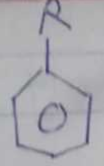
Heterogeneous catalytic hydrogenation of aromatic rings:-



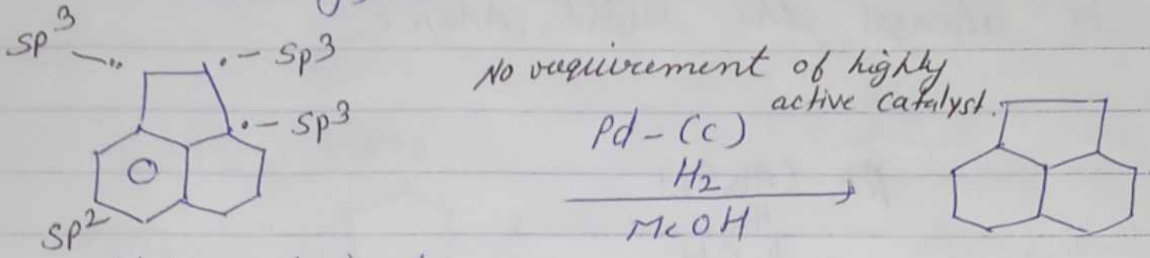
Rh > Ru > Pt > Ni > Pd > Co

General order of reactivity towards hydrogenation of aromatic rings

↳ selective in presence of other functional group

→ Rh is used as $\underbrace{\text{Rh }(Al_2O_3),\ 20\text{-}60^\circ C,\ 3\text{-}4\text{ atm } H_2}_{\text{mild rxn conditions}}$

→ Ni (Raney), >100°C > 50 – 100 atm of H_2

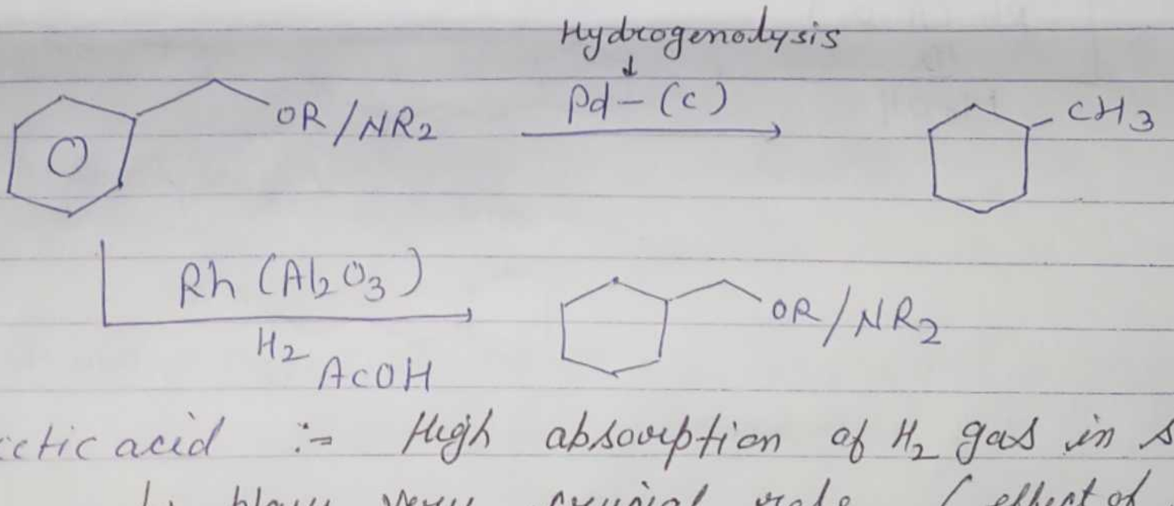


No requirement of highly active catalyst.

highly strained compd.

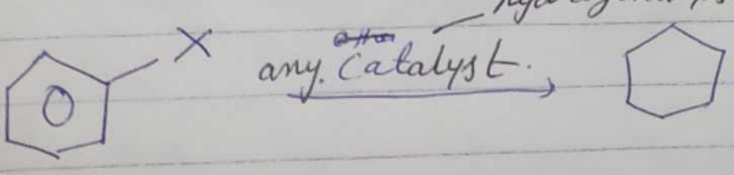
So ⌬ is highly reactive

* Basically, strain is promoting the reaction.

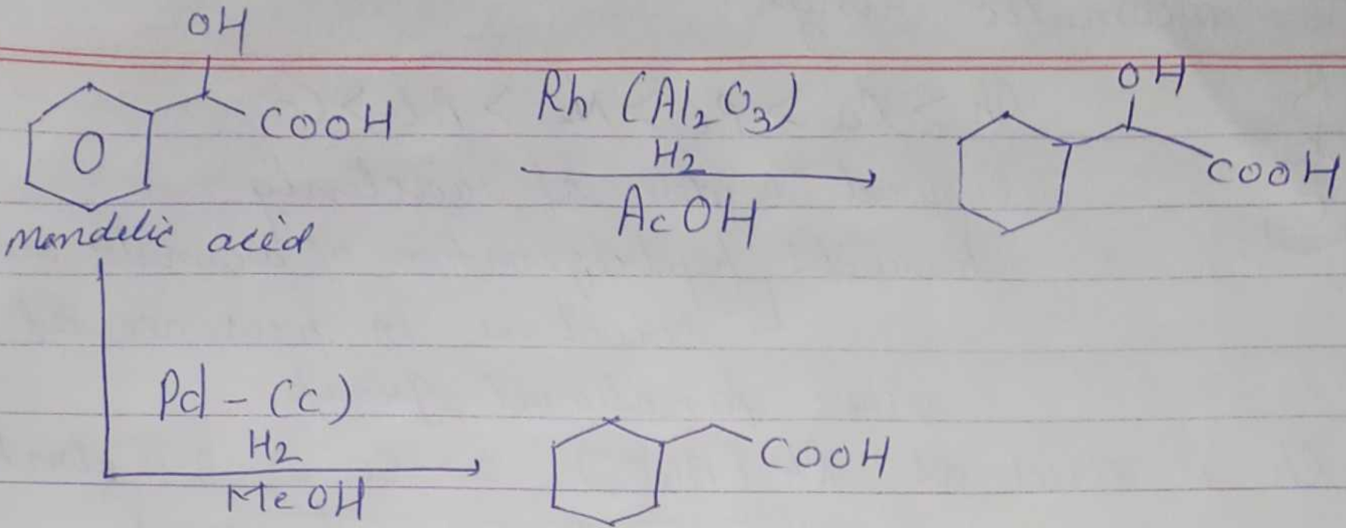


Acetic acid :- High absorption of H_2 gas in solution.
↳ plays very crucial role (effect of solvent.)

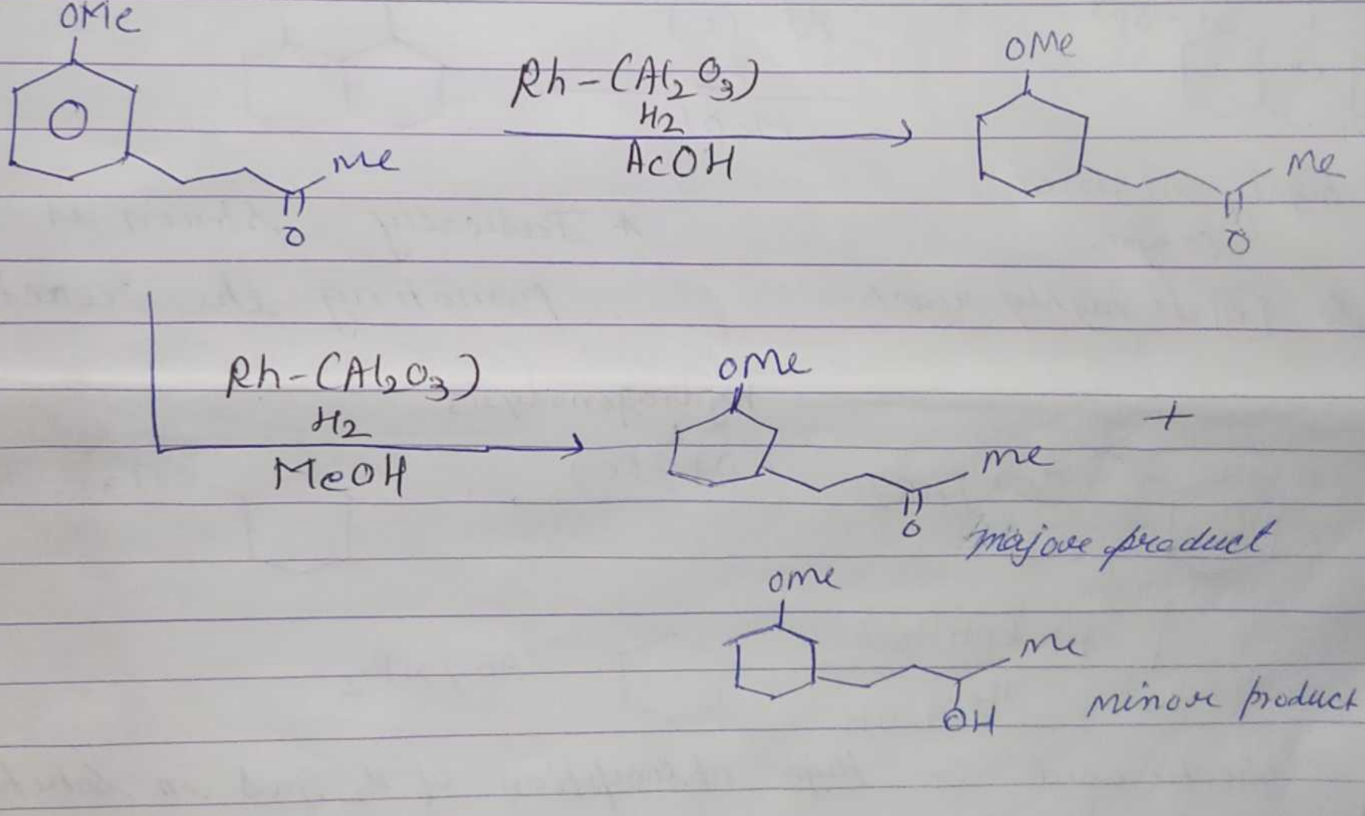
* RuO_2 – (C), EtOH, 100°C, 100 atm H_2] rxn conditions
~~Re~~ catalytic activity of Ru is less than Rh, that's why we need elevated T & P.

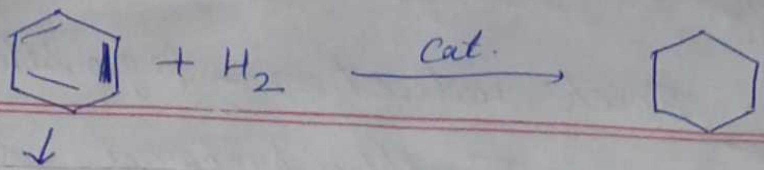


hydrogenolysis of C–X bond always take place.



* if we want hydrogenolysis at benzylic position, Pd on charcoal is always the right choice.



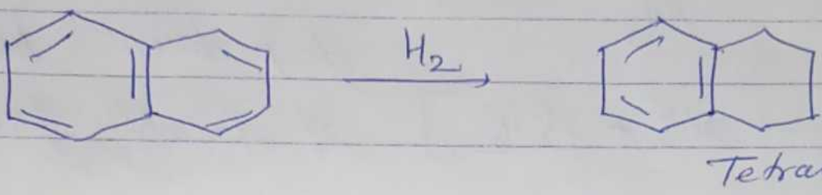


E_s = 150.8 K.cal/mole (more stable)

I step :- Breaking up of conjugation.

Endothermic
requires more energy.

subsequent steps are easier and exothermic



Tetralin

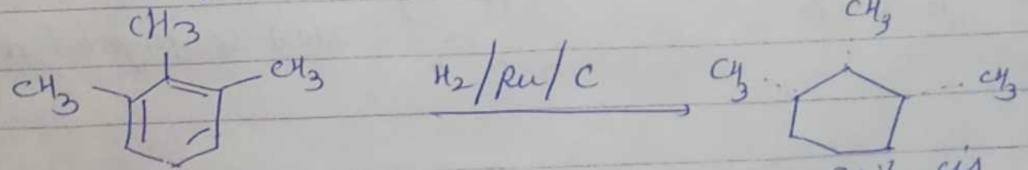
E_s of naphthalene is lesser than benzene, so hydrogenation is easier.

Heterogeneous catalysts:-

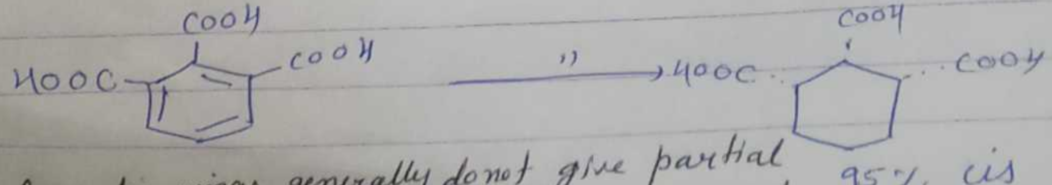
1) finely divided metals like Pt, Pd etc. on activated charcoal, alumina or silica.
2) PtO_2 (Adam's catalyst)
3) Raney Nickel

Homogeneous catalyst → Wilkinson's catalyst or Ruthenium complexes.

* One face of an aromatic ring to be adsorbed onto metal surface, the subsequent addition of H_2 to come from the metal. → cis diastereomers would formed.



90% cis



95% cis

* Aromatic rings generally do not give partial reduction in presence of heterogenous cat.