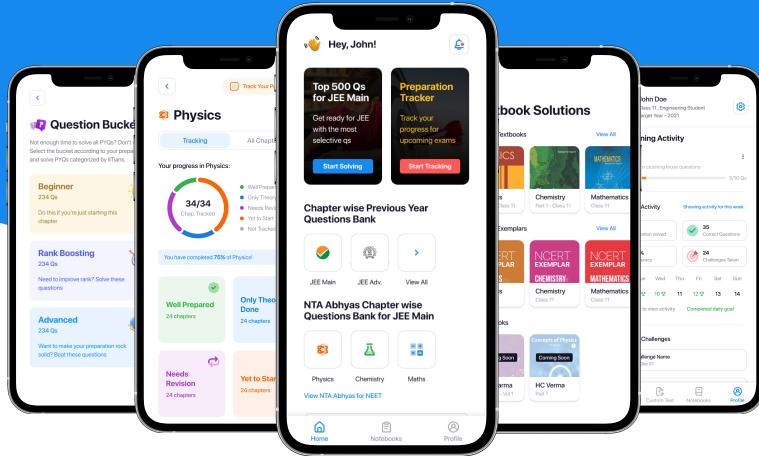




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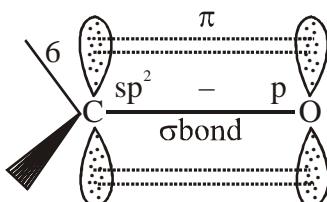
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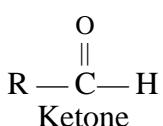
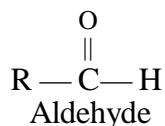
ALDEHYDES KETONES

STRUCTURE OF CARBONYL GROUPS :

The $>\text{C}=\text{O}$ bond in aldehyde and ketones is made up of one σ and one π -bond around the carbon oxygen bond.

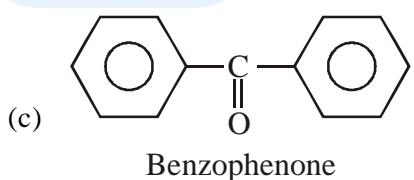
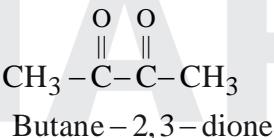
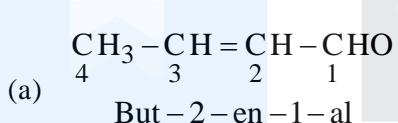


The electron cloud of the π -bond lies both above and below the $\text{C}=\text{O}$, σ bond

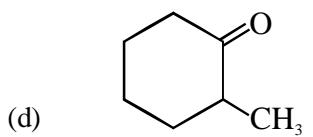


NOMENCLATURE OF ALDEHYDE AND KETONES :

The suffix term for aldehyde is 'al' and for ketone is 'one'.



Benzophenone

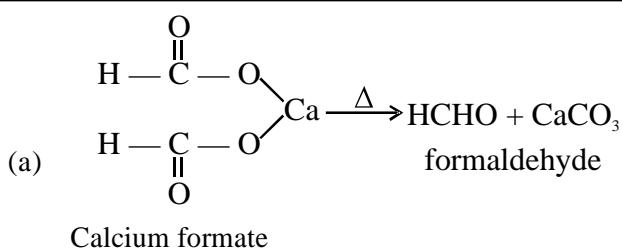


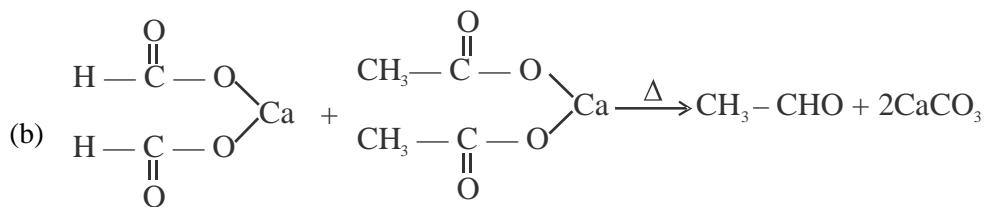
2-Methyl-cyclohexanone

Aldehyde and ketones are functional isomers to each, due to which their properties largely resembles to each other.

GENERAL METHODS OF PREPARATION OF ALDEHYDES AND KETONES:

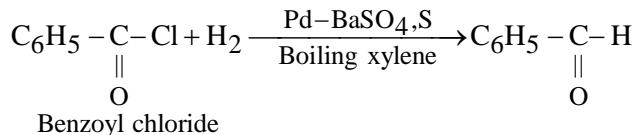
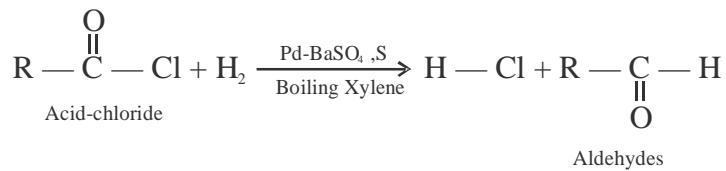
(1) BY DRY-DISTILLATION OF CALCIUM SALT OF CARBOXYLIC ACIDS :





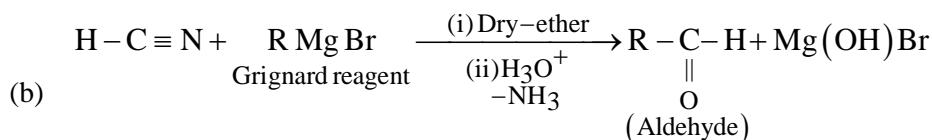
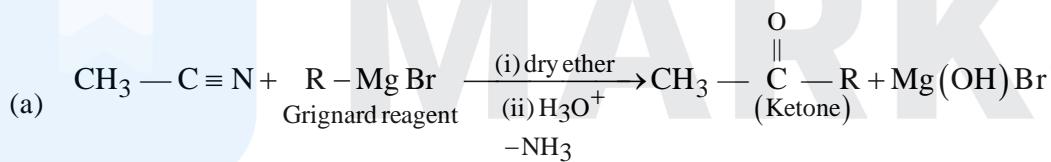
2. BY ROSEN MUND'S REDUCTION:

Only aldehydes can be synthesised by this reaction.

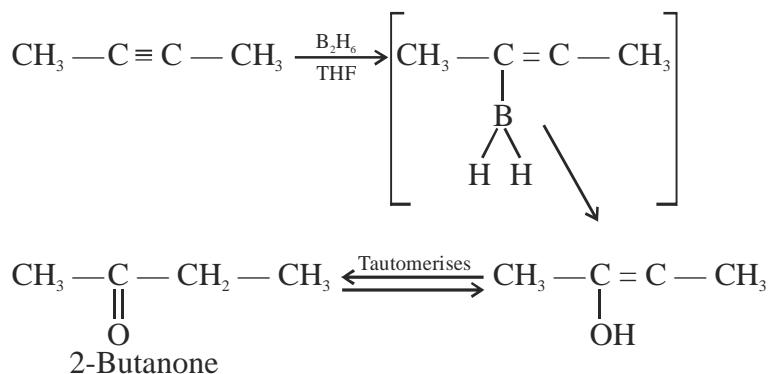


Note : Formaldehydes can't be obtained by this method. Ketones also can't be synthesised by this reaction.

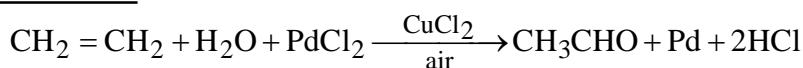
3. FROM NITRILES :



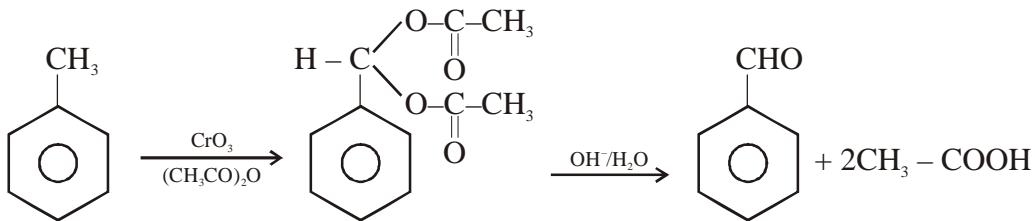
4. BY HYDROBORATION - OXIDATION OF ALKYNES :



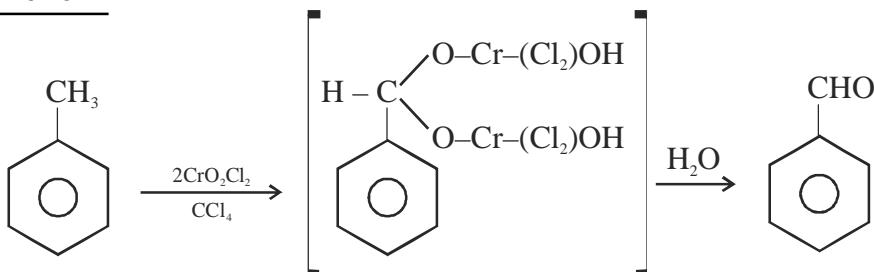
5. WACKER'S PROCESS :



6. OXIDATION OF METHYL BENZENE :



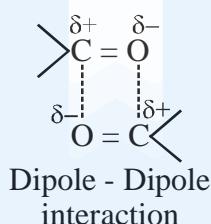
7. ETARD REACTION:



Physical Properties :

(1) Boiling - point :

Aldehyde and Ketone molecule are polar molecules due to the presence of carbonyl groups.

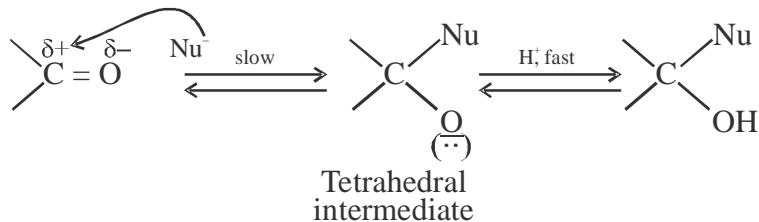


Among isomeric aldehydes and ketones, ketone have slightly higher boiling point value

Chemical properties of aldehyde and ketones :

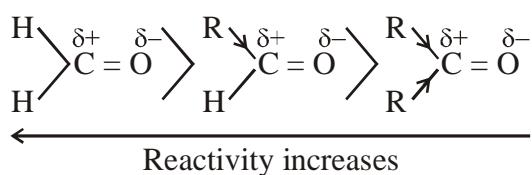
Aldehydes and ketones are highly reactive due to the presence of polarized carbonyl groups. The reaction of aldehyde and ketones can be divided into following categories :

(1) Nucleophilic addition reactions :



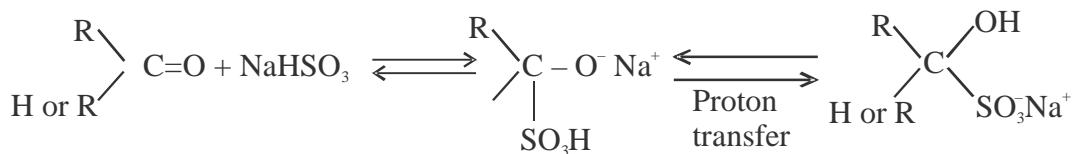
The ability of the highly electronegative oxygen to retain the negative charge over it, causes the nucleophilic addition reaction at carbon. In addition, nucleophilic attack causes the formation of stable tetrahedral intermediate.

The relative reactivity of aldehydes and ketone is effected by at least given two factors :



SOME IMPORTANT NUCLEOPHILIC ADDITION REACTION :

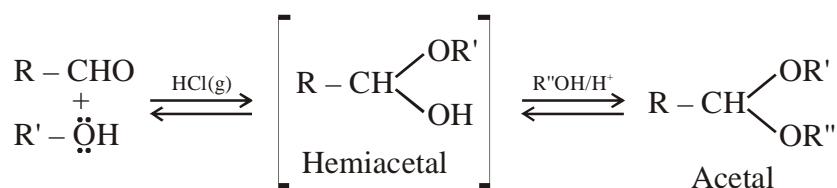
1. ADDITION OF SODIUM BISULPHITE



⇒ The position of equilibrium lies largely to the right for most aldehyde and for most of ketones it lies toward left.

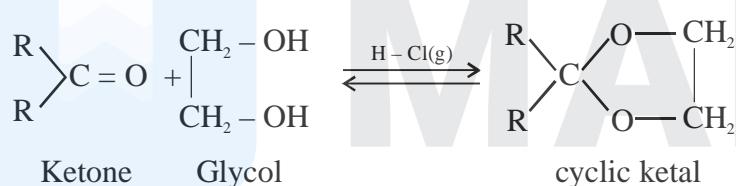
2. ADDITION OF ALCOHOL :

Aldehyde with one molecule of R-OH forms ‘hemiacetal’ and with another molecule it forms acetal.



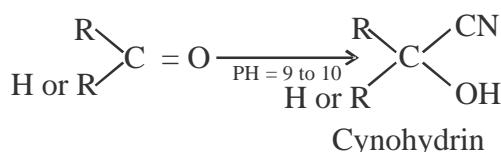
Ketone, similarly forms hemiketal and ketal.

3. WITH DIOL :



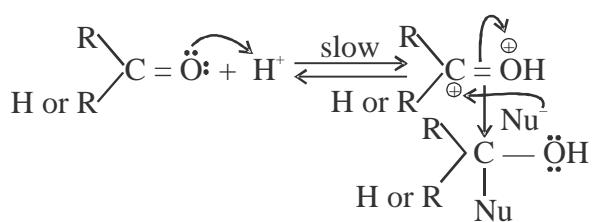
4. WITH HCN :

Cyanohydrins is formed



5. ADDITION OF AMMONIA DERIVATIVES :

The addition of ammonia derivative to aldehyde and ketone is catalysed by weak acids.

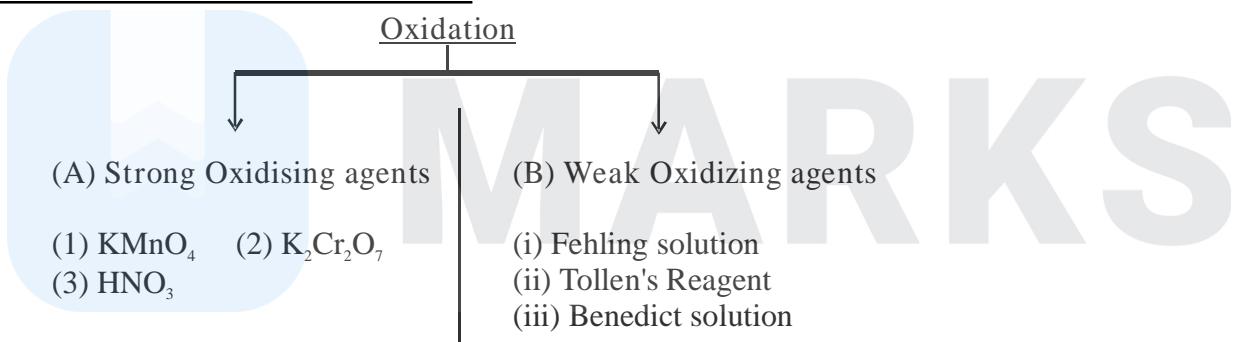


⇒ Due to protonation, the ease of nucleophilic addition becomes faster.

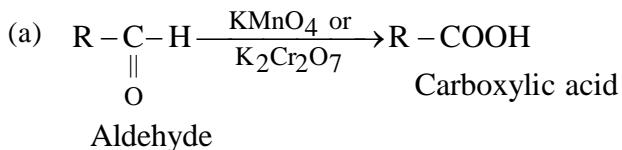
6.

AMMONIA DERIVATIVE USED		PRODUCT OBTAINED	
Structure	Name	Structure	Name
NH_2OH	Hydroxylamine	$\text{C} = \text{N} - \text{OH}$	Oxime
$\text{NH}_2 - \text{NH}_2$	Hydrazine	$\text{C} = \text{N} - \text{NH}_2$	Hydrazone
$\text{NH}_2 - \text{NH} - \text{C}_6\text{H}_5$	Phenyldiazine	$\text{C} = \text{N} - \text{NH} - \text{C}_6\text{H}_5$	Phenylhydrazone
$\text{NH}_2 - \text{NH} - \text{C}_6\text{H}_3(\text{NO}_2)_2$	2,4-Dinitro-phenyldiazine	$\text{C} = \text{N} - \text{NH} - \text{C}_6\text{H}_3(\text{NO}_2)_2$	2,4-Dinitrophenyl-hydrazone
$\text{NH}_2\text{CONHNH}_2$	Semicarbazide	$\text{C} = \text{NNHCONH}_2$	Semicarbazone

7. OXIDATION OF ALDEHYDE AND KETONES



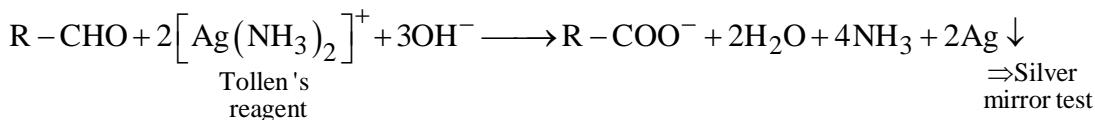
(A) Strong Oxidising agents :



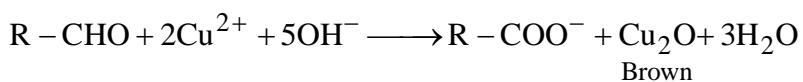
(B) Oxidation by weak oxidising agents :

The given reactions are also used to distinguish between aldehyde and ketones.

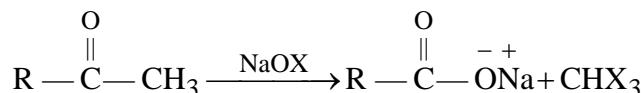
(i) By Tollen's reagent :



(ii) Fehling's solution :



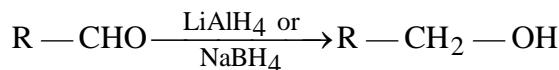
(C) Oxidation of methyl ketones by Haloform reaction :



8. REDUCITON :

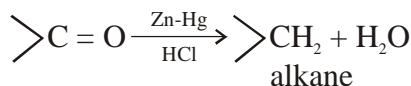
Reduction :  (a) To alcohol
(b) To alkane

(A) To alcohols :

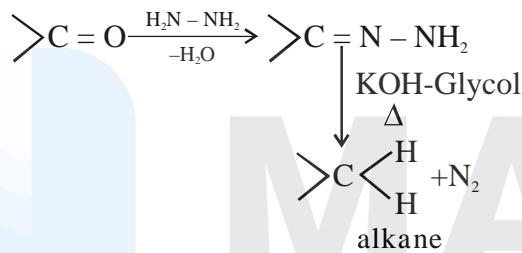


(B) To alkane :

(i) Clemmensen's reduction:

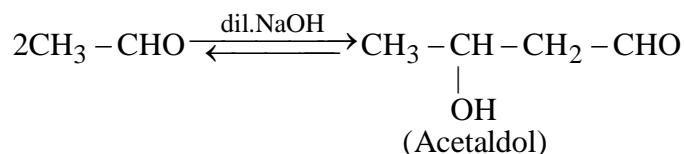


(ii) Wolff-kishner reduction:

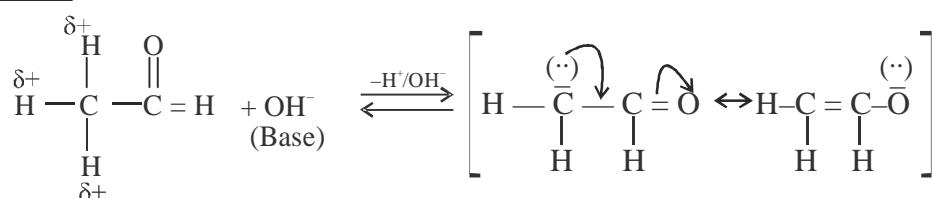


9. REACTION INVOLVING α -HYDROGEN (ALDOL-CONDENSATION REACTION) :

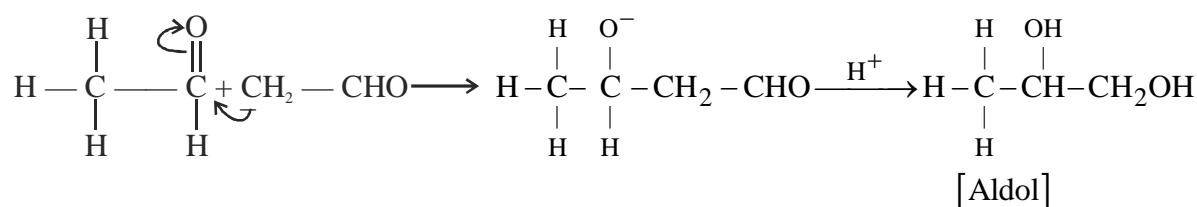
Aldehyde and Ketones having α H undergoes condensation in presence of these dilute base to form aldol. Thus reactions are also called as aldol condensation reactions.



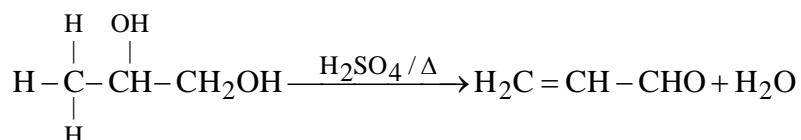
Mechanism :



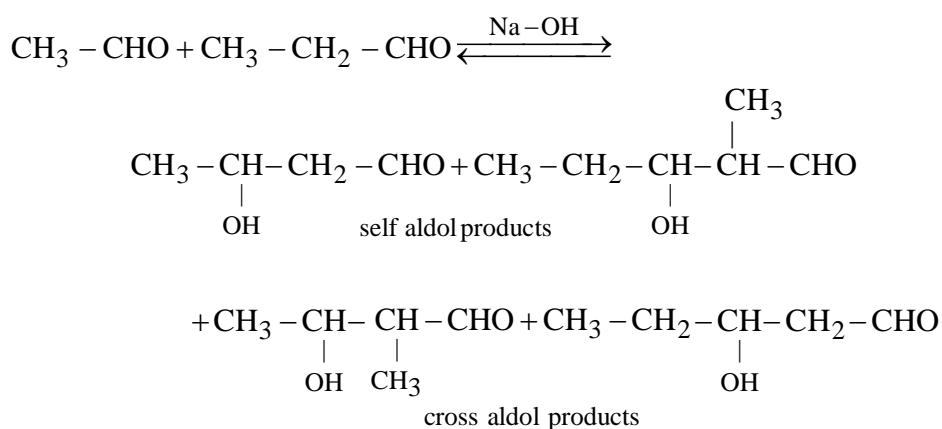
2nd Step :



Note: The aldol formed may undergo dehydration in presence of dilute acids, upon heating.

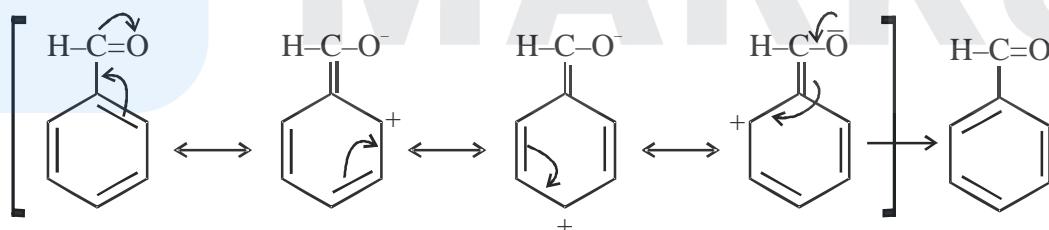


Cross Aldol condensation reaction:

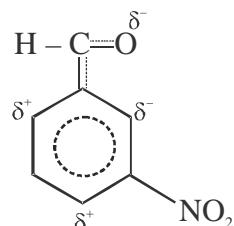


Electrophilic Substitution reaction :

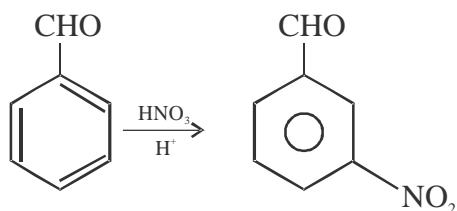
Aromatic aldehydes and ketones, gives rise to electrophilic substitution reaction at meta position. The carbonyl groups acts as deactivating, group for incoming electrophiles



Resonance hybrid:

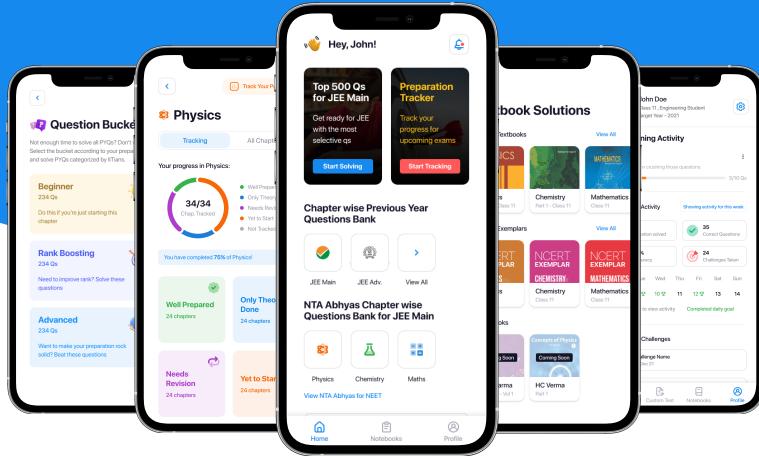


(1) Nitration:





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