### 26.8.2.1.3 Variation 3: Sulfur-Substituted Aryl Ketones

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### 26.8.2.1.5.3 Variation 3: Heteroatom-Substituted Aryl Ketones by [4 + 2] Aromatic 

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### 26.8.2.1.5.4 Variation 4: Heteroatom-Substituted Aryl Ketones by [4 + 2] Aromatic 

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S. P. Marsden

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Addition of Allylmetals to Carboxylic Amides

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Addition of Allylmetals to Reactive Carboxylic Acid Derivatives

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Addition of Allylmetals to Nitriles

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Deconjugative Alkylation of α,β-Unsaturated Ketones

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### 26.9.3.1 Method 3: Transition-Metal-Catalyzed Vinylation of Enolates

Transition-Metal-Catalyzed Vinylation of Enolates

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### 26.10 Product Class 10: Saturated and Unsaturated Ketones with an Additional Carbonyl, Nitrile, or Carboxy Substituent or Equivalent at a β- or More Remote Position: Synthesis of the Ketone Functionality

I. Chataigner, A. Harrison-Marchand, and J. Maddaluno

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### 26.10.1 Product Subclass 1: Oxonitriles

Oxonitriles

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Product Subclass 2: Oxo Esters and Oxo Amides

Synthesis of Product Subclass 2

Method 1: Oxidation

Variation 1: From Oxygen-Containing Carbonyl Compounds

Variation 2: From Nitrogen-Containing Carbonyl Compounds

Variation 3: From Unsaturated Carbonyl Compounds

Method 2: Electrophilic Acylation

Variation 1: With Acyl Halides and Acyl Cyanides

Variation 2: With Carboxylic Acids, Anhydrides, or Esters

Variation 3: With Amides or Nitriles

Variation 4: With Miscellaneous Electrophiles

Method 3: Nucleophilic Acylation

Variation 1: With Aldehydes (via Cyanohydrins and Related Compounds)

Variation 2: With Metal–Carbonyl Reagents

Variation 3: With Miscellaneous Nucleophiles

Variation 4: With Miscellaneous Electrophiles

Method 4: Radical Acylation of Unsaturated Carbonyl Compounds

Variation 1: With Aldehydes

Variation 2: With Anhydrides

Variation 3: With Selenoesters

Variation 4: With Cyclopropanols

Method 5: Carbonylation

Variation 1: The Pauson–Khand Reaction

Variation 2: Free-Radical Carbonylation

Variation 3: With Organometallic Complexes

Method 6: By Rearrangement

Variation 1: Ring Expansions by Radical Methods

Variation 2: Ring Expansion by Nonradical Methods

Variation 3: Electrocyclic Rearrangements

Variation 4: Miscellaneous Rearrangements

Method 7: Cyclization and Cycloaddition

Variation 1: Dieckmann Condensation

Variation 2: Cycloadditions and Miscellaneous Cyclizations

Methods 8: Miscellaneous Methods

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Variation 2: Hydration of Alkynes

Variation 3: Arylation of Baylis–Hillman Adducts

Product Subclass 3: Diketones and Oxo Imines

Synthesis of Product Subclass 3

Method 1: Oxidation

Variation 1: Of Hydroxy Ketones and Diols

Variation 2: Of Nitro Ketones

Variation 3: Of Alkanones and Alkenones

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