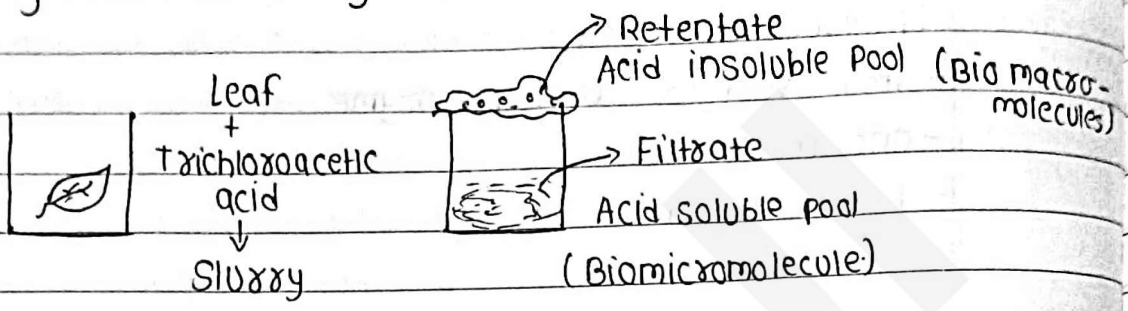
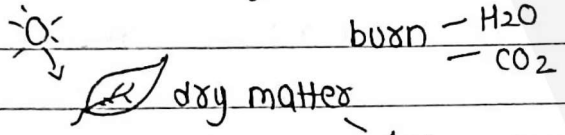
* Biomolecules *

* Biomolecule

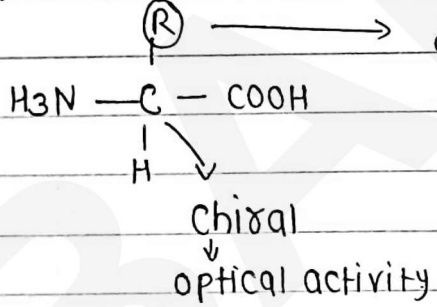
- Carbon containing compounds present in living system
- They contain carbohydrates, Proteins, Nucleic Acids, Lipids



Ash Analysis



* Amino Acids.



R → decides its physical & chemical properties
- Substituted methane
- found in filtrate

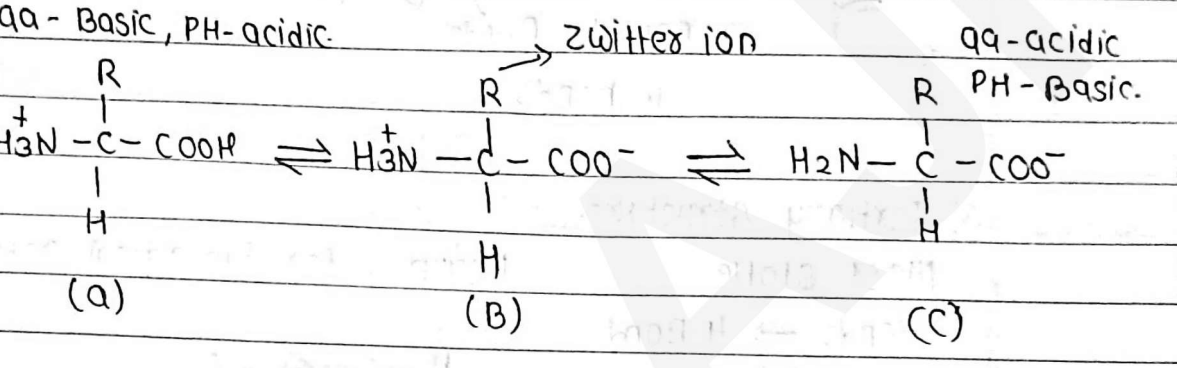
Glycine doesn't show optical activity

Types.

1) Neutral aa - Glycine, alanine, valine, Leucine, Isoleucine
2) Acidic a.a - Glutamic acid, Aspartic acid.
3) Basic aa - Arginine & lysine (Histone)
4) Aromatic a.a - Phenylalanine, Tryptophan, Tyrosine
   - ↳ Auxin in plants
   - ↳ Serotonin & Melatonin

5) Alcoholic a.a - Serine
6) Sulphur containing - Methionine & Cysteine
Essential a.a - Valine, Isoleucine, Threhine, methionine, lysine, phenylalanine, Histidine, Leucine

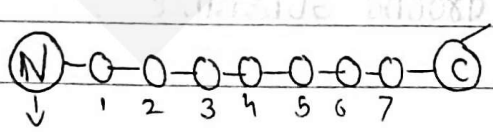
Zwitter ion / Bipolar / dipolar



PI - PH at which a molecule has zero net charge.

Protein:
- Protein is a heteropolymer
- most abundant in biosphere - Rubisco
- most abundant in Animal - Collagen

Classification
1) Primary Structure

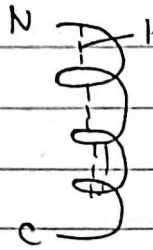


N-terminal

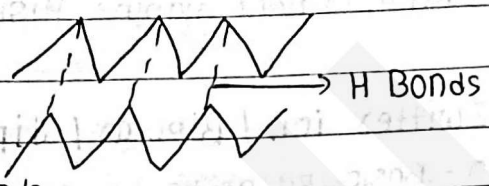
Which amino acid is there at what position

2) Secondary Structure.

helix



B-pleated



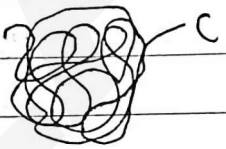
Peptide Bonds

H-bonds

3) Tertiary Structure.

Most Stable — Required for biological activities

Bonds → H Bond
→ Peptide
→ disulphide
Ionic vander wall forces



Eg- Myoglobin

Hydrophobic bonds

4) Quaternary Structure Eg- haemoglobin

Functions of Protein.

Collagen - Intercellular ground substance
Trypsin - Enzyme
Insulin - Hormone
Antibody - fight against infections
Receptor - Sensory reception
GLOT-4 → Enables transport of Glucose into cells.

* Carbohydrates

- Monosaccharide
  - one sugar
  - Ribose (5C)
  - Glucose, Fructose, Galactose (6C)
- Oligosaccharide
  - → 2-10 sugar
  - Lactose (Glu + Galactose)
  - Sucrose (Glu + Fructose)
  - Mallose (Glu + Glu)
- Polysaccharide
  - more than 10 sugar
  - Heteropolysaccharide
    - peptidoglycan (NAG - NAM)
  - Homopolysaccharide
    - Storage
      - Glycogen (Glucose)
      - Starch (Glucose)
      - Inulin (Fructose (In some plants)
    - Structural
      - cellulose (Glycan)
      - Chitin (exo-Skeleton of arthropods)

* Lipids:

- water insoluble
- Lipids contain carbon, Hydrogen, oxygen (number of Oxygen atoms are less)
- Types of lipids:

1) Simple lipids

- formed by fatty acid + glycerol

R-COOH

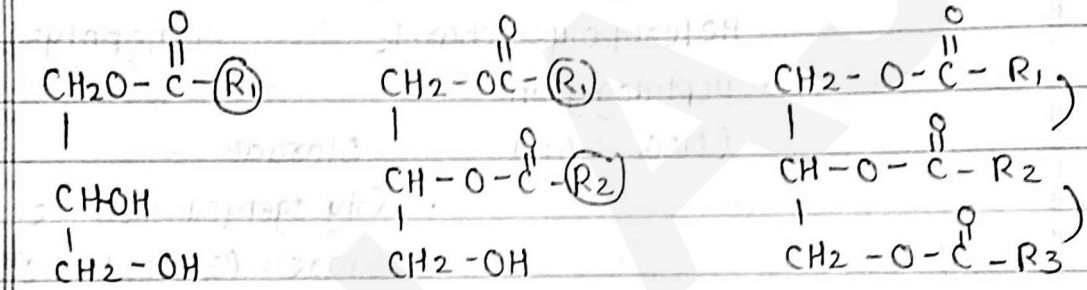
Eg- Palmitic acid (16C)

Arachidonic acid (20C)

Fatty acid

Saturated	Unsaturated
No double or triple bond	one or more C=C
Ex - palmitic acid, Stearic acid	Eg - oleic acid

Structure OF Glycerol (Trihydroxy propane)



Monoglyceride Diglyceride Triglyceride

2) Compound lipids

Formed by Fatty acid + glycerol + additional group (phosphate)

Ex - Phospholipid (Lecithin - cell memb)

3) Derived lipids.

Formed by Simple lipid + compound lipid

Ex - Cholesterol

Based on melting point of lipids

Fats oils (low melting point)

high melting

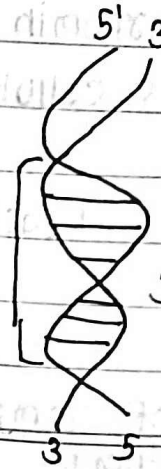
* Nucleic Acid (RNA & DNA)
- Heteropolymers of nucleotides
- Nucleotides formed by phosphate, sugar & Nitrogen bases

Nitrogen bases (Nitrogen containing cyclic compound)

Purines	Pyrimidines
- Adenine (A)	Cytosine (C)
- Guanine (G)	Thymine (T)
	Uracil (U) → RNA

Nitrogen base + Sugar = Nucleoside
Adenine + " = Adenosine
Guanine + " = Guanosine
Cytosine + " = Cytidine
Thymine + " = Thymidine
Uracil + " = Uridine

Nitrogen Base + Sugar + Phosphate grp = Nucleotide
Adenine + " + " = Adenylic Acid
Guanine + " + " = Guanylic Acid
Cytosine + " + " = Cytidylic Acid
Thymine + " + " = Thymidylic Acid
Uracil + " + " = Uridylic Acid



DNA
2 Strands antiparallel (double helix)
one full turn = 10 steps (10 base pairs)
distance between 2 bp = 3.4
DNA backbone - sugar-phosphate

Nitrogen bases
A, G, T & C xUK
A = T Phosphate-sugar
G ≡ C ↓ phosphodiester bond
Sugar - NB
N-glycosidic bond

* **Metabolism**

Sum of all the biochemical Reaction occuring in an organism
Metabolites - organic compounds that take part in metabolism

Primary metabolites	Secondary metabolites
Necessary for life	Not involved in
aa, nucleic acids	normal growth / reproduction
vitamins, lipids	

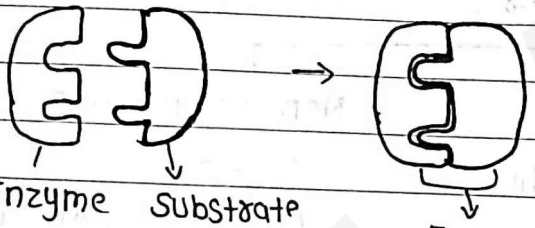
Secondary metabolites	Examples
Pigments	carotenoids, Anthocyanins
Alkaloids	Morphine, Codeine
Terpenoids	Monoterpenes, Diterpens
Essential oils	Lemon grass oil
Toxins	Abrin, Ricin
Lectins	Concanavalin A
Drugs	Vinblastin, curcumin
Polymeric substances	Rubber, gums, cellulose

Metabolic pathways - Series of linked chemical Reaction

Anabolic	Catabolic
synthesis of biomolecules	Breakdown of complex molecule
- consumes energy	Releases energy

☆ The living state is a non-equilibrium steady state to be able to perform

* Enzymes:
- Biological catalyst
- All enzymes are proteins but "Ribozymes" are nucleic acid (RNA)
- Enzymes are very specific for their substrats
- Enzymes form tertiary structure with some pockets



→ Enzyme product complex. (EP)

↓

Product + Enzyme

↓

Free for another Rxn

Factor affecting Enzyme Activity

$Ba(OH)_2 + H_2SO_4 \longrightarrow BaSO_4 + 2H_2O$

Inorganic Rxn

Starch + H_2O → Glucose

Organic rxn

Rate of Reaction = $\frac{\text{amount of Product}}{\text{Unit time}} = \frac{\delta P}{\delta t}$

If the direction of Rxn is specified → velocity

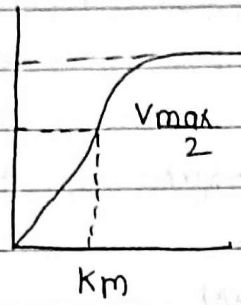
Temperature - for every 10°C change

doubles or decrease by half.

At low temp - no enzyme activity

high temp - Destroy enzyme

Concentration of substrate.

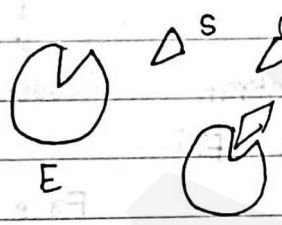


NO free Enzyme
Can't bind with substrate - no produ

(Michaelis constant)

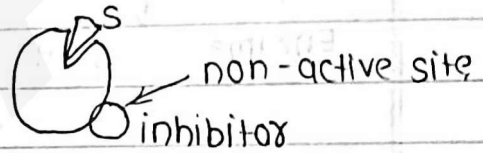
Presence of Inhibitor

Competitive



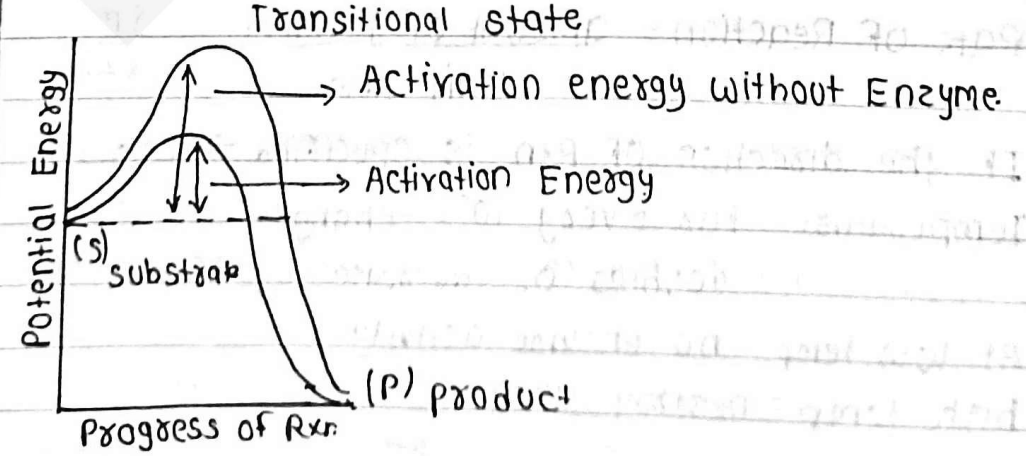
Inhibition of succinic dehydrogenase by malonate because it has similar str. to succinate

Non-competitive

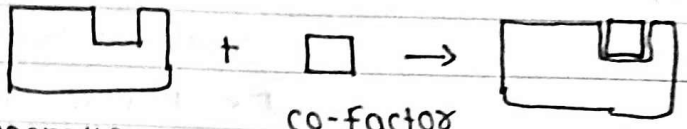


Change the Shape, structure of Enzyme

Activation Energy



* Co-Factors



Types of Co factors.

Prosthetic grp	Co-enzyme	Metal ions
– tightly bound organic	loosely bound organic	Zn – carboxypeptidase Mg^{2+} – kinase
Haem – Peroxidase ↓ Catalase H_2O_2 (Brain)	NAD, NADP (niacin) vitamin	