Golden Notes

Chemistry

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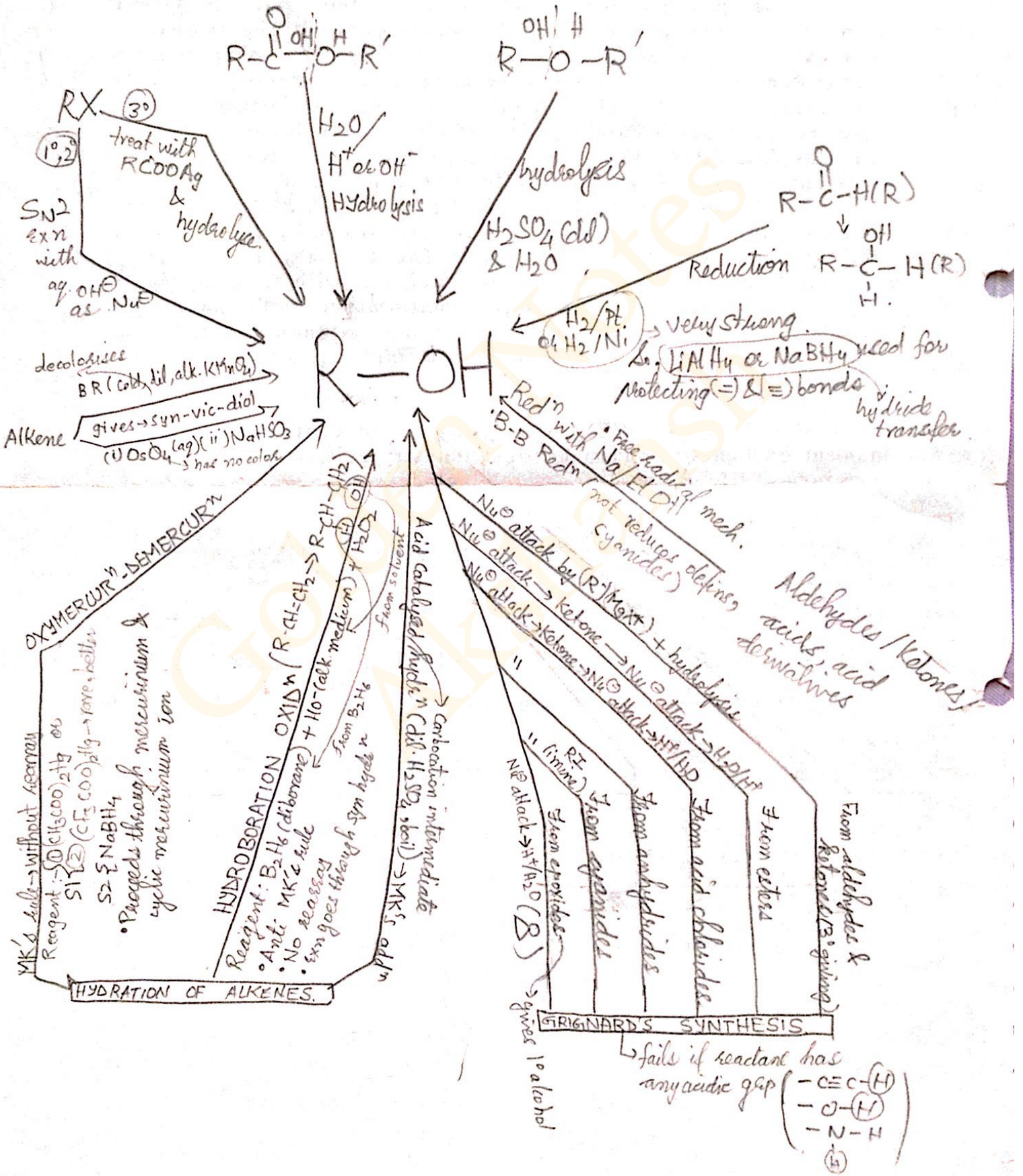
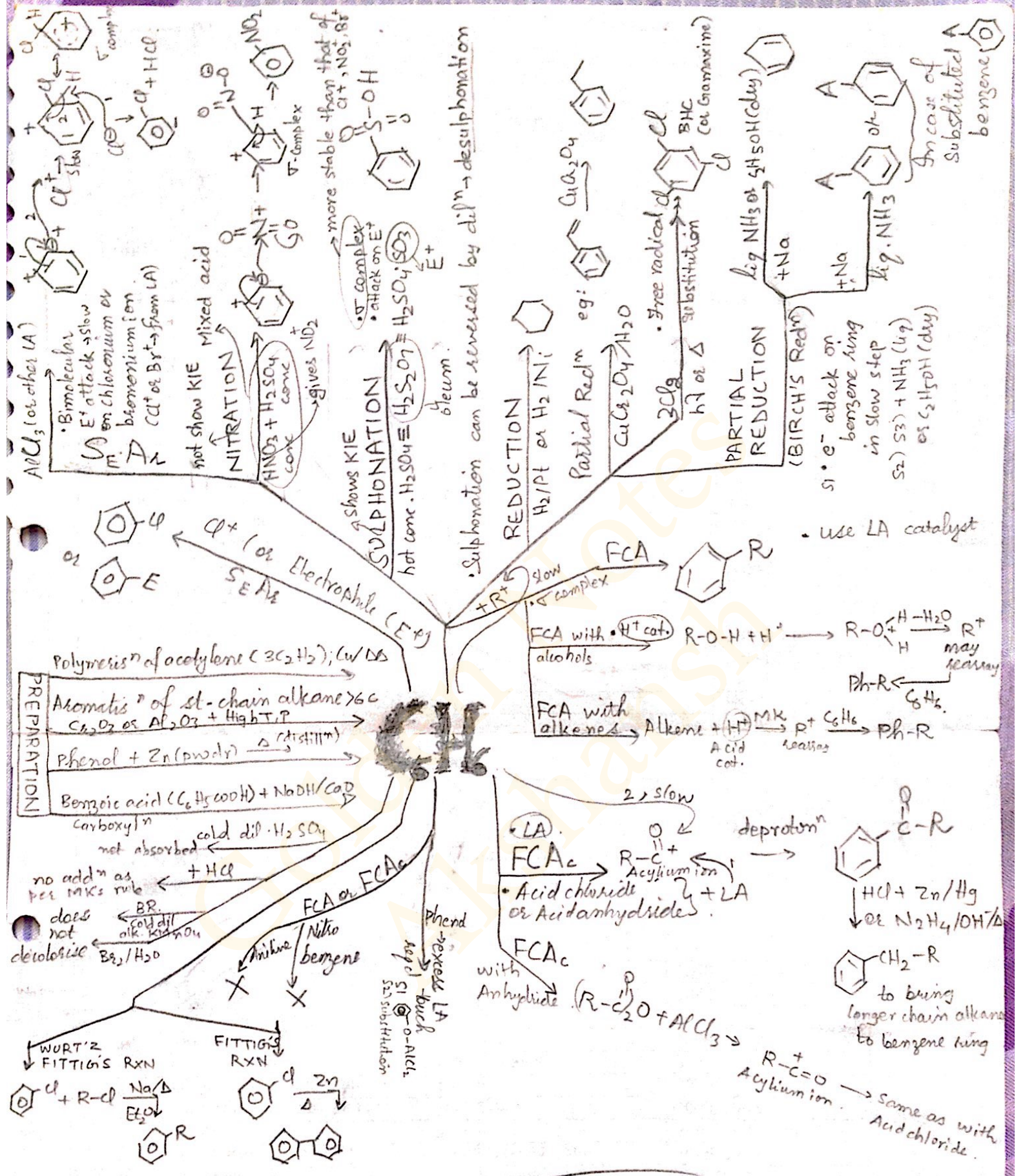
ALCOHOLS → PREPARATION



PREPARATION

MADE BY
AKSHANSH

REACTION



S_EAr :

ACTIVATING

o-p directing

- -R
- -OR
- $-NH_2$
- -OH
- $-NHCOR$
- $-\overset{H}{N}-\overset{O}{C}-R$ (carboxylic part; aniline part) ANILIDE

DEACTIVATING

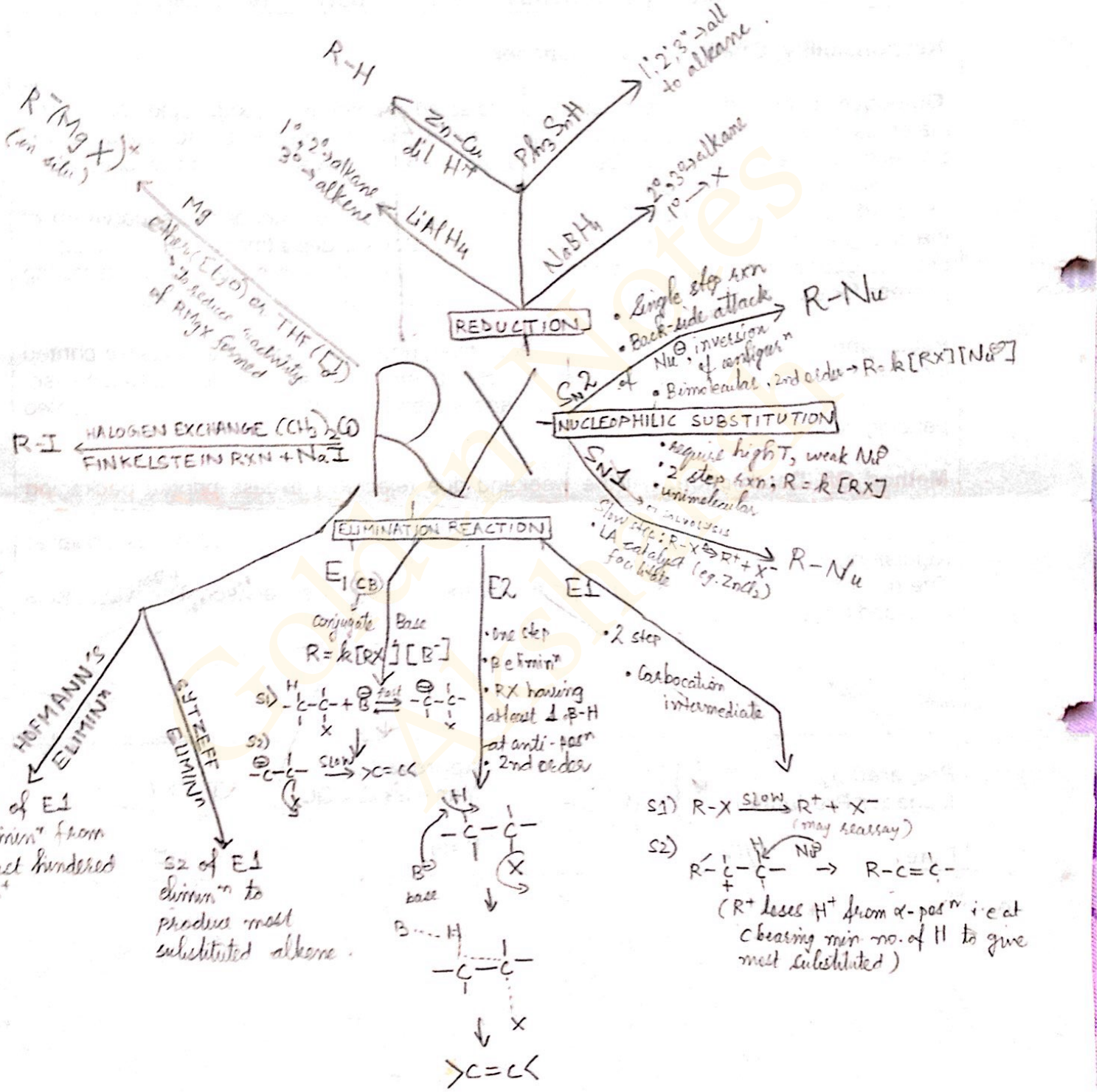
m-directing

- $-NO_2$
- -CN
- -CHO
- -C(O)R
- $-SO_3H$
- $-C(O)NH_2$
- -C(O)-OR

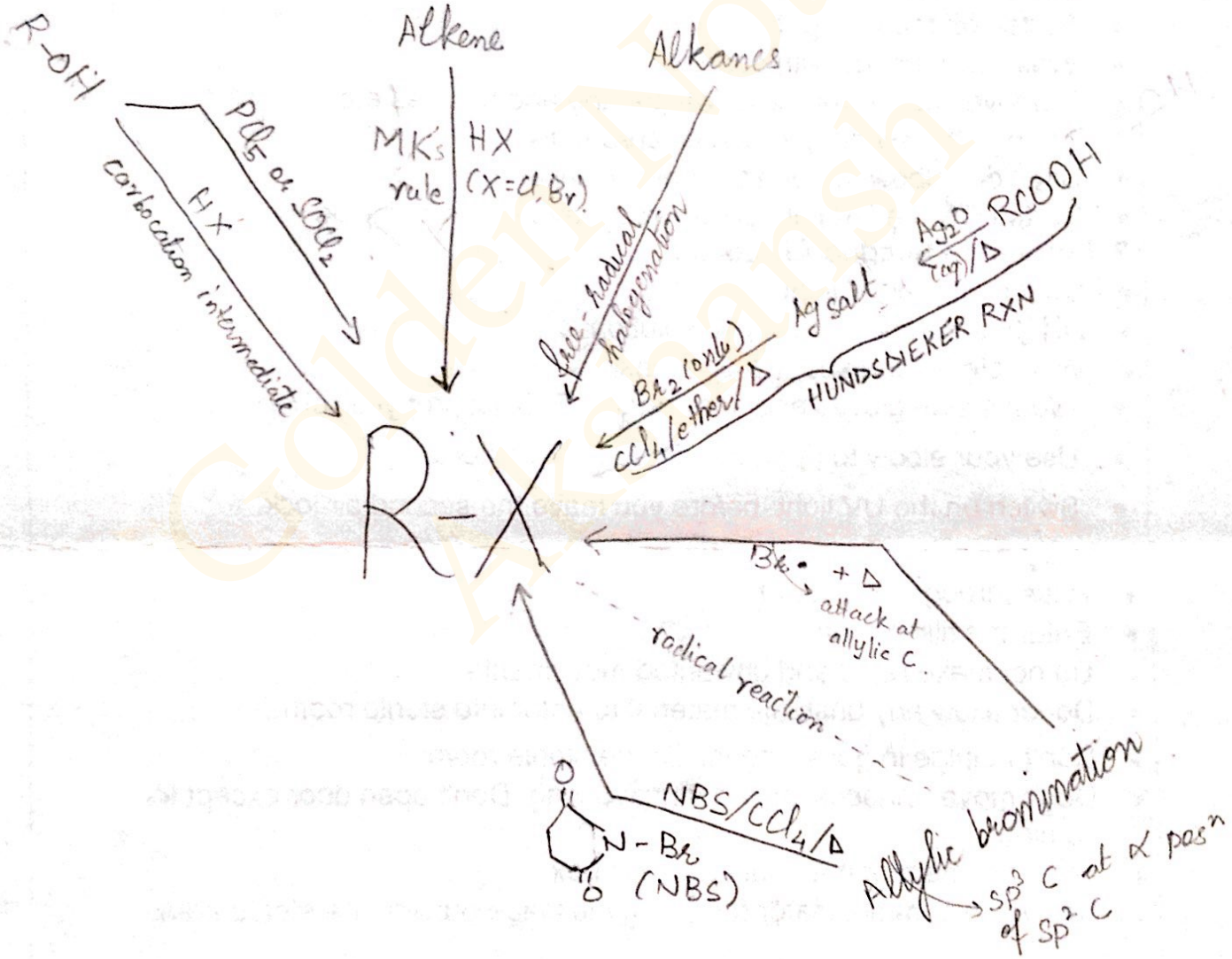
o-p directing

- -X

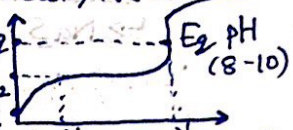
REACTIONS


R-H
Zn-Cu
dil HCl
Ph3SnH
1°,2°,3° → all to alkane
R'-Mg-X
(in dry Et2O)
1°, 2°, 3° alkane → alkene
LiAlH4
NaBH4
2°, 3° alkane
1° → X
Mg
ether (Et2O) or THF (cyclic)
• reactivity of RMgX formed
REDUCTION
• Single step rxn
• Back-side attack
Nu⊖ : inversion of configuration
• Bimolecular, 2nd order → R = k[RX][Nu⊖]
R-Nu
SN2
NUCLEOPHILIC SUBSTITUTION
• require high T, weak NP
• 2 step rxn; R = k[RX]
• unimolecular
SN1
in SOLVOLYSIS
Slow step: R-X ⇌ R+ + X−
• LA catalyst (eg. ZnCl2) for halide
R-Nu
R-I
HALOGEN EXCHANGE (CH3)2CO
FINKELSTEIN RXN + NaI
RX
ELIMINATION REACTION
E1(CB)
conjugate Base
R = k[RX][B⁻]
S1)
S2)
slow
>C=C<
E2
• one step
• β elimin
• RX having atleast 1 β-H at anti-para
• 2nd order
B: base
E1
• 2 step
• Carbocation intermediate
S1) R-X slow R+ + X−
(may rearrange)
S2)
(R+ loses H+ from α-para i.e at C bearing min no. of H to give most substituted)
HOFMANN'S ELIMIN
S2 of E1 elimin from least hindered R+
SAYTZEFF ELIMIN
S2 of E1 elimin to produce most substituted alkene.

PREPARATION



- For strong base & weak acid, Ka can be found as: $pH_{1/2} = Ka = [H^+]_{1/2}$



- Conc. of weak acid: $[HA] = \frac{[H^+]^2}{Ka} + [H^+]$; $[H^+]$ comes from $pH_{initial}$

- n/p ratio at Z = 20 is req^d 1. After Z = 21, n/p > 1.
- n/p > 1 : β⁻ decay
  n/p < 1 : Positron, e⁻ capture
- Kth root of unity is given by cis $\frac{2K\pi}{n}$
- r_+ : tetrahedral : 0.225
  r_- octahedral : 0.414
- Order of acidity :-
  $RH < RCH=CH_2 < NH_3 < R-C\equiv CH < ROH < H_2O <$ Phenol $< RCOOH < RSO_3H$
- Critical mass : Min. mass req^d to induce a chain reactor to sufficient explosion.
- Avg. BE/nucleon lies 8 to 9 MeV.
- Nuclear stability
  n & p :- even : stable
  odd : unstable
- Magic no. (At. mass stable)
  2, 8, 20, 28, 50, 82, 126
- Gelatin has min. gold no.
- conc. ∝ Power of coagul^n
- For same conc. of diff^t electrolyte, valency ↑; coagul^n power ↑.
- Extensive quantity :- depends on amt.
  eg: ΔH, all energy, resistance.
- Intensive : eg : conc. unit, molar energy, emf, resistivity, conductivity, viscosity, surface tension.
- State f^{ns} :- ΔH, ΔU, ΔS, ΔG.
- Al Purification : HOOP's PROCESS
- ZnS : Sphalerite.

- Magnetic moment $(\vec{M}) = i\vec{A}$
- Current (i) = (frequency)(charge) $= \left(\frac{\omega}{2\pi}\right)(q)$

- Force experienced by a dielectric slab when its just outside or at some distance inside // plate capacitor :-
  $|\vec{F}| = \frac{1}{2} bV^2 (\epsilon_0/d)(K-1)$
  d : distance b/w plates ; b : breadth.
- % age strength of oleum ($H_2SO_4 \cdot SO_3$) : Wt. of H_2SO_4 obtained on complete hydrolysis of 100g of oleum.
- Vol. strength of H_2O_2 : Vol. of $O_2(g)$ measured at STP which is produced on complete decompos^n of unit vol. of H_2O_2
  $N = \frac{\text{Vol. strength}}{56}$; $M = \frac{\text{Vol. strength}}{11.2}$; n factor = 2
- Fajan's Rule
- Cation is polarising ion
  Anion is ion to be polarised.
- Smaller size or higher charge of cation ⇒ greater polarising power
- Larger size or higher charge of anion ⇒ greater ability to be polarised.
- Cation having d orbital > noble gas : Polarising power
- Covalency ∝ $\frac{1}{\text{Thermal Stability}}$
- Osmium has max. density (22.4).
- $E = n(f/2\, K_b T)$
- $M(OH)_2$, MF_2 : Solubility ↑ down the grp. 2.
- MCO_3, MSO_4 : Solubility ↓ down the grp 2.

- Borax ($Na_2B_4O_7 \cdot 10H_2O$) is used as buffer.
  n-factor = 2
  Methyl orange indicator req^d for end pt.
  Bead in Borax bead test is of HBO_2.

- To reduce only 1 NO_2 grp on C_6H_6
  ↳ Na_2S

- Ore of Mg: Dolomite ($MgCO_3 \cdot CaCO_3$)
  Ca: Colemanite ($Ca_2B_6O_{11} \cdot 5H_2O$)

- Lattice energy & hydr^n energy:
  ↓ down the grp.

- In any reaction, if the net vol. change is less, conc. is high ($\because$ conc. $\propto \frac{1}{Vol.}$). Hence, temp. change is high ($\because$ conc. $\propto \Delta$Temp.)

- Solubility $\propto \frac{1}{\text{Stability}}$ $\propto \frac{1}{\text{size}}$

- $\Delta Q = \Delta U + \Delta W$; $\Delta Q = \Delta H = nC_p dT$

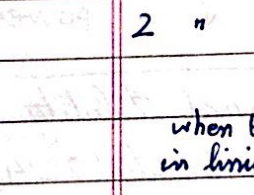
- Microcosmic salt: $[NaNH_4HPO_4]$

- Magnesia: MgO

- $MgCl_2 \cdot 6H_2O$: To dehydrate,
  $MgCl_2 \cdot 6H_2O \xrightarrow[\text{by dry HCl}]{\text{dehydrated}} MgCl_2$
  otherwise, $MgCl_2 \cdot 6H_2O \xrightarrow{\Delta} Mg(OH)Cl \xrightarrow{\Delta} MgO$

- Epsom salt ($MgSO_4 \cdot 7H_2O$)
  made from Kieserite
  $MgSO_4 \cdot 7H_2O \xrightarrow{150^\circ C} MgSO_4 \cdot H_2O \xrightarrow{200^\circ C} MgSO_4$ (170–180°C)

- $H_3BO_3 \xrightarrow{100^\circ C} HBO_2$ (metaboric acid) $\xrightarrow{160^\circ C} H_2B_4O_7$ (tetraboric acid)
  $B_2H_6 \xleftarrow[Al]{H_2} B_2O_3$ (Boron trioxide) $\xleftarrow{300^\circ C}$ tetraboric acid

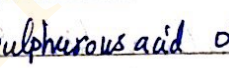
- Silicones
  1 halide: dimer (ON HYDROLYSIS)
  2 " : linear chain
  2 " : 
  when H_2O in limited amt
  3 halides: cross link.

- CN: predecided
  Mg = 6 Ag = 2
  Zn = 4 Cu = 6

- SILICATES (no. of O_2 paired)
  - Ortho $[SiO_4]^{4-}$ — 0
  - Pyro $[Si_2O_7]^{6-}$ — 1
  - Cyclic/Ring $(SiO_3)_n^{2n-}$ — 2
  - Chain $(SiO_3)_n^{2n-}$ — 2
    - Linear: Pyroxene
    - Cross chain: Amphibole
  - Sheet — 3
  - 3D (∞ repeating units) (SiO_2) — 4.

- Phosphorous
  Black > Red > White: Stability
  P_4(white) $\xrightarrow{250^\circ C}$ Red P $\xrightarrow[\text{without air}]{500^\circ C}$ P_4(v)

- Fools gold: FeS_2: Pysite

- Sulphurous acid series
  Pyrosulphurous acid 

- Ferny salt (KHF_2)
  $KHF_2 + H_2O \rightarrow (KHF)^+ + F^-$
  $KHF_2 \xrightarrow{\text{molten}} K^+ + H^+ + 2F^-$

- X_2 + conc. Base → XO_3^- (only for chlorine)
  + dil. Base → OX^- ⋯→ $(Cl)O_3^-$

- Oxides of Cl.
  Cl_2O + Base → HOCl
  ClO_2 + Base → $HClO_2 + HClO_3$
  Cl_2O_6 + Base → $HClO_3 + HClO_4$
  Cl_2O_7 + Base → $HClO_4$

- (Xe)
  $XeF_4 + 2SF_4 \rightarrow Xe + 2SF_6$
  $2XeF_6 + SiO_2 \rightarrow 2XeOF_4 + SiF_4$
  $XeF_2 + H_2 \rightarrow 2HF + Xe$
  $XeF_2 + H_2O \rightarrow Xe + 2HF + \frac{1}{2}O_2$ (slow)
  $8XeF_6 + 6H_2O$ (limited) $\rightarrow XeOF_4 + 2HF$
  $XeF_6 + 3H_2O \rightarrow XeO_3 + 6HF$ (violent rxn)

Equivalent mass

of elemt = Molar mass / valency

ion = Molar mass / valency of ion

base = Molar mass / Acidity (no. of displacable OH^- ions)

acid = Molar mass / Basicity (displaceable H^+ ions)

salt = Molar mass / Total +ve valency of metal

$\lambda_m^\circ = \frac{k \times 1000}{S}$ — molar conduc. for sparingly soluble soln; S = solubility

(5) Strength = amt of solute (g) / V of soln (L)

N = no. of geq of solute / V of soln (L) = $\frac{Wt}{\text{Equivalent wt}} \times \frac{1}{V}$ = $\frac{Wt \times \text{valency}}{\text{Molar mass} \times V}$

- Ideal solns — C_6H_6 - Toluene, hexane-heptane, bromobenzene - chlorobenzene.
- +ve deviation from Raoult's law: eg: acetone + ethanol or acetone + carbon disulphide
- -ve deviation: eg: phenol + aniline
- 1 atm = 101325 Pa = 1.01325 bar
- Colligative property $\propto$ no. of particles of solute
- Colligative property $\propto \frac{1}{\text{Molar mass of solute}}$

On Raoult's law

- $\frac{P - P_A^\circ}{P_B^\circ - P_A^\circ} = \chi_B$
- $\Delta T_b = K_b m$ — elevn in BPt; molality
- $\Delta T_f = K_f m$ — elevn in F.Pt
- $K_f = \frac{R \times M_1 \times T_f^2}{1000 \times \Delta H_{fus}}$
- $K_b = \frac{R \times M_1 \times T_b^2}{1000 \times \Delta H_{vap}}$

- If we add a non-volatile solute to a liqd, the VP of soln = VP of the volatile component only.
  i.e $P = P_A^\circ \chi_A$
  $\Rightarrow \frac{P}{P_A^\circ} = \chi_A$
  $\Rightarrow 1 - \frac{P}{P_A^\circ} = 1 - \chi_A$
  $\Rightarrow \boxed{\frac{P_A^\circ - P}{P_A^\circ} = \chi_B}$ — amt. by which P dec. on adding non-volatile solute (B)

For dilute solns: $\frac{P_A^\circ - P}{P_A^\circ} = \frac{n_B}{n_A}$

For conc. solns: $\frac{P_A^\circ - P_s}{P_s} = \frac{n_B}{n_A} = \frac{W_B \times M_A}{M_B \times W_A}$

- $\pi = CRT$ — osmotic P; C = conc; n = mole; V
- If a soln of V cm^3 contains 1 geq of electrolyte then $\lambda_{eq} = kV$ — equivalent conductivity; kappa
- $\Delta G = -nFE_{cell}$
- $\Delta G^\circ = -nFE^\circ_{cell}$
- If C geq are present in 1000 cm^3 of soln, then 1 geq = $\frac{1000}{C}$ cm^3 of soln. So, $\lambda_{eq} = \frac{k \times 1000}{C}$ — conc.
- $\chi_m = \frac{k \times 1000}{M}$ — molar conductivity; Molarity
- $\alpha = \frac{\lambda_m^c}{\lambda_m^\circ}$ — degree of dissociation

Debye-Huckel Onsager eqn

- $\Lambda_m^c = \lambda_m^\circ - A\sqrt{C}$ — at any conc; at ∞ dil^n; constt; conc.

weak electrolytes

- Kohlrausch law: $\lambda^\circ_{A_xB_y} = x\lambda^\circ_{A^+} + y\lambda^\circ_{B^-}$

- Na/Ethanol → Reduces all to alcohols, te spares olefins.
- $(CH_3COO)_2Hg$ / (H_2O) → $NaBH_4$ No rearray, Markovnikoff's add^n of H_2O
- B_2H_6 (OH^-) / H_2O_2 → Anti markovnikoff's addition of water.
- Bayer's Reagent → Add^n of H_2O at C=C
- MsCl, TsCl → Used to substitute (OH^-); Triflate best in category (T_f)
- PCl_3, PCl_5, $SOCl_2$ → alcohol → chloride [$SOCl_2$ only for 1° alc.]
- HI/P (red) → Reduces everything.
- Jone's Reagent [CrO_3 in aq. acetone] :- O.A., does not affect olefenic bonds.
- PCC (CrO_3/HCl) → Alcohol to carbonyl.
- Hot, conc., acidic $KMnO_4$ → exhaustive oxid^n. Gives two acids for Tale. ($-\overset{O}{\overset{\|}{C}}-$ formed goes with smaller alkyl group.
- CuO/Δ → Alcohol to carbonyl. (But require high temp.)
- dil H_2SO_4/Δ → Hydration
- conc. H_2SO_4/Δ → Dehydration
- Alumina Al_2O_3 strong dehydrating agent (no rearray.)
- Lucas Reagent $ZnCl_2$/conc HCl → on addition to 3° Alc. turbid; 2° delay 1° not turbid
- DIBAH Reduces acid chl., anhydride, ester into resp. aldehyde
- $SnCl_2$, c.HCl (Stephen's Reagent) :- $R-C\equiv N \rightarrow R-\overset{O}{\overset{\|}{C}}-H$
- Oppenauer Oxidation ([$(t\text{-}BuO)_3Al$] aq) :- same as Jone's Reagent.
- Lemeiux Reagent (HIO_4) – Periodic Acid cleavage of syn, vic, diol.
- MPV reduction ($iPrO_3Al$) aq. :- Reduces C=O to C–OH does not affect anything else
- Clemmenson's Reagent [Zn(Hg); c.HCl] :- $>C=O \rightarrow >CH_2$
- Wolf-Kischner [N_2H_4/OH^- Δ] $>C=O \rightarrow >CH_2$
- Rosenmund ($Pd/BaSO_4$; Quindine) :- Acid chloride → carbonyl.
- $Al(C_2H_5O)_3/H_2O$:- Forced cannizzaro of aldehyde with α-H