REDUCING REAGENTS

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TOPICS COVERED

- Reduction and Oxidation Reaction
- Priority order of Functional groups in Reduction and Oxidation
- General Reduction Reactions
- Reduction by Catalytic Hydrogenation
- Comparative analysis of Catalytic Hydrogenation
- Reduction by hydride ion or proton

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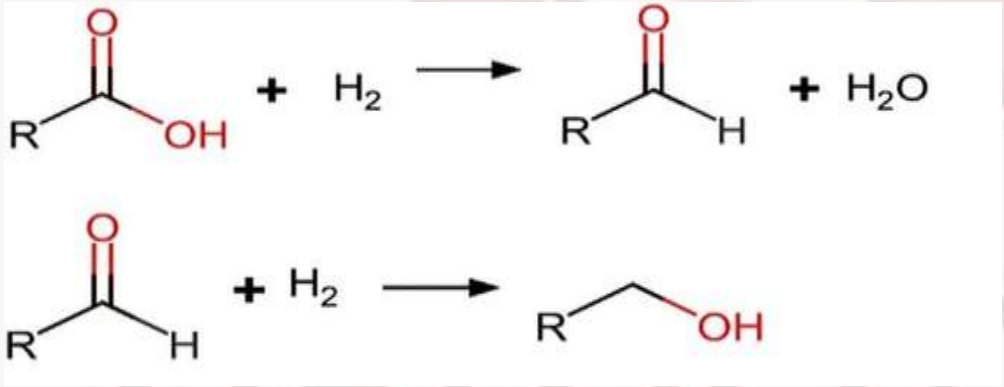
Reduction and Oxidation Reaction

- Reduction of an organic molecule usually corresponds to increasing it's hydrogen content and decreasing it's oxygen content.

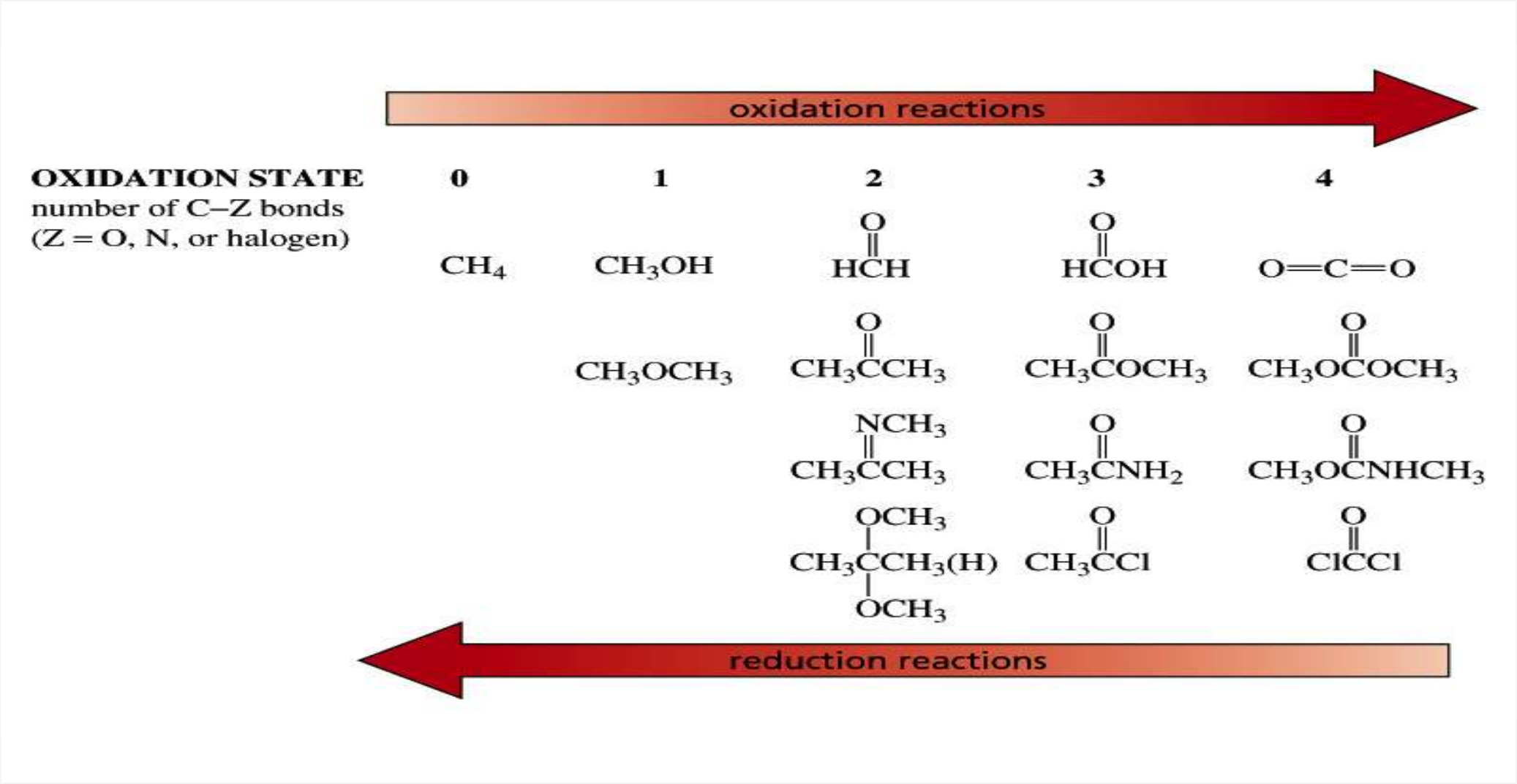
exa: Conversion of carboxylic acid to aldehyde and aldehyde to alcohol.



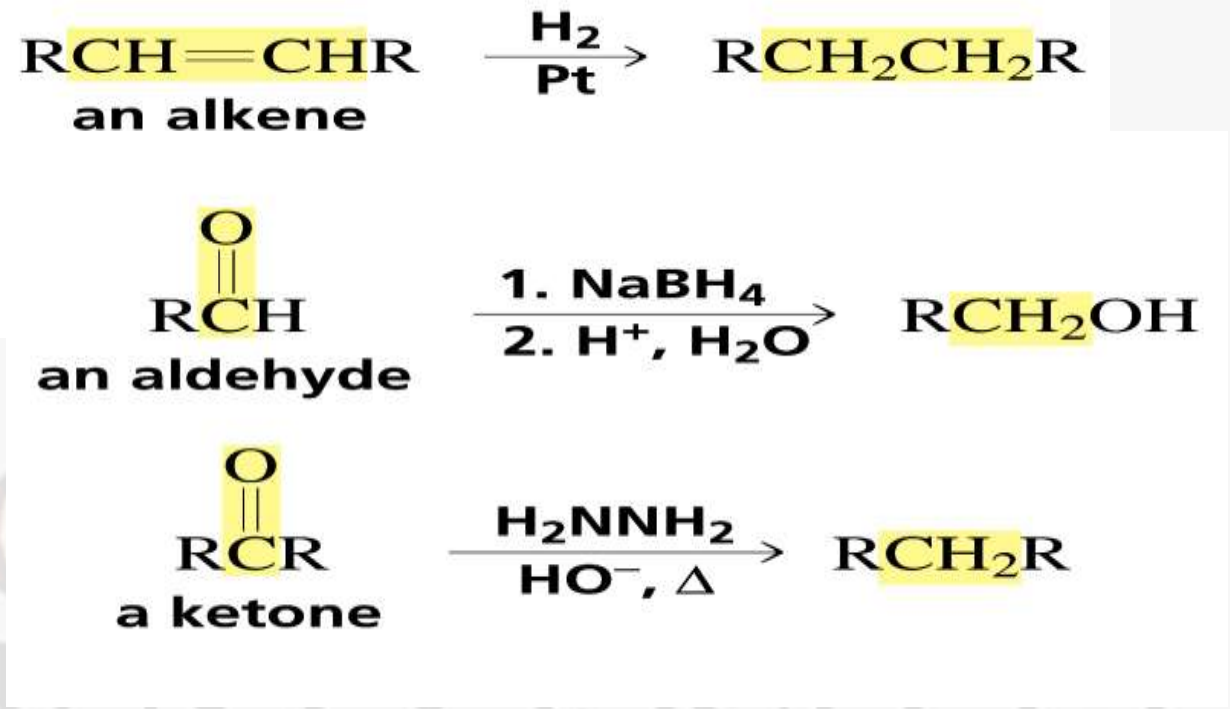
- Oxidation is reverse of reduction. The reagent which help in reduction is reducing agent and which help in oxidation is oxidizing agent.

Oxidation and Reduction Reactions

- Oxidation is always coupled with reduction
  - Gain of electrons is reduction
  - Loss of electrons is oxidation
- The oxidation state of a carbon atom equals the total number of its C–O, C–N, and C–X bonds


oxidation reactions
OXIDATION STATE
number of C–Z bonds
(Z = O, N, or halogen)
0
1
2
3
4
CH4
CH3OH
HCH
HCOH
O=C=O
CH3OCH3
CH3CCH3
CH3COCH3
CH3OCOCH3
NCH3
CH3CCH3
CH3CNH2
CH3OCNHCH3
OCH3
CH3CCH3(H)
OCH3
CH3CCl
ClCCl
reduction reactions

Hydrogen, sodium borohydride, and hydrazine are the reducing agents



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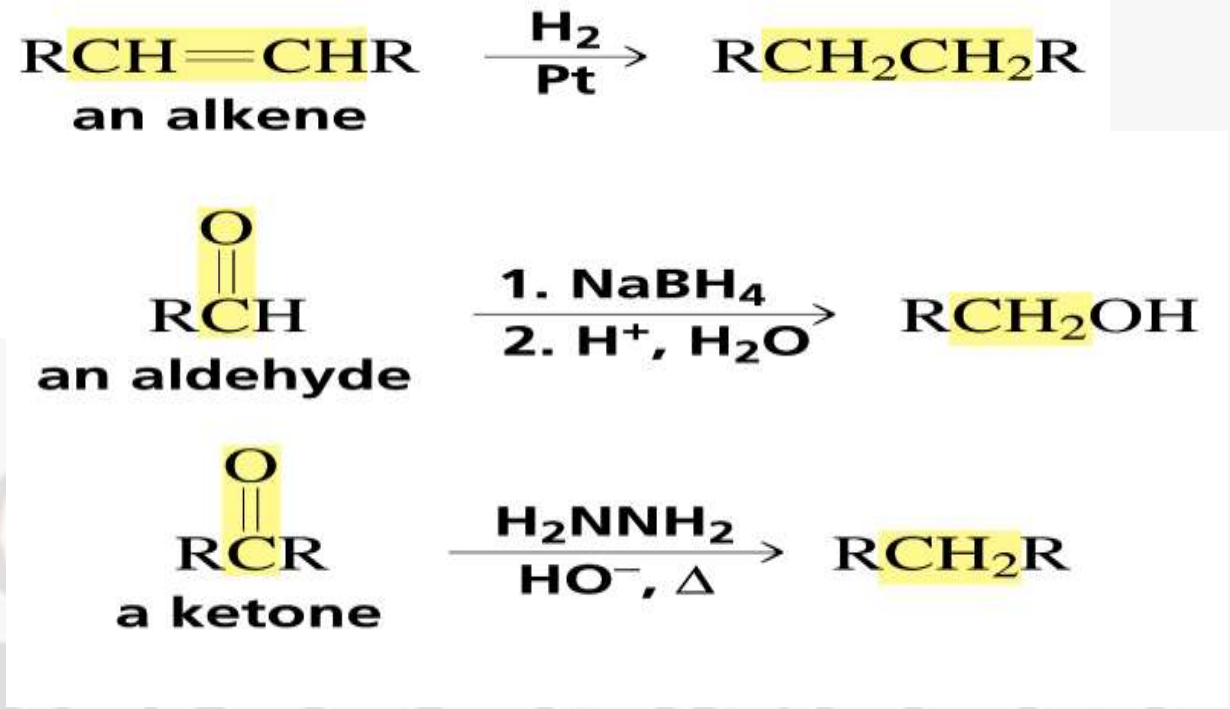
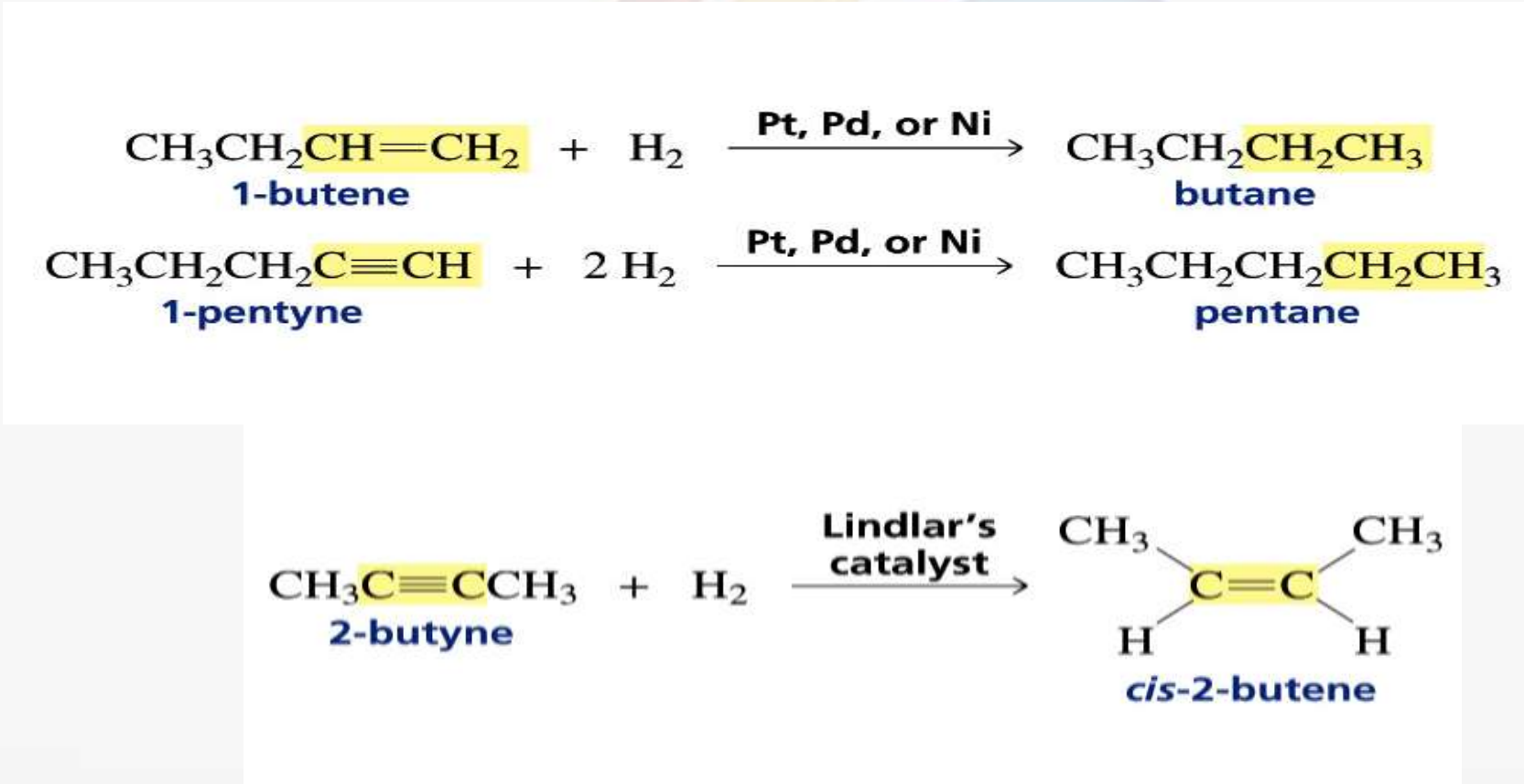
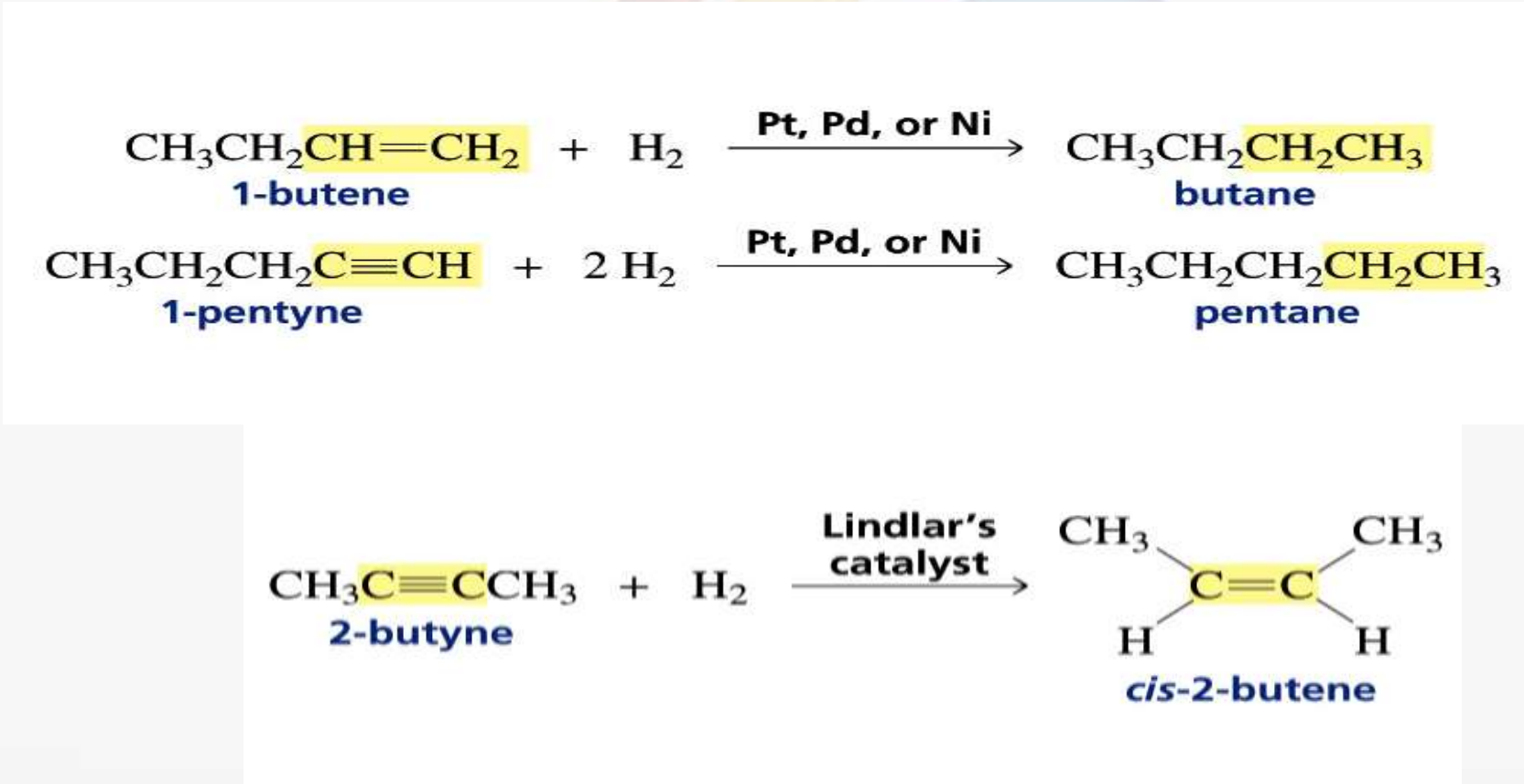


Reduction by Catalytic Hydrogenation



Reduction by Catalytic Hydrogenation

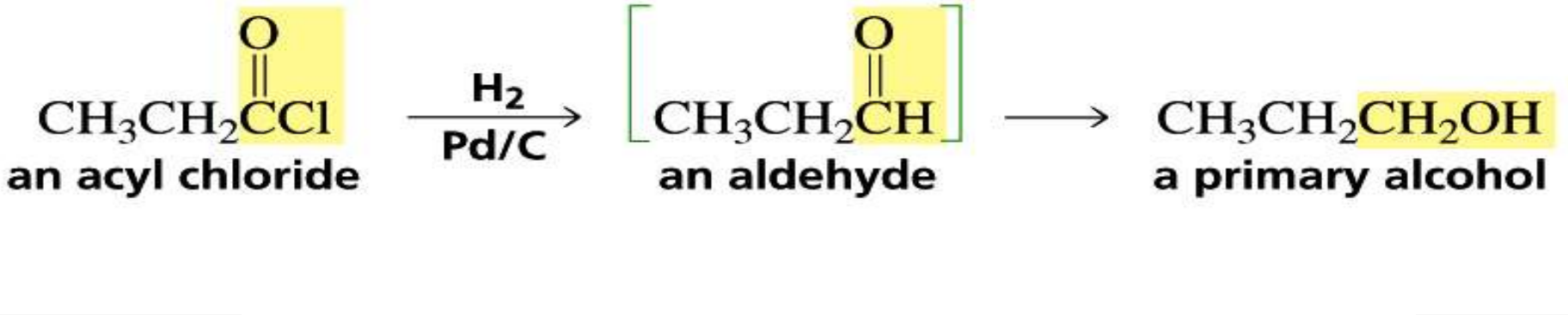


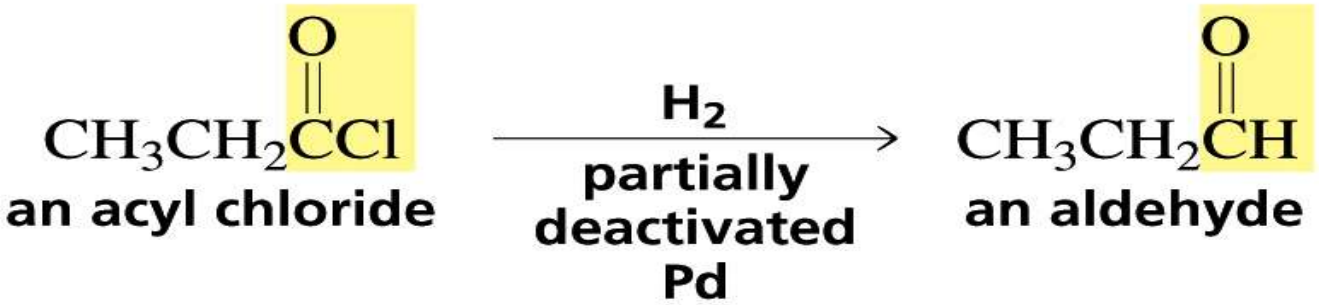
$$CH_3CH_2CH{=}NCH_3 + H_2 \xrightarrow{Pd/C} CH_3CH_2CH_2NHCH_3$$

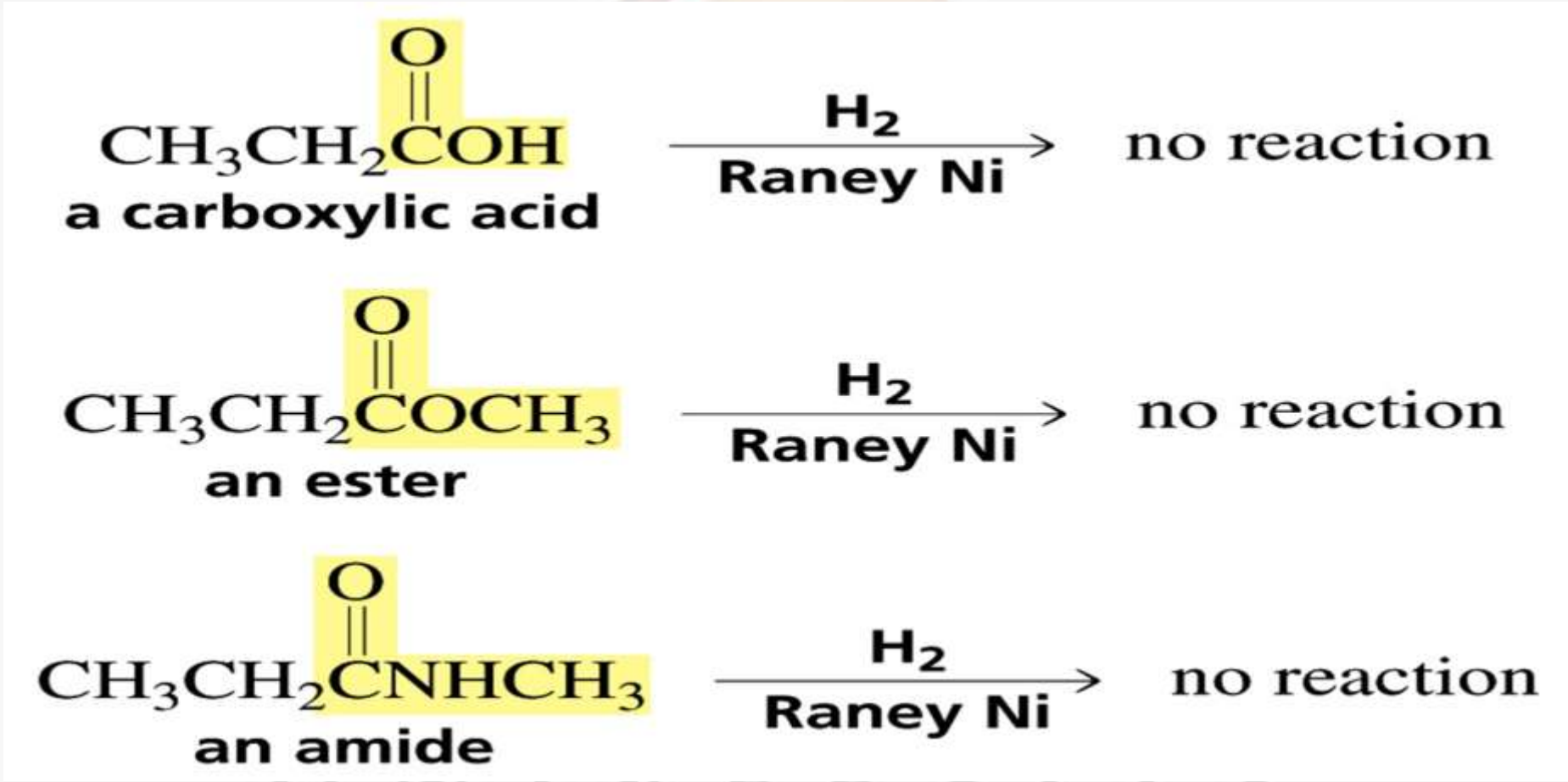
methylpropylamine

$$CH_3CH_2CH_2C{\equiv}N + 2\,H_2 \xrightarrow{Pd/C} CH_3CH_2CH_2CH_2NH_2$$

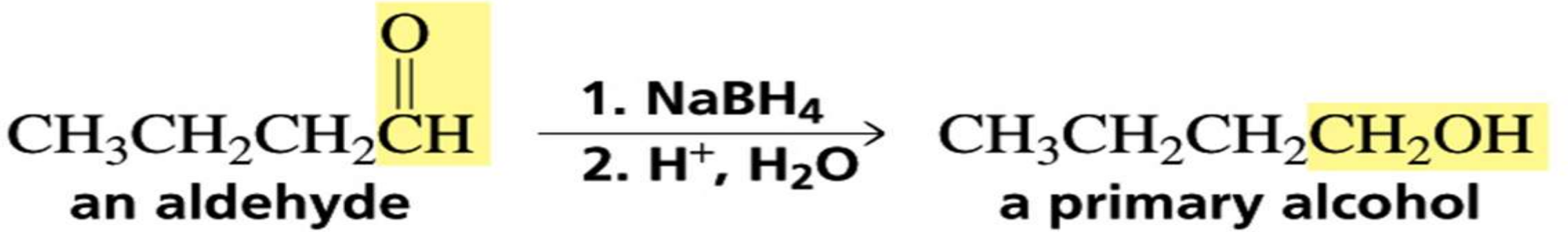
butylamine

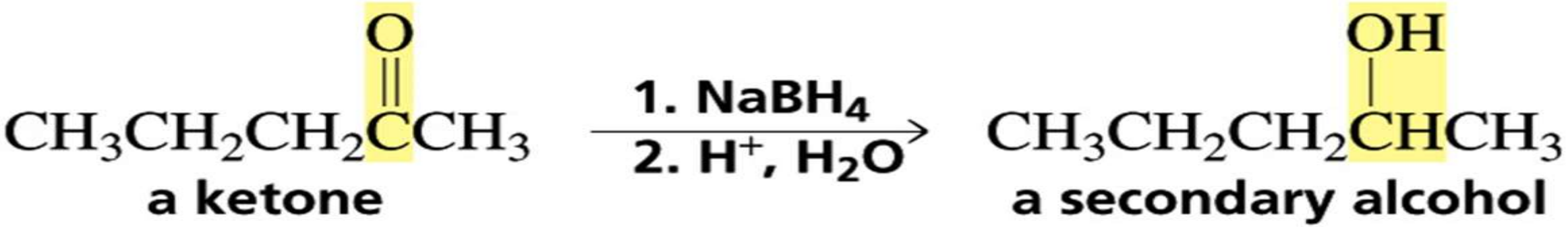

CH3CH2CCl
O
an acyl chloride
H2
Pd/C
CH3CH2CH
O
an aldehyde
CH3CH2CH2OH
a primary alcohol


CH3CH2CCl
O
an acyl chloride
H2
partially
deactivated
Pd
CH3CH2CH
O
an aldehyde


CH3CH2COH
a carboxylic acid
H2
Raney Ni
no reaction
CH3CH2COCH3
an ester
H2
Raney Ni
no reaction
CH3CH2CNHCH3
an amide
H2
Raney Ni
no reaction

Reduction by Addition of a Hydride Ion and a Proton





References

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THANK YOU

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