



"Bringing Excellence to Students"



Handwritten Notes On CARBOHYDRATES

Carbohydrates

- all $C_x(H_2O)_y$ aren't carbs
- all compounds, not following $(C_x(H_2O)_y)$ aren't necessarily non-carbohydrates (eg, Rhamnose ($C_6H_{12}O_5$), deoxyribose ($C_5H_{10}O_4$))
- chemically, defined as optically active polyhydroxy ald./ketones or compounds which produce such units on hydrolysis.
- All carbs giving Fehling's and Tollen's Test are reducing.
- All monosacch. are reducing.
- In disacch., if reducing grp of constituent monosacch are bonded, non reducing (Sucrose)
- 'D' and 'L' refers to their relation with a particular isomer of glyceraldehyde.

Glucose

(Two crystalline forms)

α (mp -419K)

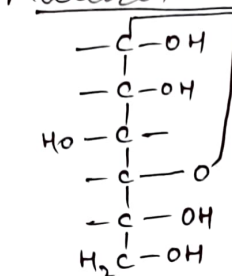
β (mp -423K)
@ 371K ($\pm 50^\circ C$)

→ obtained by crystallization from conc. solⁿ of glucose @ 303K (30°C)

→ The word pyranose / furanose derived from:

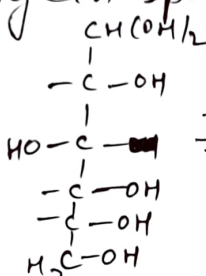
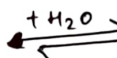


→ Mutarotation: change in specific rotation value due to inter-conversion



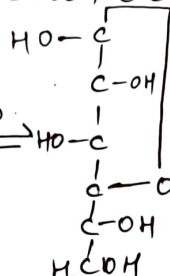
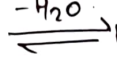
α -D.
[α]_D = +113

(36.1°)



(intermediate aldehydot form)

[α]_D = +52.5

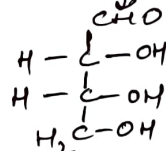
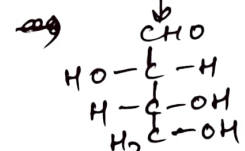


β -D.
[α]_D = +19.5

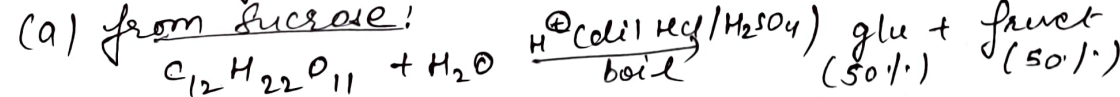
(64.1°)

→ If C at which epimer forms aren't specified, assume C₂

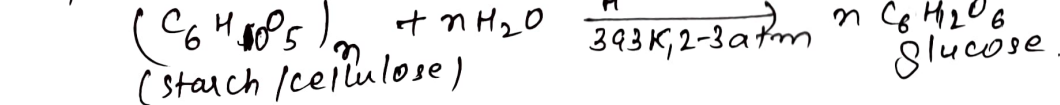
→ threose is a C₂ epimer of erythrose.



→ Prepⁿ of Glucose:

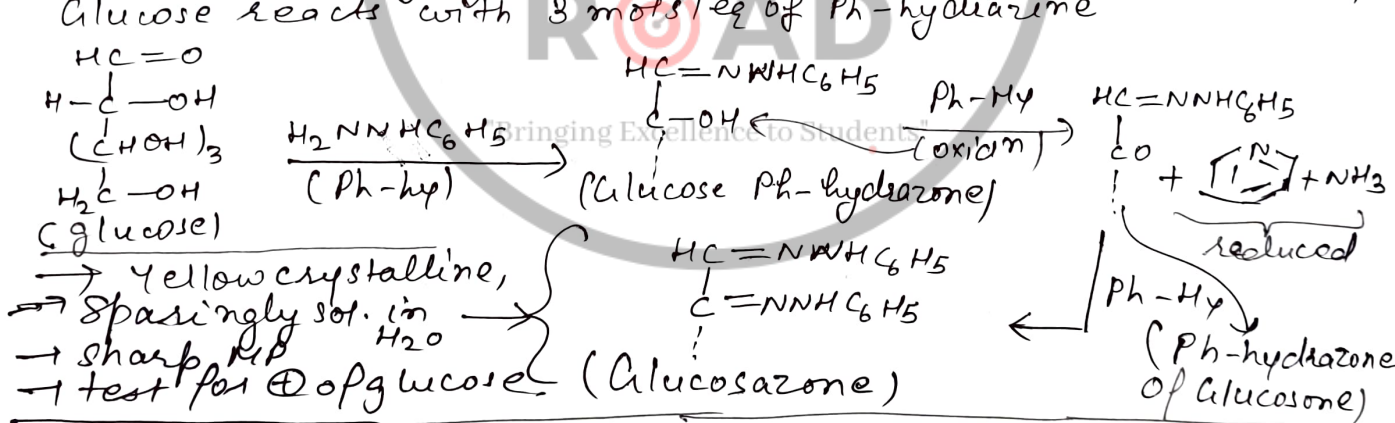
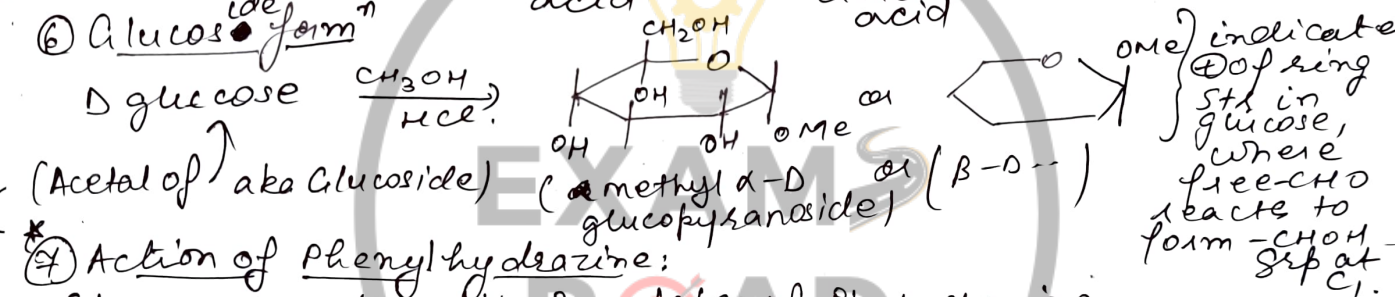


(b) commercial method (from starch):



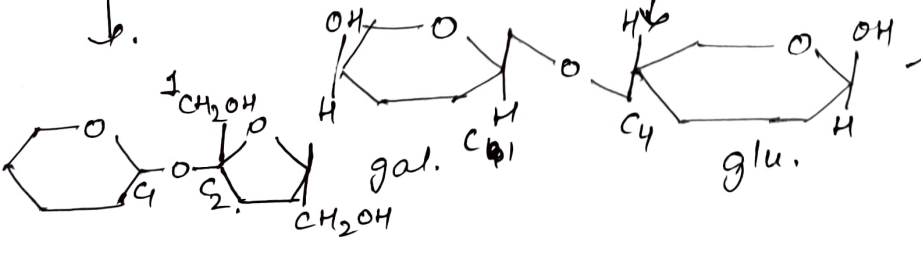
rxⁿs of glucose:

- ① glucose $\xrightarrow[\text{HI}/\Delta]{\text{Red P}}$ (n-Hexane) (suggests that all 6 carbons are linearly arranged)
- ② rxⁿ of ald. grp. $\xrightarrow[\text{HCHO}]{\text{(i) } \text{NH}_2\text{OH}}$ (hydroxylamine) $\text{C}_5\text{H}_{11}\text{O}_5 - \text{CHO} \rightarrow \text{C}_5\text{H}_{11}\text{O}_5 - \text{CH}=\text{N}-\text{OH}$ (confirmⁿ of \oplus of carbonyl grp)
 $\xrightarrow[\text{HCHO}]{\text{(ii)}}$ $\text{C}_5\text{H}_{11}\text{O}_5 - \text{CH}(\text{CN})_2$ (cyanohydrin)
- ③ CHO $\xrightarrow[\text{(eg Br}_2)]{\text{mild o.a.}}$ COOH (glucosonic acid) } (indicates \oplus of ald grp as carbonyl grp.)
 $(\text{CHOH})_4$
 CH_2OH
- ④ CHO $\xrightarrow[\text{(Acetic anhydride)}]{\text{Acetylation}}$ $\text{CH}-\text{OCOCH}_3$ } confirms \oplus of 5-OH grps on diff carbons.
 $(\text{CHOH})_4$
 $\text{CH}_2-\text{OCOCH}_3$
- ⑤ CHO $\xrightarrow[\text{(oxidⁿ)}]{\text{HNO}_3}$ COOH } indicates \oplus of a 1^o alcohol grp.
 $(\text{CHOH})_4$ $\xrightarrow{-\text{H}}$ $(\text{CHOH})_4$
 CH_2OH Saccharic acid Glucosonic acid



Disacch: Done

- Sucrose (α -D glu + β -D fruct)
- Maltose (α -D, α -D) → Lactose (β -D gal, β -D glu)



lysacch: amylose
starch: amylopectin
 amylose
 → 15-20%
 → water soluble
 → linear, α → (1,4)
 → 200-1000
 → I₂ test (blue-black) ✓

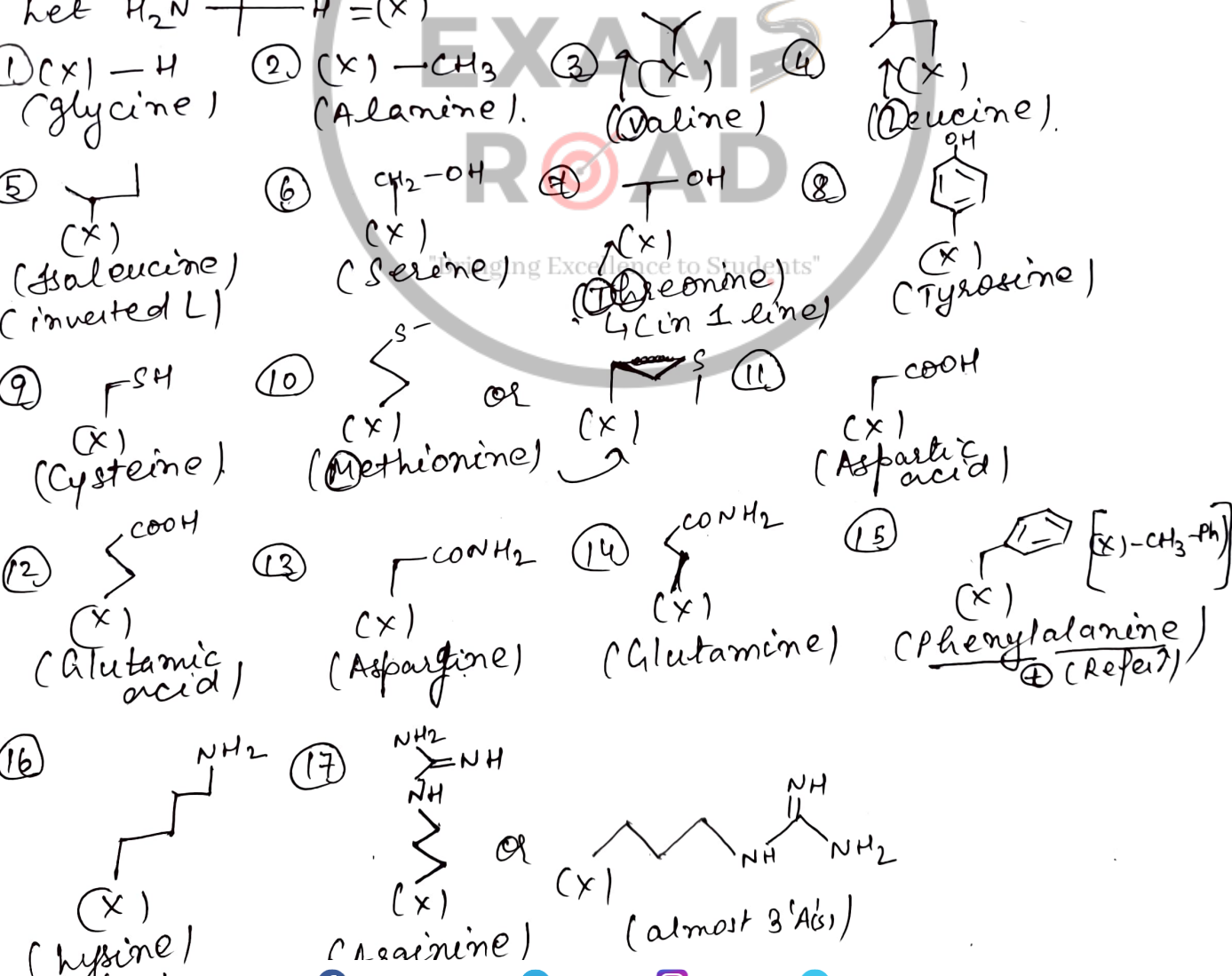
amylopectin
 → 80-85%
 insoluble
 → branched, α → (1,4 or 1-6)
 → T high
 → x

Glycogen: ⊕ in liver, brain, muscles
 → animal starch (like to amylopectin but branching ↑)
 → also ⊕ in yeast, fungi

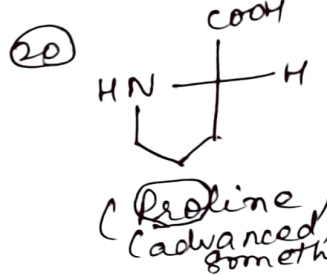
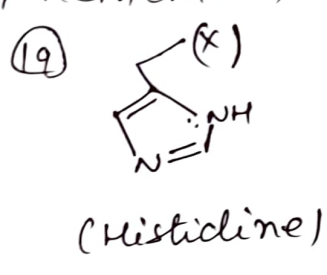
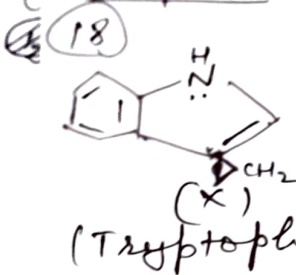
(Rest Done)

Amino acids: Depending on position of NH₂ & COOH grp (α, β, γ, δ, ...)
 → proteins → α ⊕
 → Glycine (as Glykos: sweet), tyrosine was first obtained from cheese (tyros: cheese)

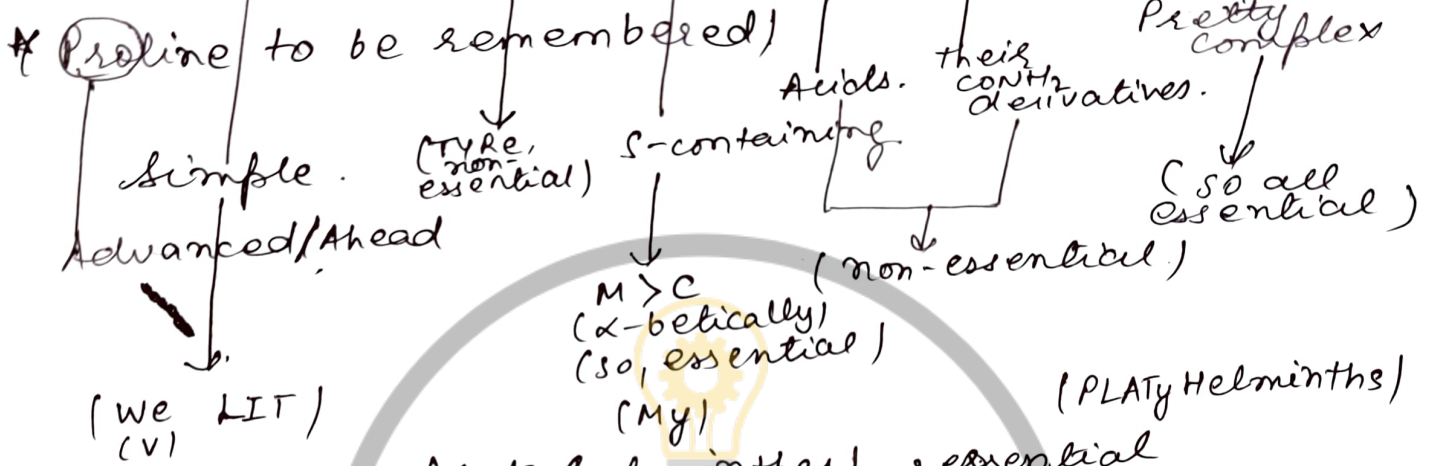
How to Remember Amino acid structures:



Complex: (Just Remember)



[GAVE LIST; TYRE CAM AGE AGE; PLATy Helminths]



(we list my platyhelminthes) → essential

Exceptions to one letter code:

1. Arginine → R
 2. Lysine → K
 3. Glutamic acid → E
 4. Aspartic acid → D
 5. Glutamine → Q
 6. Asparagine → N
 7. Ph-OH₃ → F
 8. Tyrosine → Y
 9. Tryptophan → W
- all irregular

As per the above seq:

- A. acid → D
- G. acid → E
- A → N
- G. → Q

Asp → R (as A was already used)

Lysine → K (as after K, L comes)

Ph-OH₃ → F (as DE already used above)

Tyr → Y (as T was already used)

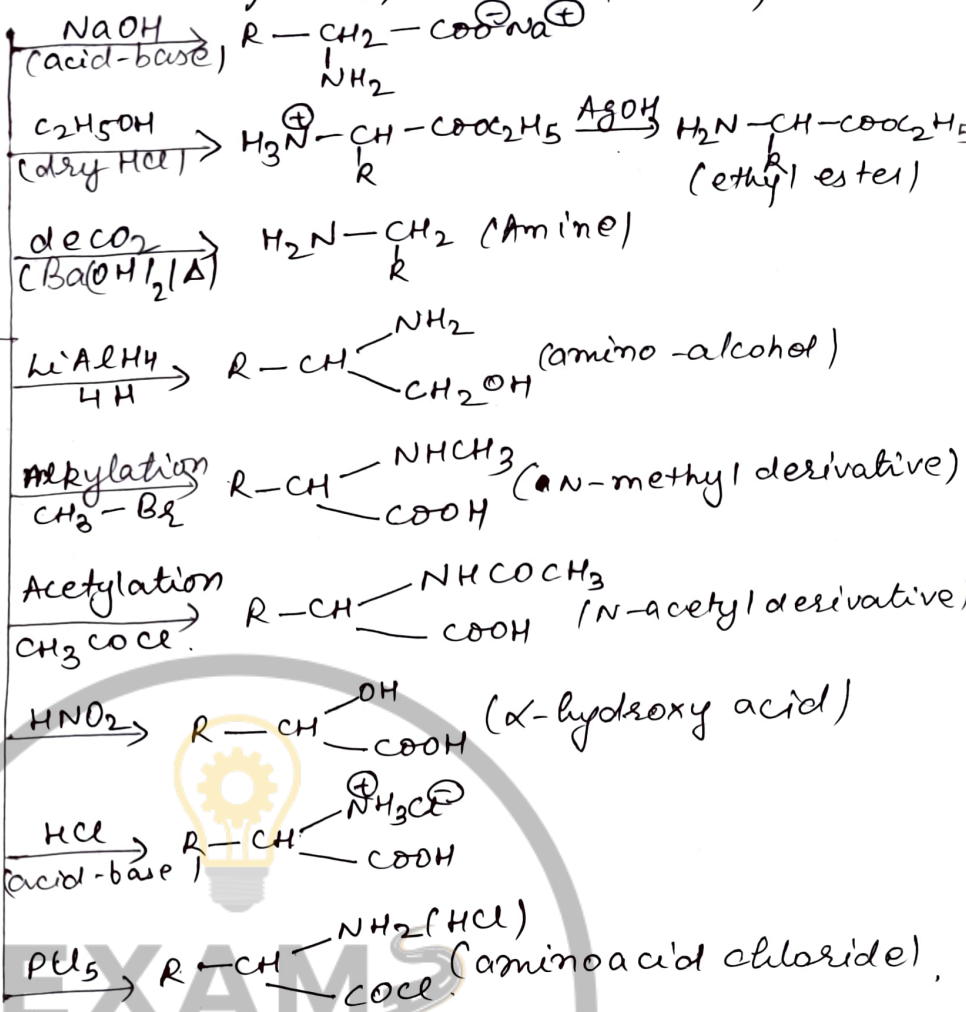
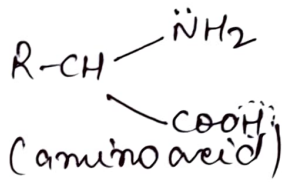
Trp → W (to follow the trend, two skipped)

* for others, blindly use the 1st letter.
(also, PLATy 9 acids and derivatives and TYRE are exceptions)

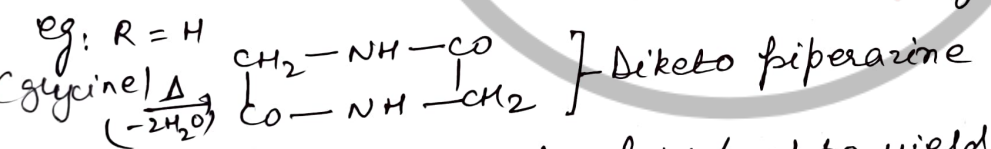
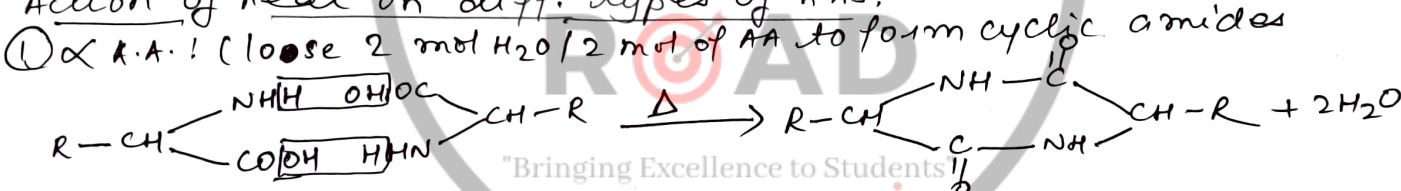
Exceptions to three letter code (very less):

1. Isoleucine → Ile (Iso can't be used)
 2. Glutamine → Gln (to indicate they are amides)
 3. Asparagine → Asn
 4. Tryptophan → Trp (already learnt in Trp operon)
- ↳ I cut it. (I got it)!

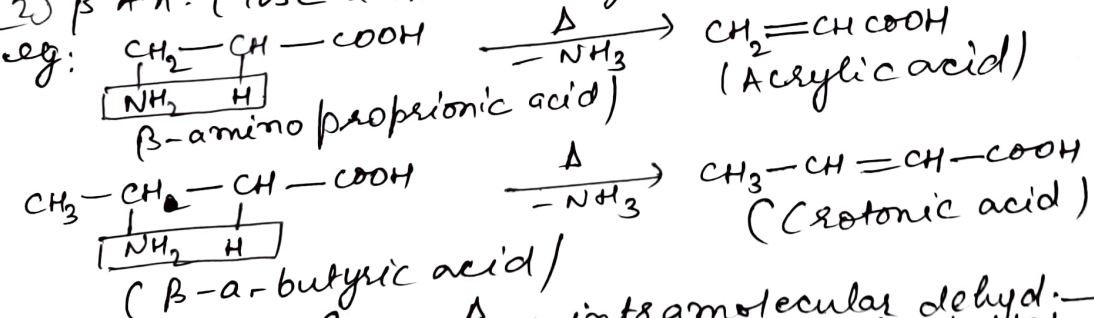
Chemical Properties: (show rxns of $-NH_2$, $-COOH$ and/or both)



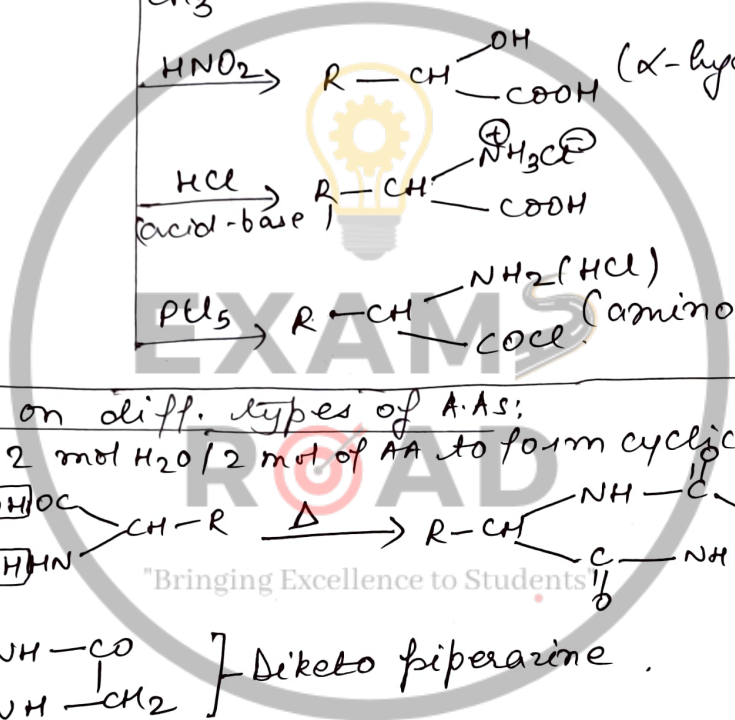
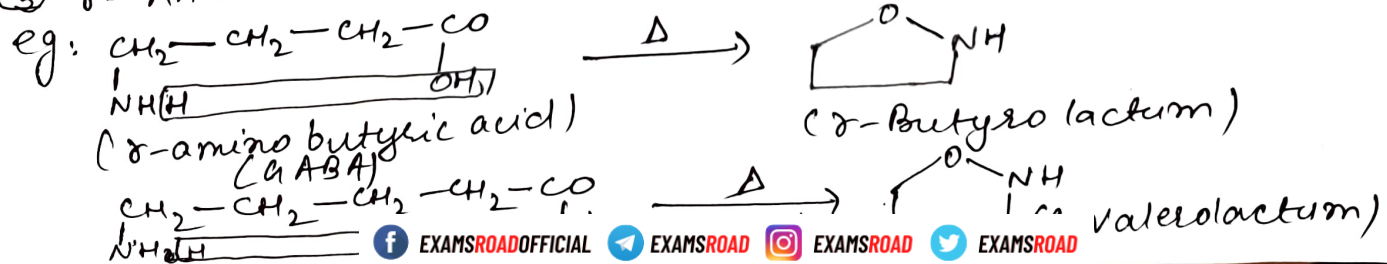
Action of heat on diff. types of A.As:



② β A.A.: (lose a molecule of NH_3 / mol to yield α,β unsaturated acids)

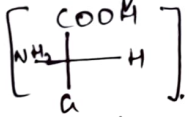


③ γ -AA and δ A.A $\xrightarrow{\Delta}$ intramolecular dehyd. \rightarrow cyclic aka lactam amides (as 5/6 m.c.s. stable)



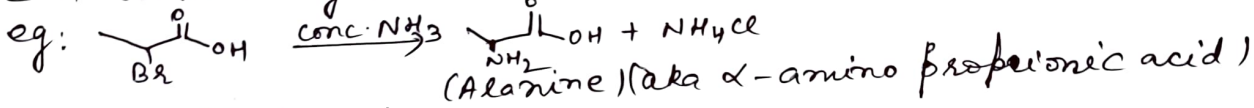
→ Amino acids: usually colourless, crystalline solids, water soluble, high melting solids, behave as salts (rather as acid/amides) due to existence in zwitterion form.

→ most naturally occurring A.A. are 'L' form, represented by writing NH_2 grp on LHS

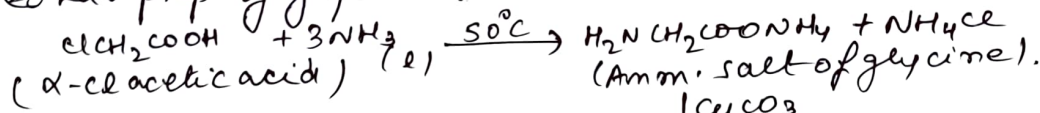


Methods of Prepⁿ of A.A:

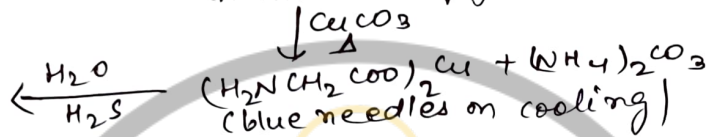
① Amination of α -halo acids



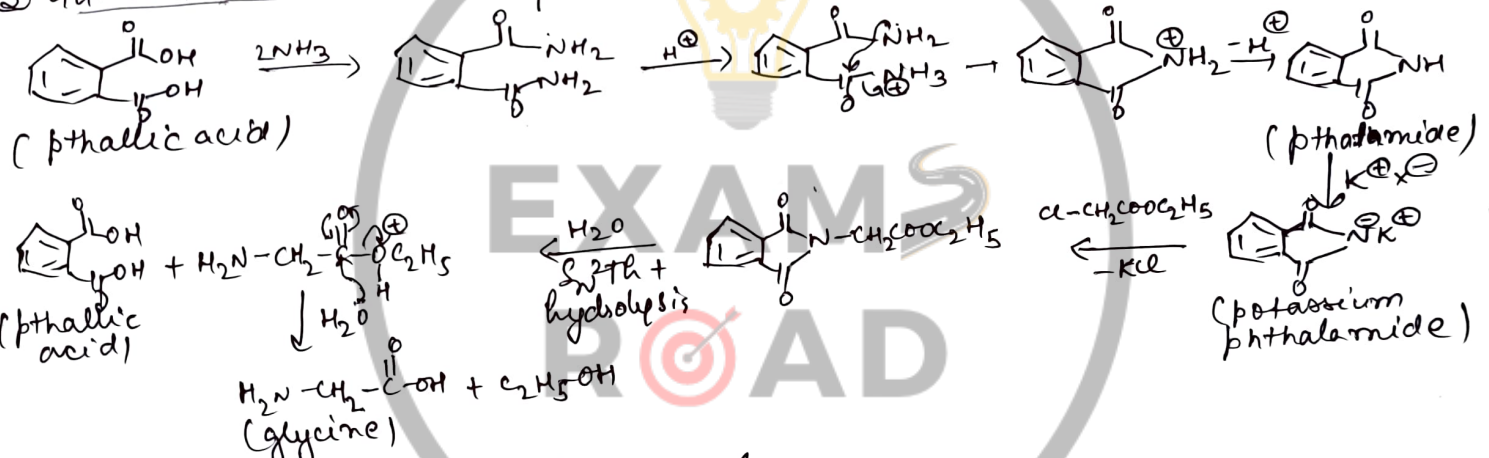
② Lab prepⁿ of glycine:



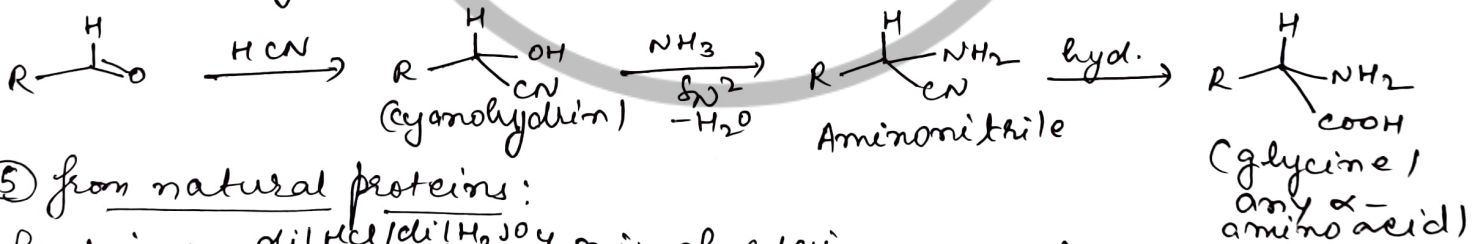
$\text{CuS} \downarrow$ + glycine



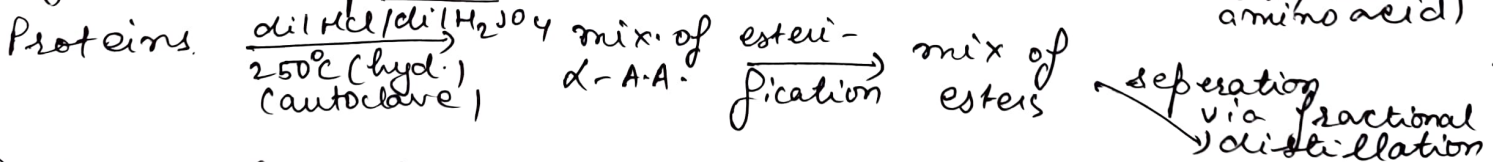
③ Gabriel Phthalimide synthesis:



④ Strecker synthesis (from aldehyde)



⑤ from natural proteins:

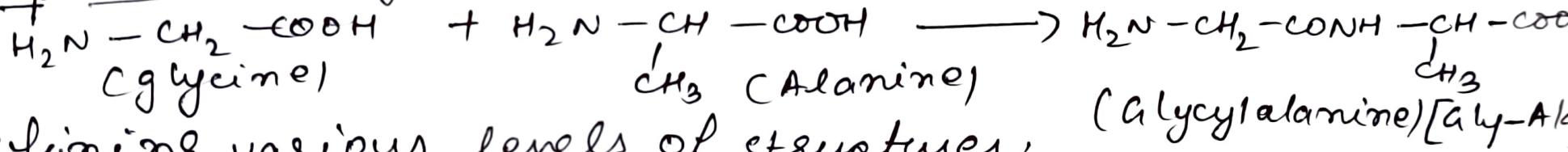


Properties of A.A. (Physical)

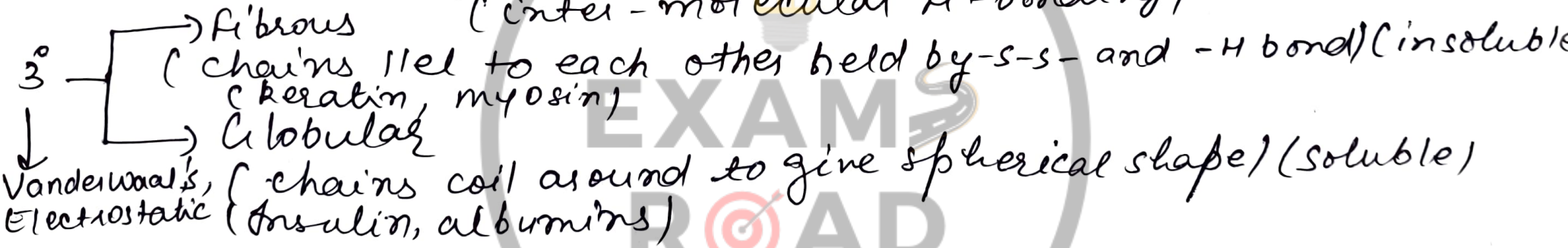
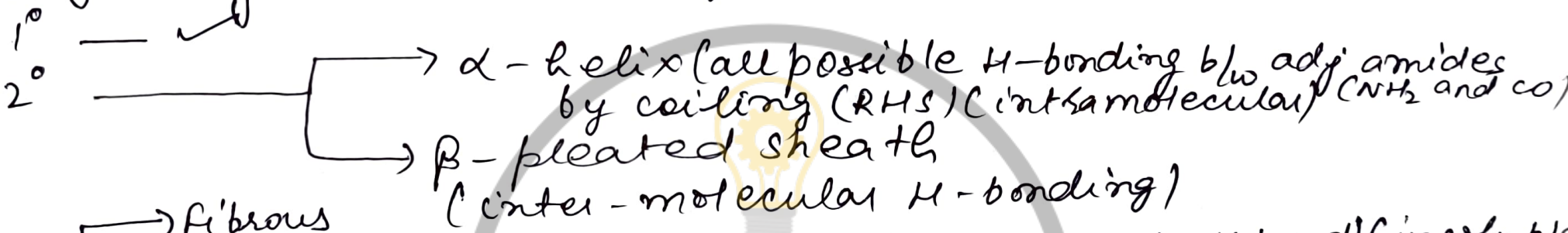
- ① Colourless, crystalline, sweet taste, melt via decomposition @ $>200^\circ\text{C}$. soluble in water but insoluble in organic solvents.
- ② In proteins, mostly L-conformation of A.A. found.
- ③ In neutral medium, 'inner salt' formed, aka bipolar ion/zwitterion which is why - high melting solids (∴ charged, ionic)
- ④ Isoelectric point

Proteins: (word proteios: primary / of prime importance)

peptide linkage:



Defining various levels of structures:



4° → Two or more chains / subunits.
(way of arrangement of 1°) → defined by 4° structure.

* Hb — 574 amino acids

Normal Hb: V H I T P E E K
(remember) (we hit Peek)

SCA: V H I T P V E K
(automatically ✓)

Composition (normally):	
C (50-53%)	S (1%) → Con H ₂ S
O (23-25%)	Hb → Fe
N (16-17%)	T ₄ → I
H (6-7%)	nucleic acids - P

native protein: Biologically active protein

Denaturation: C f EXAMROADOFFICIAL EXAMROAD EXAMROAD EXAMROAD 9 of milk.