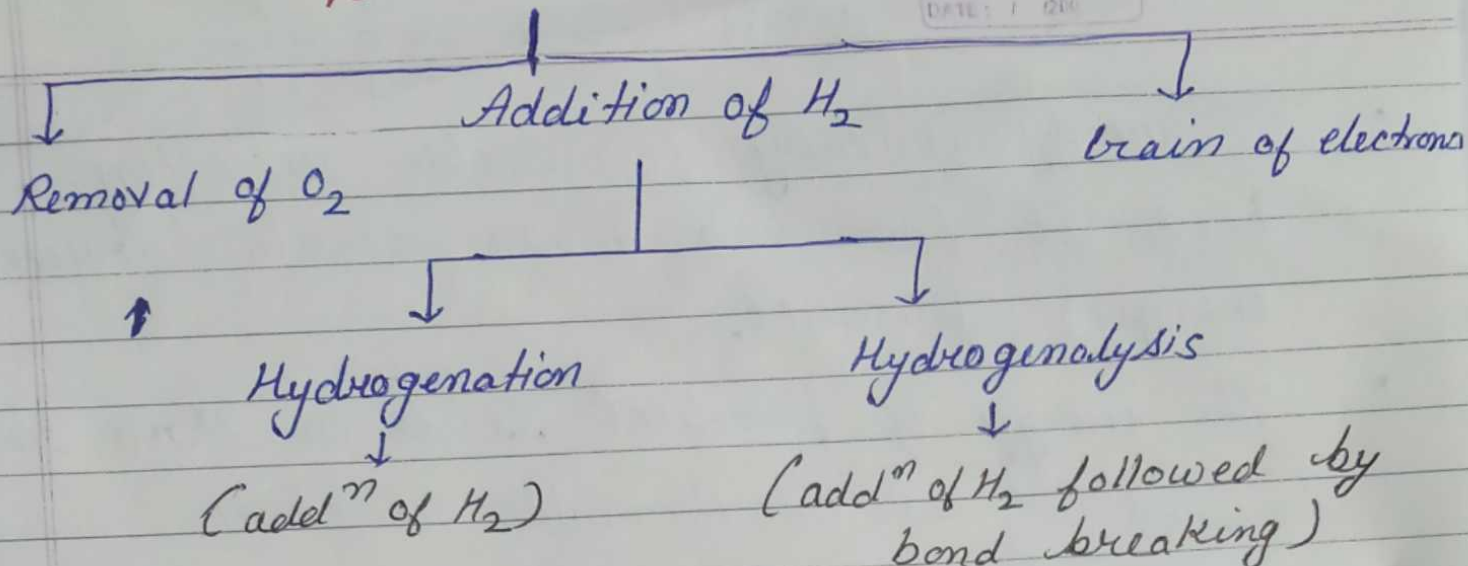


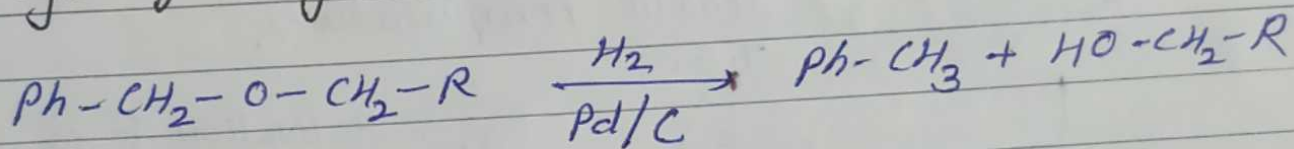
REDUCTION

Shreevath
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* ↑ in H₂ Content, ↓ in O₂ Content.

Hydrogenolysis :-



Mechanistically there are 3 pathways:

1. Addition of molecular hydrogen in the presence of catalyst.
2. By the addition of electrons, followed by either uptake of proton or by coupling.
3. By the transfer of hydride ion.

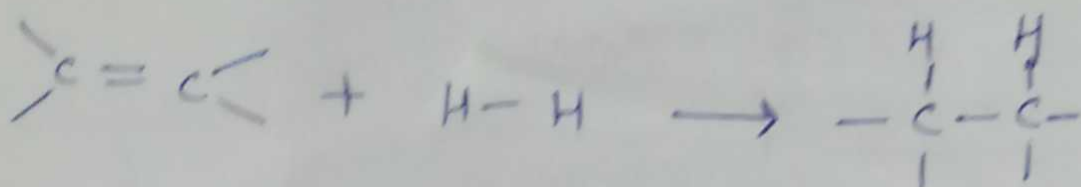
Reduction of alkenes: Catalytic hydrogenation

Heterogeneous

Homogeneous

Heterogeneous Hydrogenation :-

It consists storing the substrate with a catalyst in a suitable solvent in an atmosphere of Hydrogen.

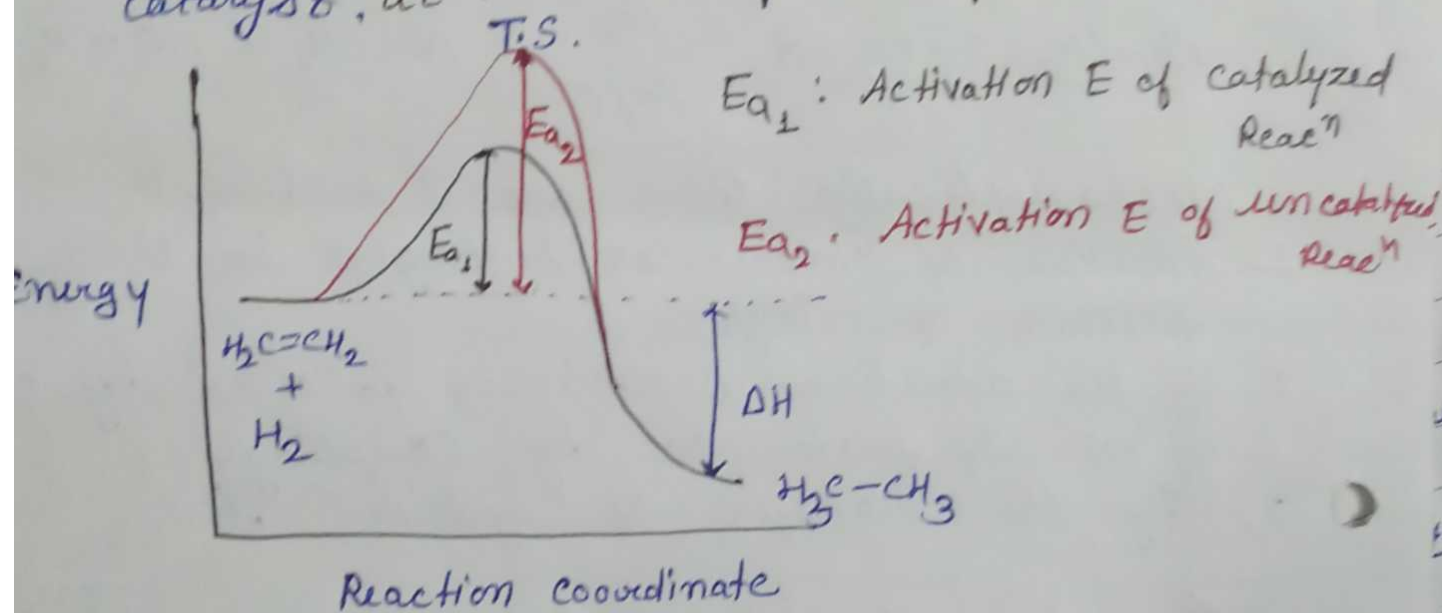


Thermodynamically favourable reaction
 becoz it forms a more stable (lower
 energy) product.

The energy of product is lower than reactant,
 thus it is exothermic reaction.

The heat released is heat of hydrogenation.

But it will not proceed without
 catalyst, at room temperature.



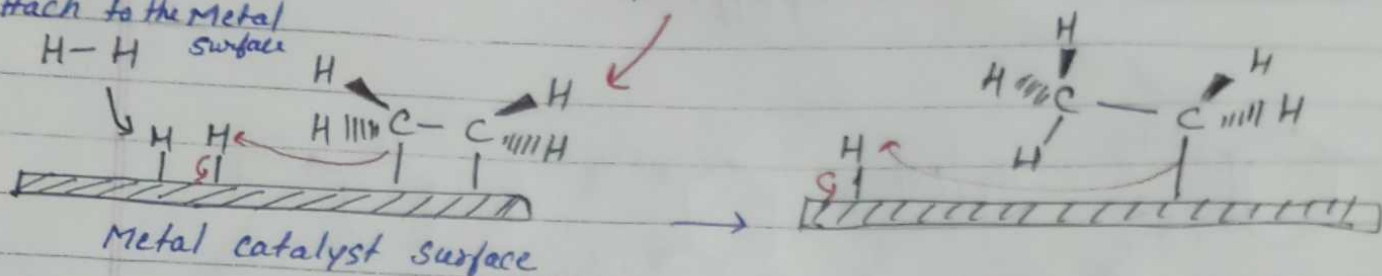
- Catalyst :- finely divided metals, metallic oxides
 or sulfides.

Most common catalysts :- Pt, Pd, Rh, Ru, Ni and
 copper chromite

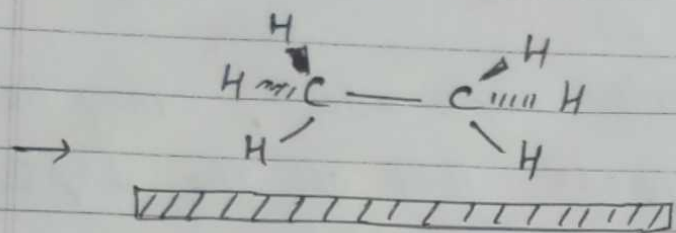
- The reduction takes place b/w gaseous H_2 and
 an organic compound, at the surface of
 catalyst which adsorbs both and facilitates their
 contact.

Alkene attached to catalyst surface

Hydrogen atoms attach to the metal surface



Metal catalyst surface



Syn addition:-
 two hydrogen atoms have added to the same face of the double bond.

Catalysts:-

Platinum :- used as its oxide, PtO_2 (Adams' catalyst). The oxide is reduced by hydrogen.
 PtO_2/H_2

Palladium :- Most widely used.

- obtained by the reduction of palladium chloride with $NaBH_4$.
- commonly used as Pd/C (palladium on charcoal, $CaCO_3$ or $BaSO_4$).

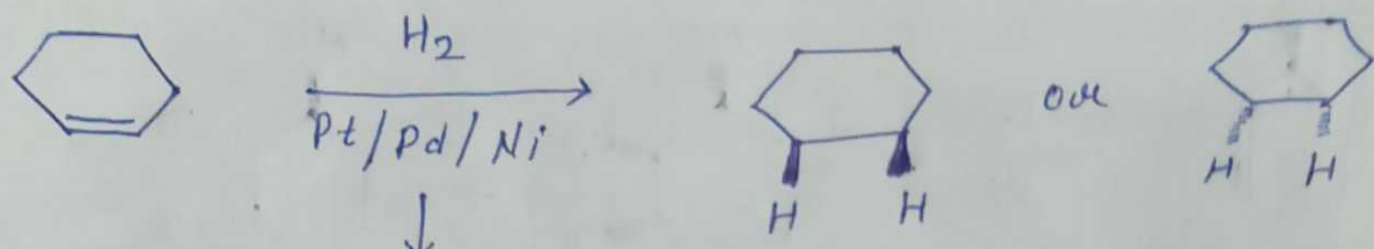
Nickel :- Raney nickel (Ni obtained by the Raney's process).

- Ni-Al Alloy (50% Ni + 50% Al) is heated with aq. $NaOH$ solⁿ at $50-100^\circ$.
- In this process Al dissolves and Ni is left behind in the form of very fine particles.

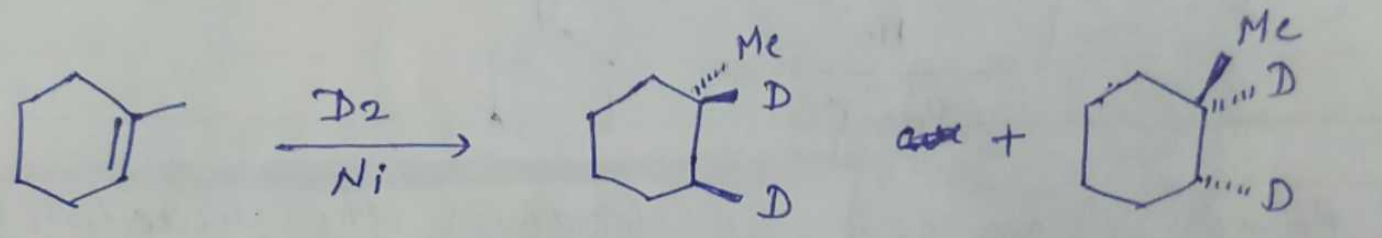
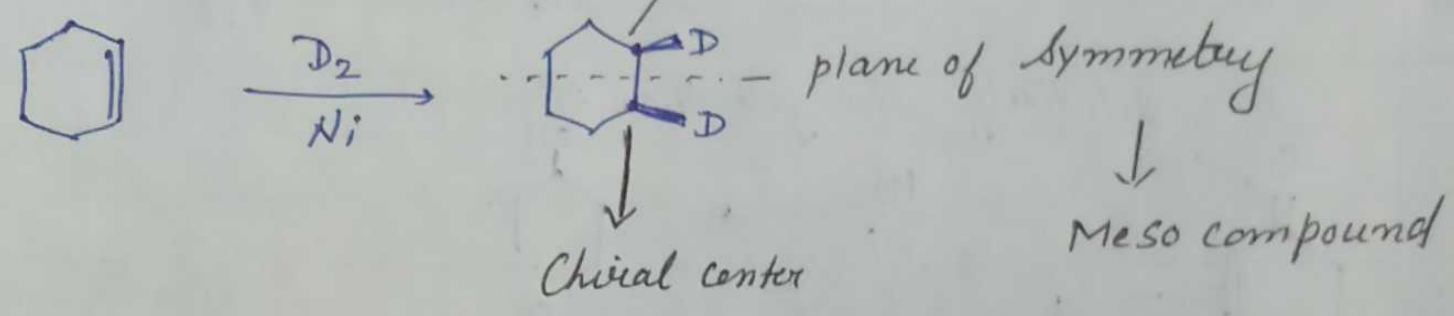
↓
Raney Ni

~~Copper chromite catalyst~~

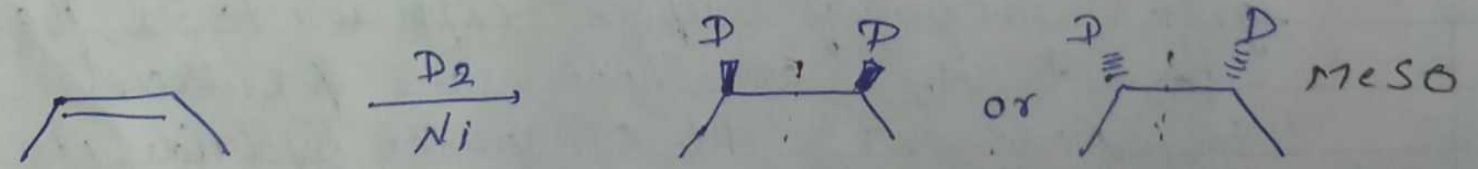
Same side addⁿ = Syn



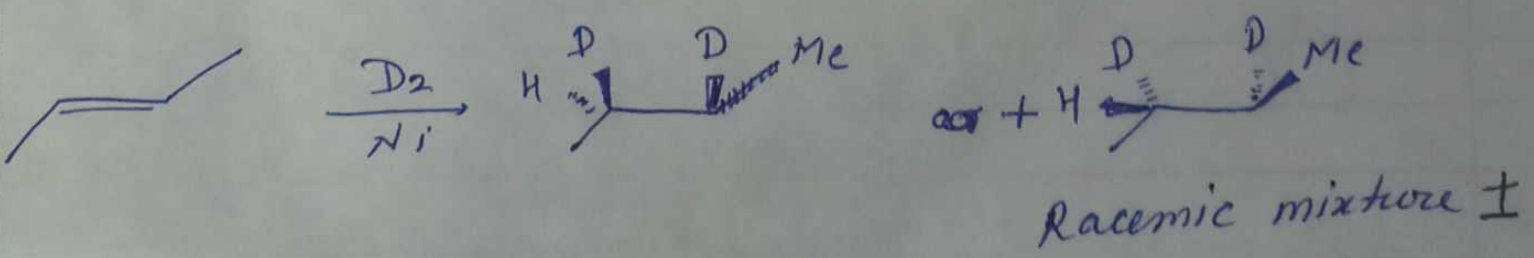
Provides surface area

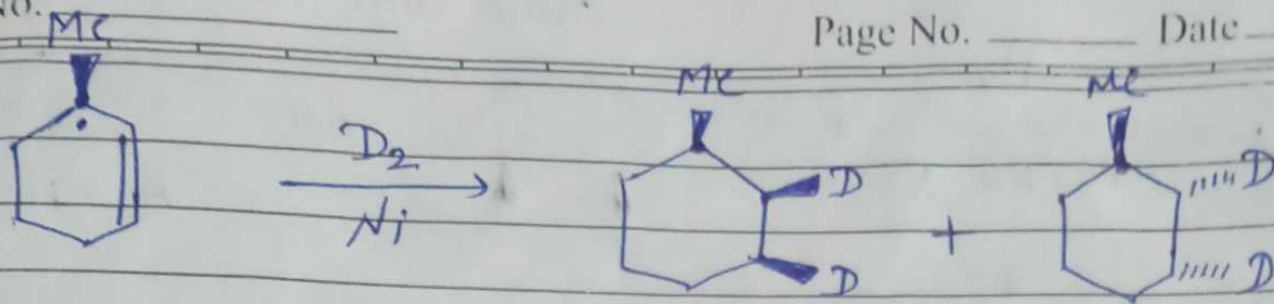


Both are enantiomers
 ↓
 equal quantity
 ↓
 Racemic mix. (±)

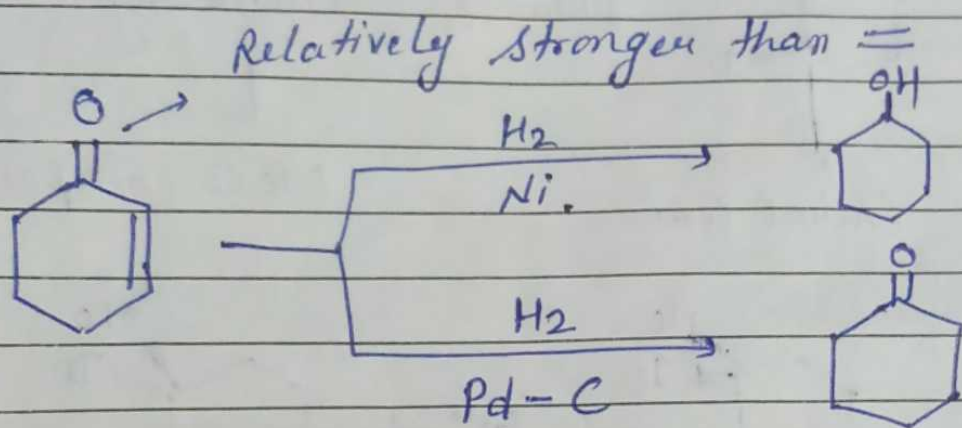


Both are identical hence only one product is formed





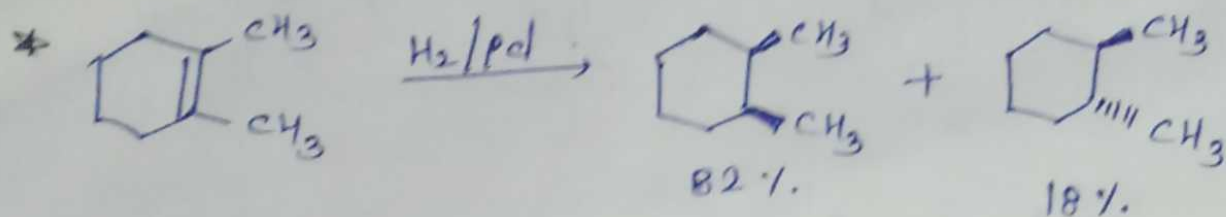
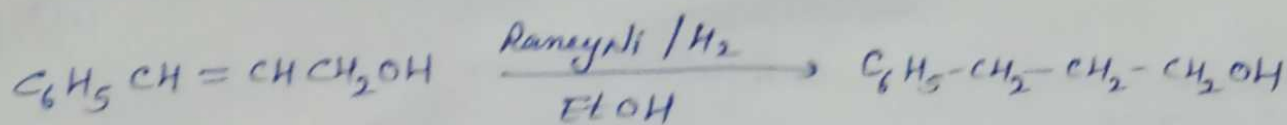
Diastereomers
(opposite configuration)



Pd-C (charcoal) \rightarrow decreases the reactivity of palladium ~~so~~ hence it only reduces weak bonds.

★ Carbon decreases the number of active sites.

★ **Pyrophoric reagents** :- Reagents that ignite instantly upon exposure to O_2 , H_2O , H_2 and heat are produced.
eg. Raney Ni, Pd-C, metal hydride etc.



* Addⁿ is not complete syn addⁿ, may be explained if we suppose that all the steps are reversible except last step.

