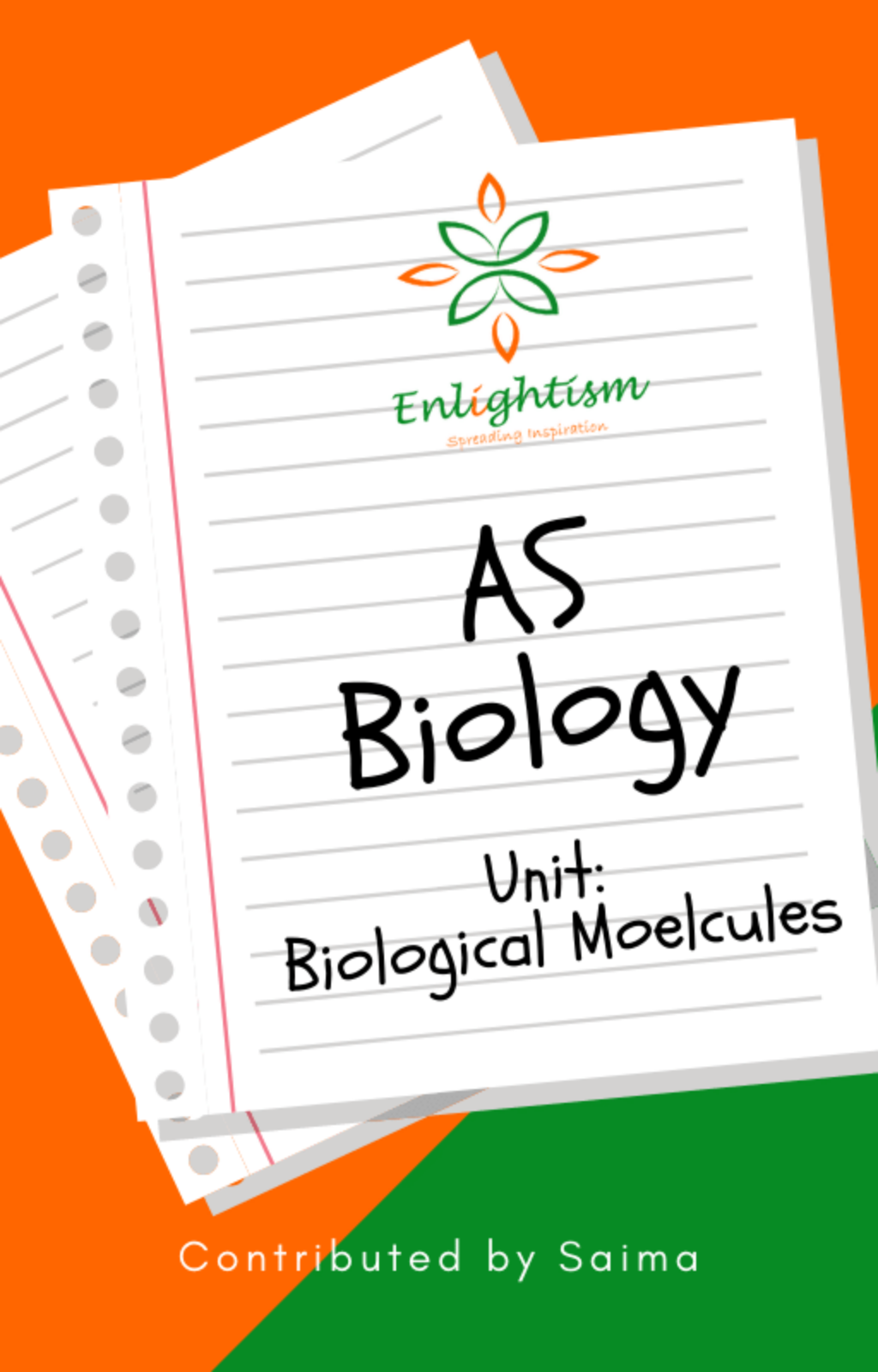

Enlightism
Spreading Inspiration
AS
Biology
Unit:
Biological Moelcules
Contributed by Saima

=> fat is not a polymer. Nd a macromolecules Just a big molecule.

Day / Date

=> polysaccharides, polypeptide and DNA / RNA are polymers.

=> carbohydrates contain a single repeating subunit i.e glucose

=> protein have 20 subunits

Biological Molecules

Single unit = Monomer → Polymer = bigger thing

micromolecule = macromolecule

polymerization/ synthesis/ condensation/

monomer ⇄ dimer ⇄ polymer

hydrolysis/(we need water) decomposition/ break down

example of monomer:

glucose, fructose galactose	3	← glucose →	carbohydrate / poly saccharide
	20	← AA →	protien / polypeptide
fat		← fatty acids + glycerol →	lipids / fats / triglyceride
uracil adenine guanine cytosine Thyamin	5	← nucleotides →	DNA / RNA

carbohydrates

1. $C_n H_{2n} O_n$
2. hydrated compound of carbon
3. monomer glucose
4. 1 g → 16/17 kJ

Classification

Monosaccharide	Disaccharide	polysaccharide
$C_6 H_{12} O_6$	$C_{12} H_{22} O_{11}$ g.f	$C_n H_{2n} O_n$, $(CH_2O)_x$
glucose, fructose, galactose	sucrose, maltose, lactose	$(C_6 H_{10} O_5)_n$, $C_x (H_2O)_y$
isomers		starch, cellulose, glycogen

Sajid

Date

Pentose → DNA → deoxyribo sugar, make DNA & RNA
↳ RNA → Ribose sugar

5C

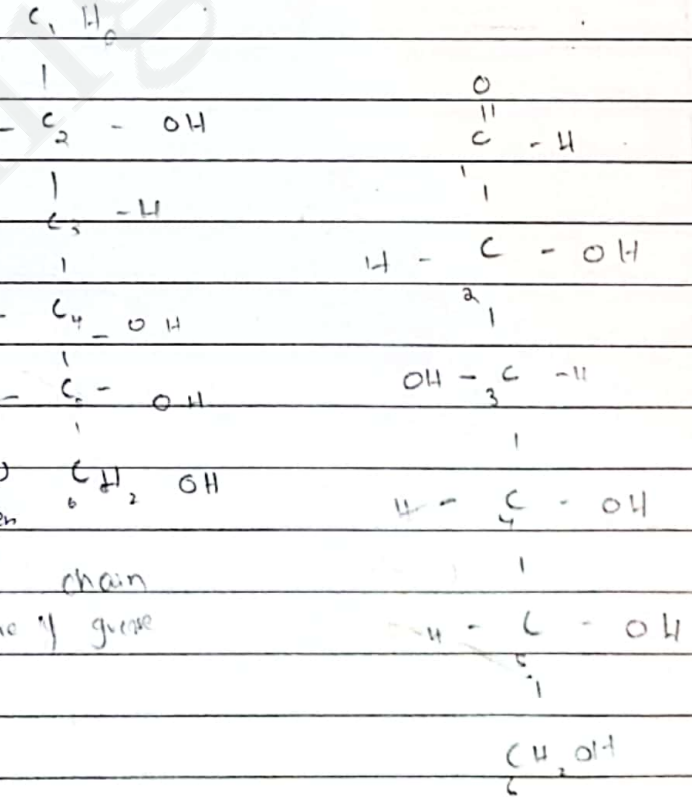
Tetrose & triose → they are present to share b/w carbohydrate metabolism
↓ resp. intermediate photosynthesis
4C & 3C

Glucose

1. Sweet in taste.
2. small molecule, dissolve in water can easily diffusing
3. can be saved during photosynthesis
4. used during resp. during resp. by mitochondria

Structure

straight chain structures never join to form dissachride. If new we have to convert Straight chain into cyclic. For this purpose we bring C_1 near C_6 C_1 joins with C_5 Oxygen becomes a part of straight chain ring C_6 moves structure of glucose as a side branch



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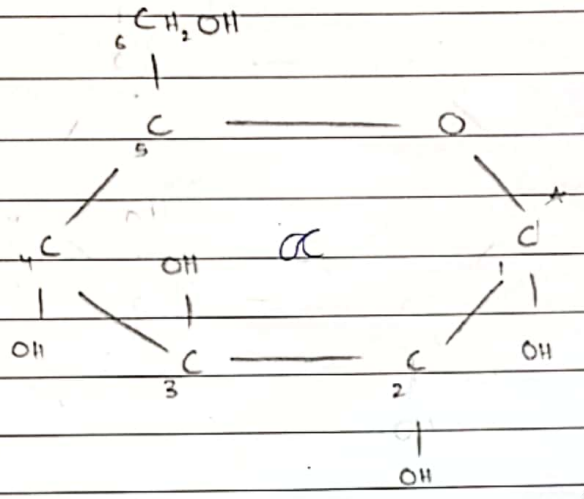
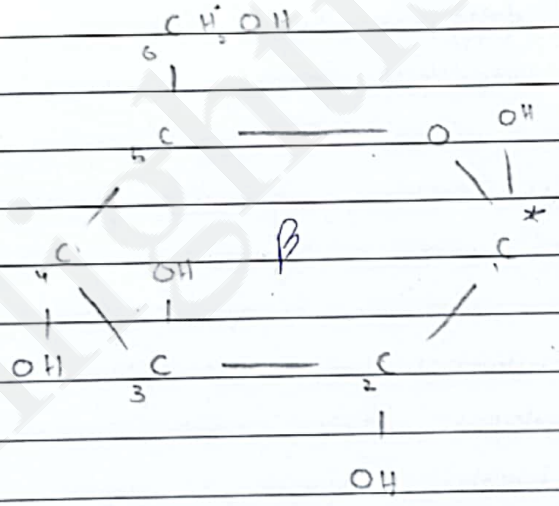


Q Draw diagram of α & β

Q Give differences b/w 2

Q Give similarities b/w 2

* 6 Carbon
* 12 OH
* Isomers

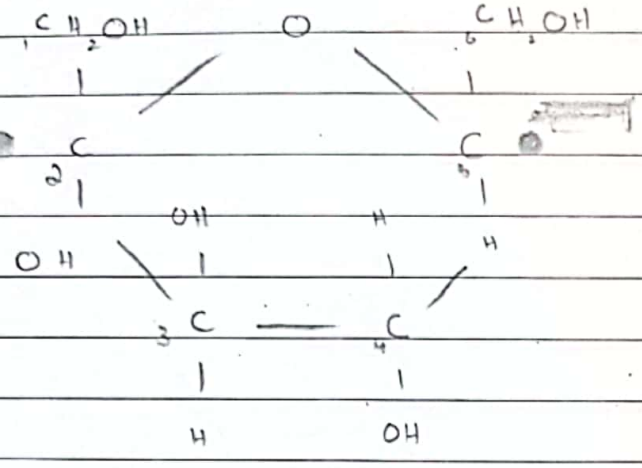


/ Date

Monomer

* learn only α & β

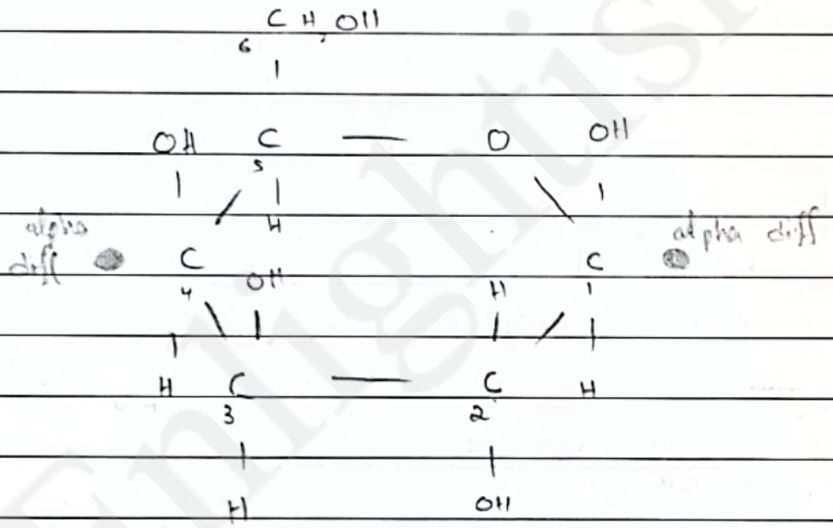
fructose $C_6H_{12}O_6$



* both have 6 carbon
* both have 5 OH groups

*ensamine does not need H. he just needs the location of OH

galactose



* fructose has a pentagonal structure while galactose has hexagonal structure
* In fructose Oxygen is presen b/w $_2C$ & $_5C$. In galactose it is present b/w $_5C$ & $_1C$
* fructose has 2 side branches whills galactose has one side branch

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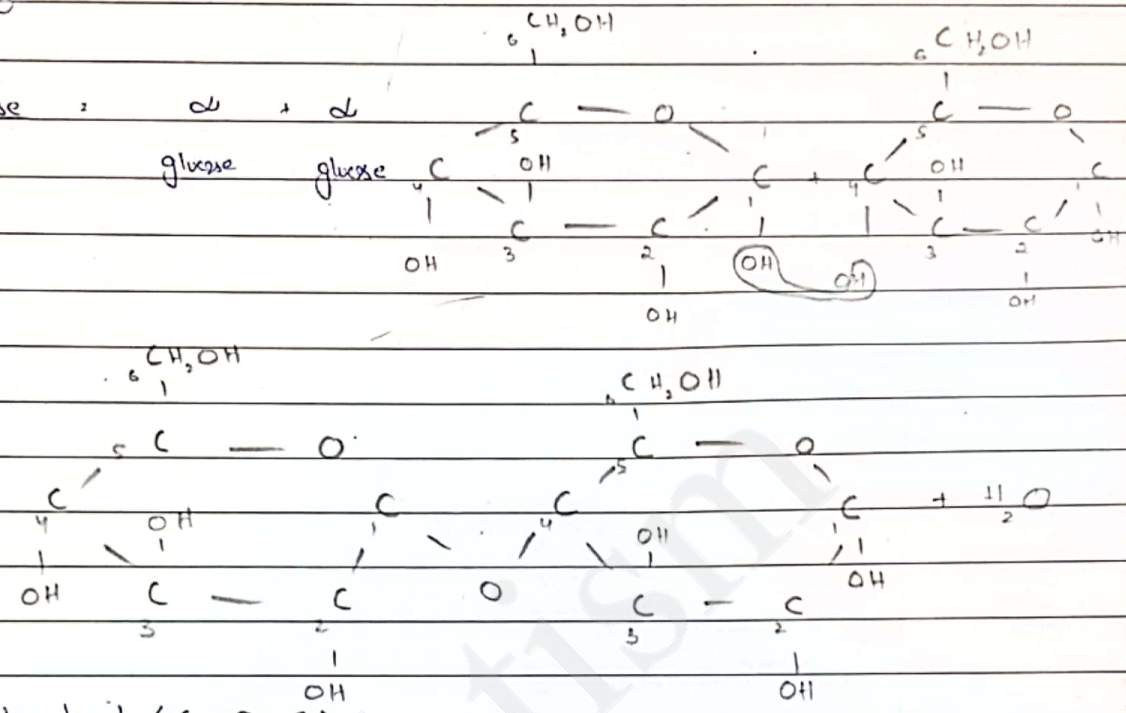
Disacchrides

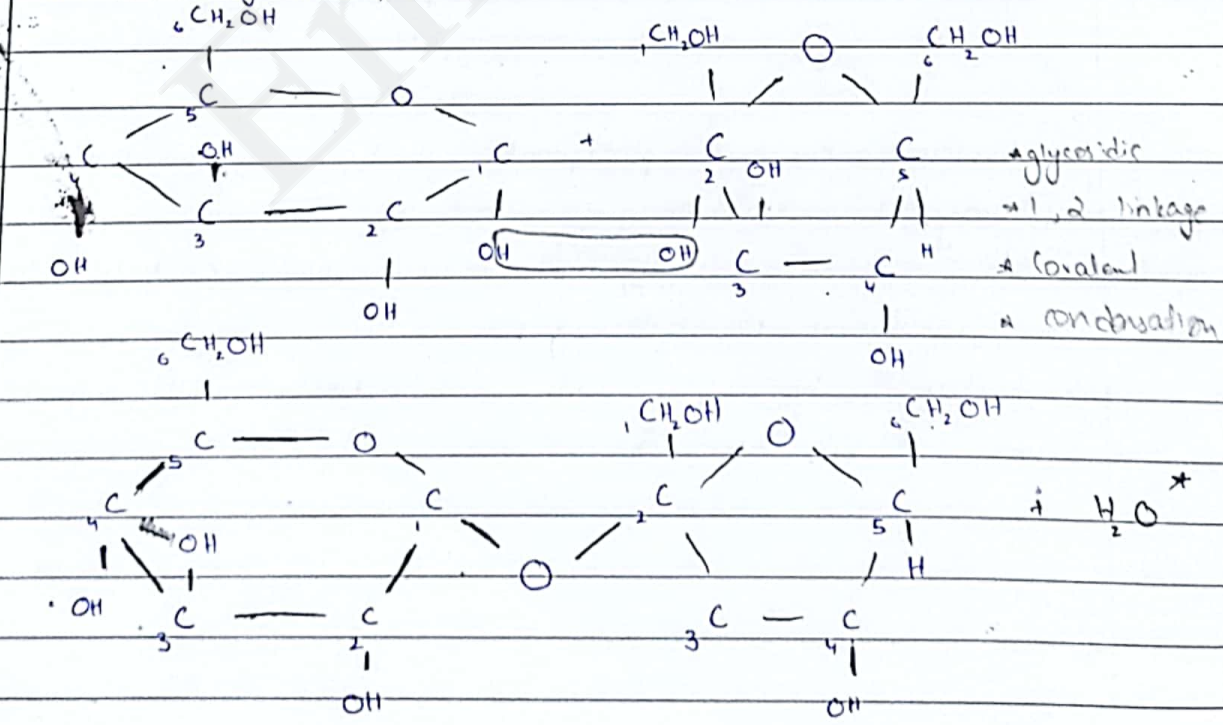
⇒ Maltose : α + α

glucose glucose



- glycosidic bond (C-O-C)
- 1,4 linkage
- covalent bond
- condensation reaction

⇒ Sucrose α glucose + fructose



- glycosidic
- 1,2 linkage
- Covalent
- condensation

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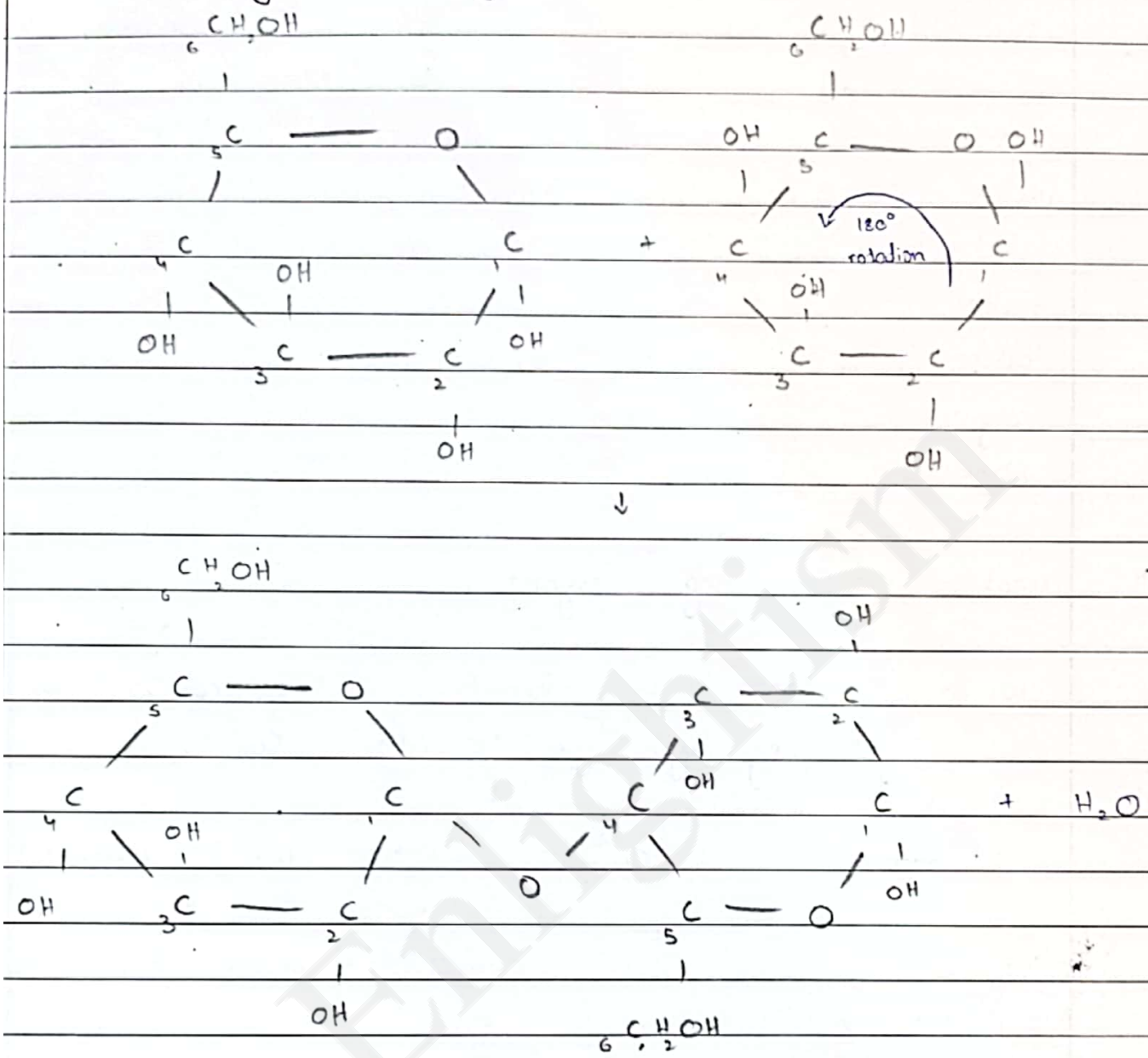
Lactose

α glucose + galactose



1, 4 linkage

+ DONOT FORGET WATER

=> upti here only sucrose was non-reducing

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Reducing

glucose
fructose
galactose (1,4 linkage)
maltose
lactose
deoxyribose
ribose

Sucrose (1,2 linkage)

Q what are reducing sugars?

When added in Benedict solution ($Cu^{+2}SO_4$) → Soluble (blue)

Reducing sugar —(oxygen)→ give $1e^-$ to $Cu^{+2}SO_4$

↓

$Cu^{+2}SO_4$ → $Cu^{+1}SO_4$ (insoluble)

↓

Coloured ppt appear

test results b g y o r

→ increasing conc.

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$C_nH_{2n}O_n$

Sucrose

non-reducing

blue result for benedict's test

$(C_6H_{10}O_5)_n$

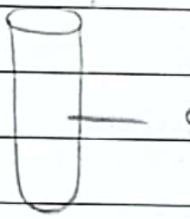
$C_x(H_2O)_y$

Convert sucrose into glucose & fructose via

i) adding enzyme (sucrase) and water → +ve benedict's test

ii) add few drops of dilute HCl + heat + cool

then add few drops of alkali to neutralize → +ve benedict's test



Solution X → benedict's test → green

same sample after hydrolysis → colour change to brick red

what was solution X?

↓

mixture of reducing & non-reducing sugar

Polysaccharide $C_n H_{2n} O_n$ ~ *starch *glycogen *cellulose

$C_x(H_2O)_y$

$(C_6H_{10}O_5)_n$

$(CH_2O)_n$

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/ Date

Starch	glycogen	cellulose
• α glucose	• α glucose	• β glucose
• Reserve food for plants	• Reserve food for animals	• structural component
• ~~Nucleus~~, cytoplasm, Chloroplast	• liver & muscle cells	
• components → amylose & amylopectin	• no such components	• no such components
• glycosidic bonds → 1,4 & 1,6	• Glbond → 1,4 & 1,6	• Glbond 1,4
• no rotation	• no rotation	• rotation is there
• no hydrogen bonding	• no hydrogen bonding	• hydrogen bonding

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Starch

→ α glucose
→ Reserve food
→ continuous linkage

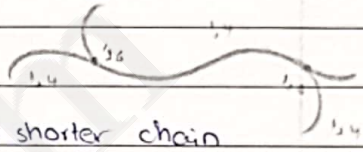
→ amylose & amylopeptin join physically not chemically
Therefore no bon formation Hw Thom Easily seperated
→ iodine test: brown to blue black due to amylose ↘ not amylopectin iodine fit into loops & helices

2 components

amylose

- longer chain
- unbranched
- 1,4 linkage
- chain so long loops and helices develop in it

amylopeptin



- shorter chain
- branched
- 1,4 1,6
- no loops no helices

Q give differences b/w amylose & amylopectin

common:

→ 1,4 linkage
→ made up of α glucose
→ polymers
→ both are found in plant cells
→ glycosidic bonds
→ covalent bonding
→ both are starch components
→ both can be separated

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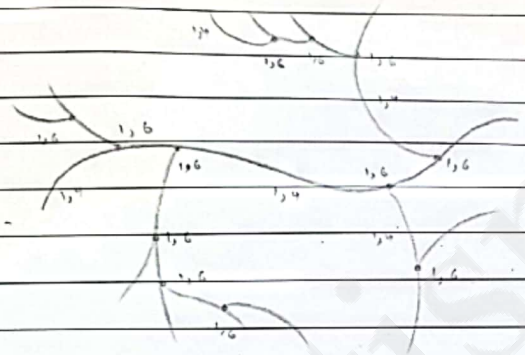
Day / Date

Glycogen

- α glucose
- highly branched
- modified form of amylo pectin
- reserved food for → liver cell
  anima → muscle cell
- 1,4 & 1,6 glycosidic
- Shorter chain



Q Give differences b/w amylopectin & glycogen [4+7]

→ glycogen has more branches
→ amylopectin in plants
→ amylopectin is dep: & glycogen is indep:

→ amylose is dep:
→ amylose only 1,4
→ amylose has loops & helices

Q b/w amylose & glycogen
→ amylose is longer chain
→ iodine sol: for amylose - ve glycogen
→ amylose in plants

b/w starch & glycogen
→ one broken by amylase, glycogen
→ animal & plants
→ starch has 2, glycogen 1 compound
→ iodine test

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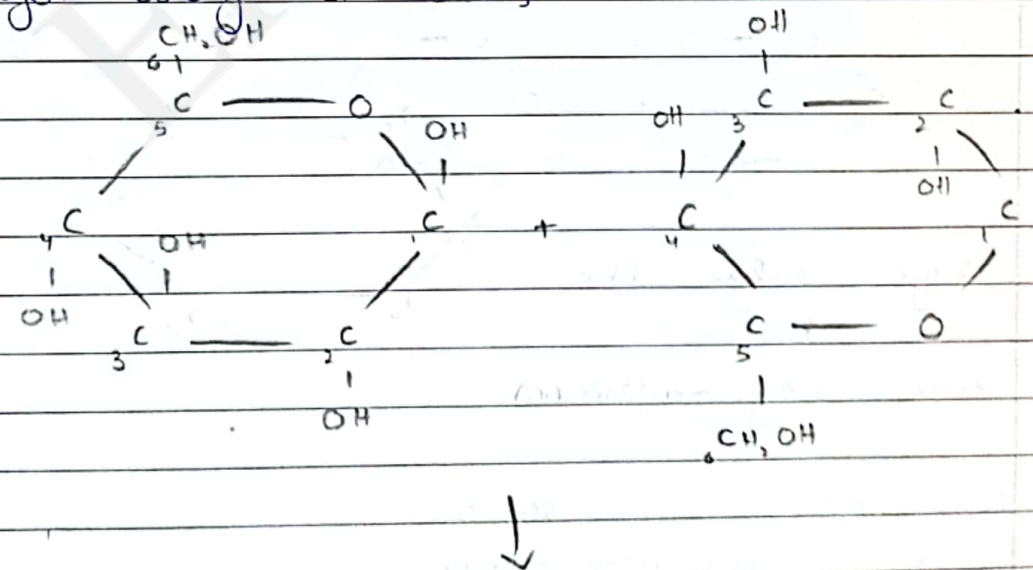
Day / Date

Why starch & glycogen are reserved food

↓	↓	↓	↓
compact	insoluble	chemically	when needed
↓	in water	inert	can be easily
covers lesser	↓	↓	hydrolysed
space	so donot	donot	with enzymes
	effect	interfere	↓
	osmotic press	with other	however enzymes
	of cell	chem reacs	diff. to break
			1,4 bond & 1,6 bond
			as we know enz. are specific

Cellulose

- β glucose
- structural component ; makes cell wall
- 1,4 glycosidic bond
- Rotation occurs. 1st one normal, other rotated
- hydrogen bonding b/w chains



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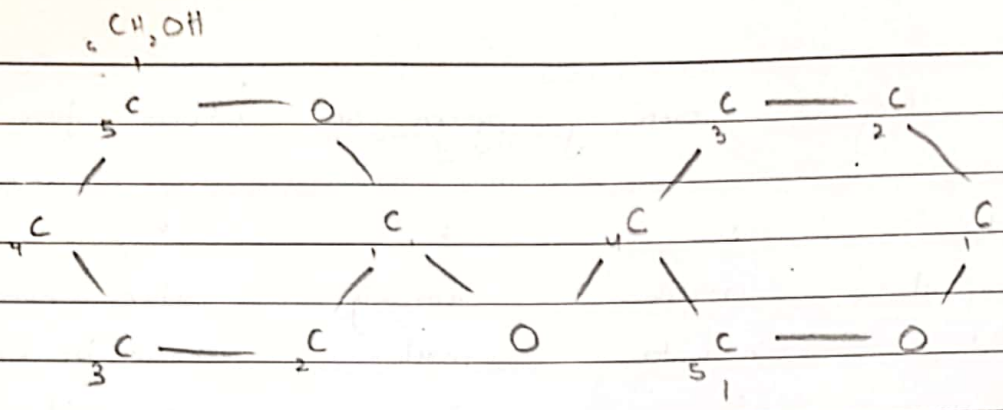
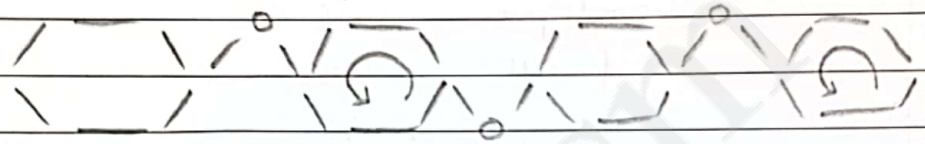
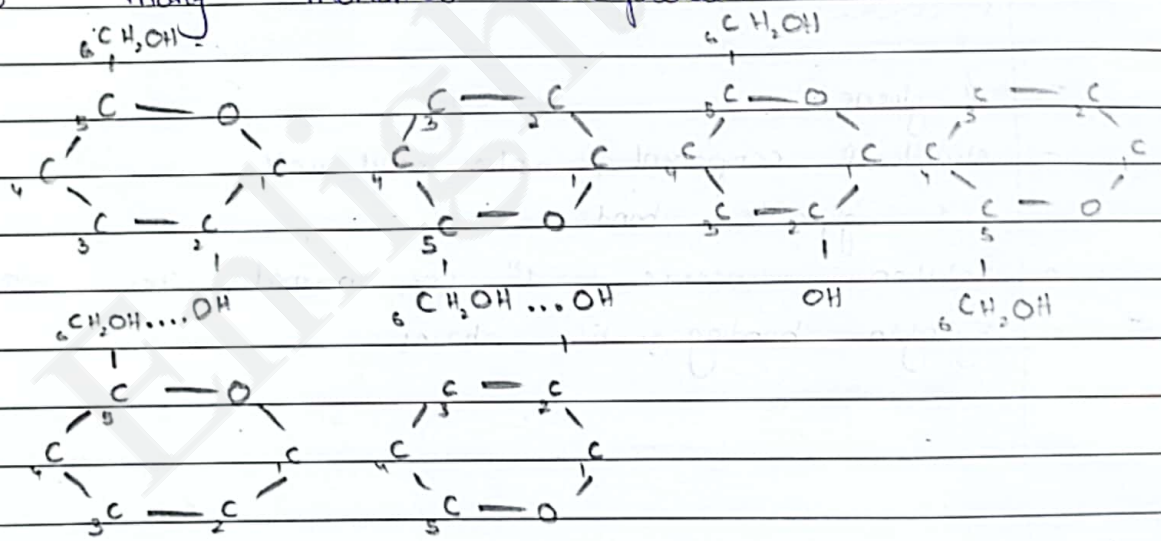


1,4 glycosidic



(a) How many water molecules are needed and how many monomers are produced.



Single cellulose fibre

↓

contains many microfibres (10)

↓

Single microfibre contains 60 - 70 chains of beta glucose running parallel to each other → tightly packed giving tensile strength

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Day / Date

	bacteria (peptidoglycan & murein)	fungi	plant
	cell wall	Chitin	cellulose
→	β glucose	"	"
	1, 4	1, 4	1, 4
	rotation	"	"
	hydrogen bonding	"	"
	A-A	A-A diff types	nothing

Q Give differences b/w cellulose & amylose

- cellulose is structural
- → cellulose has hydrogen bonding → cell has β glucose
- → cell rotates
- → cellulose is indep;
- → amylose is one straight chain

Q cellulose & glycogen

- → glycogen has 1,6 linkage
- → cell has rotation
- → cellulose has hydrogen bonding
- → cellulose has β glucose
- → glycogen is branched

Q amylopeptin & glycogen

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• Involve in mitochondria

LOL

CO - NH
amide linkage/
peptide bond

Q Give diff b/w

a) α glucose & fructose

→ fructose has pentagonal shape
→ O b/w C_2 & C_5 in fructose

b) α glucose & galactose

→ ^{1}C & ^{4}C OH group position

c) β glucose & fructose

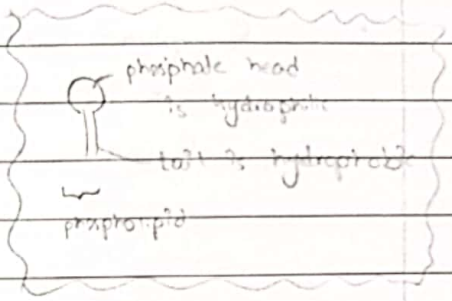
→ pentagonal
→ ^{2}C & ^{5}C b/w O

ionic
disulphide } tertiary level bonds
hydrogen

Day / Date | 2nd Sep '2019

Proteins

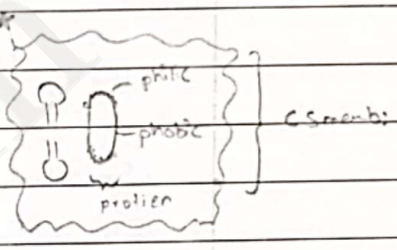
1. Components C, H, O, N, S
2. Monomer AA
3. Types of monomer 20
4. 1gm → 17/18 kJ
5. Structure of 2 single AA



R → alkyle group $(CH_2)/(CH)/(CH_3)$

(Basic) $NH_2 - C - COOH$ (acidic)

H



glutaric acid
↓ replaced by
in sickle cell anemia

mutation

valine

R group varies in diff AA

↓

always contain CH_2 / CH / CH_3 group (alkyle)

↓

AA overall neutral however if there is charge in R group

↓

AA becomes charged (means AA may be charged/uncharged on the basis of R group)

On the basis of R group AA can be

↓

hydrophilic
پانی میں گھلنے والا

↓

water loving / water soluble

↓

Polar

R groups

NH_2^+ $COOH^-$ OH

11 hydrophilic

↓

hydrophobic
پانی میں گھلنے والا

↓

water repelling / water insoluble

↓

9 hydrophobic

non-Polar

R groups

alcoholic Benzene ring

eg: cysteine
: valine (in golgi)
3 methionine

O_2/S

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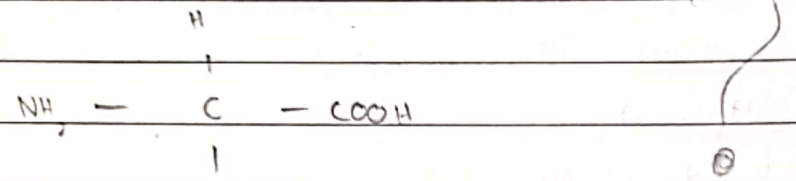
Scanned with CamScanner

Exception

↓

glycine } several workers that keeps on changing as per need



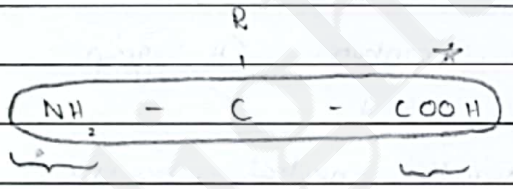
↓

No R group

Smallest AA can behave as neutral ; acidid ; alkaline

It means AA are not based on basis of R grap

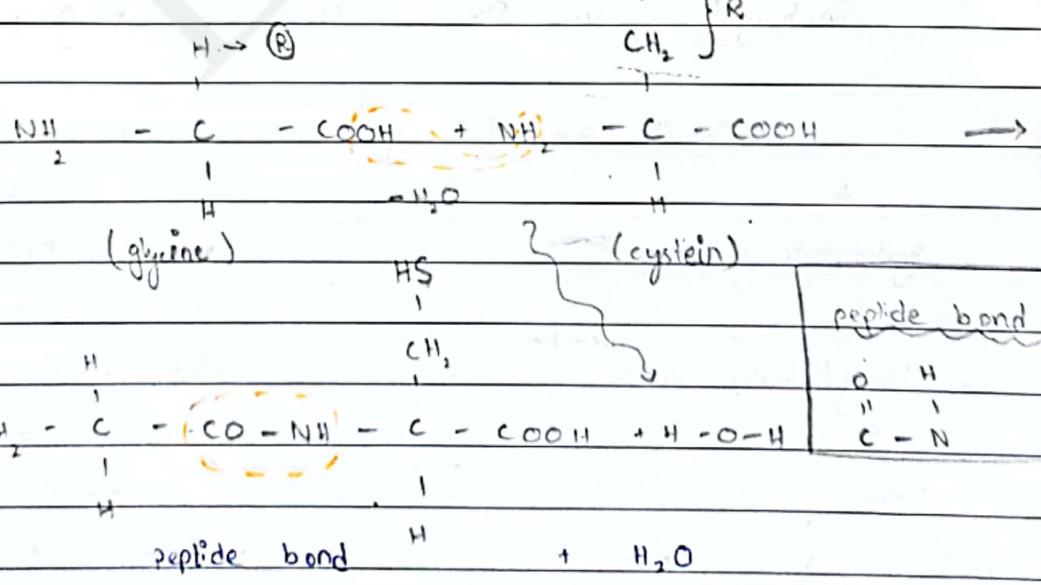
but



cystein + glycine → dipeptide

glycine + cystein → dipeptide

formula of dipeptides



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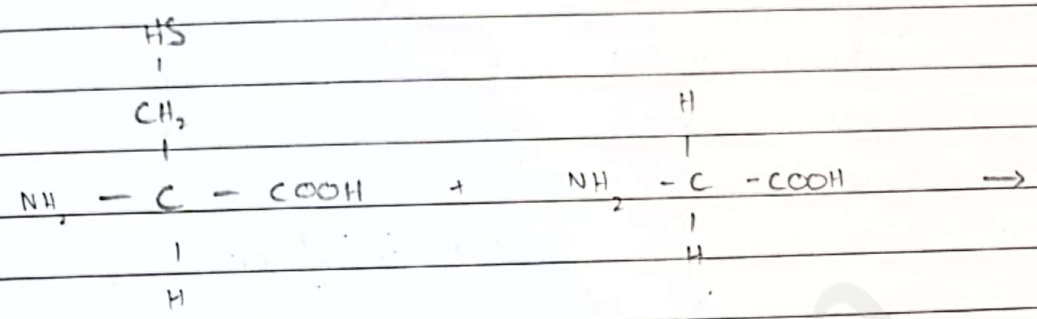
/ Date

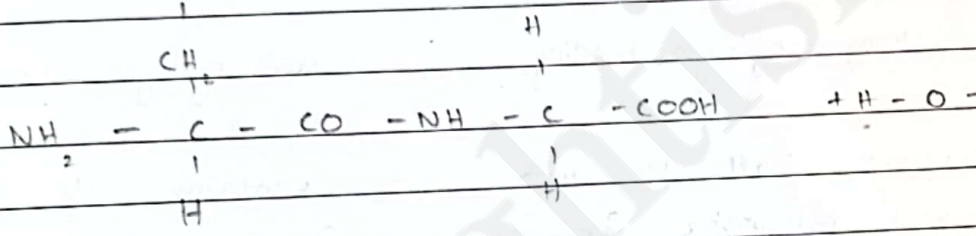
Q A poly peptide contains 100 AA. what will be the number of peptide bonds?

99

=>



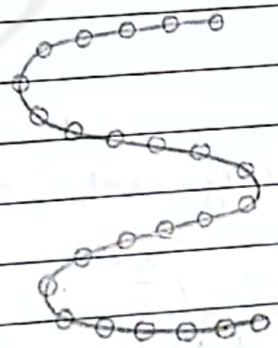
cytein + glycine →



dipeptide + H_2O

LEVELS:

Primary:



def.

1. is # sequence and types of amino acids in a polypeptide
2. contains only peptide bond
3. produced via condensation
4. designed by DNA in the form of mRNA. The product is poly-peptide, result of translation.
5. Peptide bond is the strongest bond (covalent). It is the last one to break.

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Day / Date

Secondary:

1. Contains hydrogen bonding
2. develops in ER

CO - NH

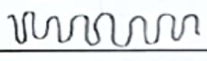
CO of 1st peptide bond develops Hydrogen bond with NH of every fourth peptide bond ahead.

- hydrogen bonding
  - → b/w R gps
  - → b/w peptide bonds

exists in 2 forms

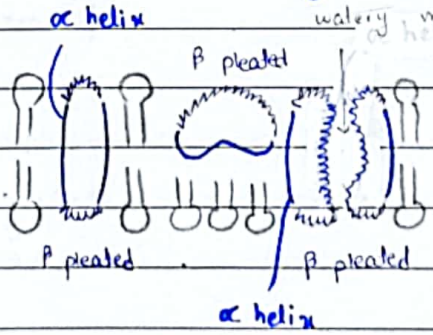
α helix	β Pleated
strong hydrogen bonding	weak hydrogen bonding
contains all AA with R gp hydrophobic in nature. R gp also develops hydrogen bonding	contains all AA with R gp hydrophilic in nature. weak bonding

α helix



β pleated

→ As a result of secondary level, coiling / folding increases



Day / Date

" Contains hydrogen bonding. Exists in 2 forms; α helix & β pleated. α helix contains strong hydrogen bonding with all the amino acids having R gp: hydrophobic in nature. However β pleated contain weak hydrogen bonding with all the amino acids having R gp: hydrophilic in nature "

Teritiary Level

Same chain
single chain
↓
more coiling & folding occurs
↓
R* groups inverted

Teritiary
↓
Bonds
↓

disulphide	ionic	hydrogen
↓	↓	↓
cystein	AA with R group	hydrogen b/w R group
↕	+ve charge	
cystein	↓	
	AA with R gp	
	-ve charge	

CO NH OH

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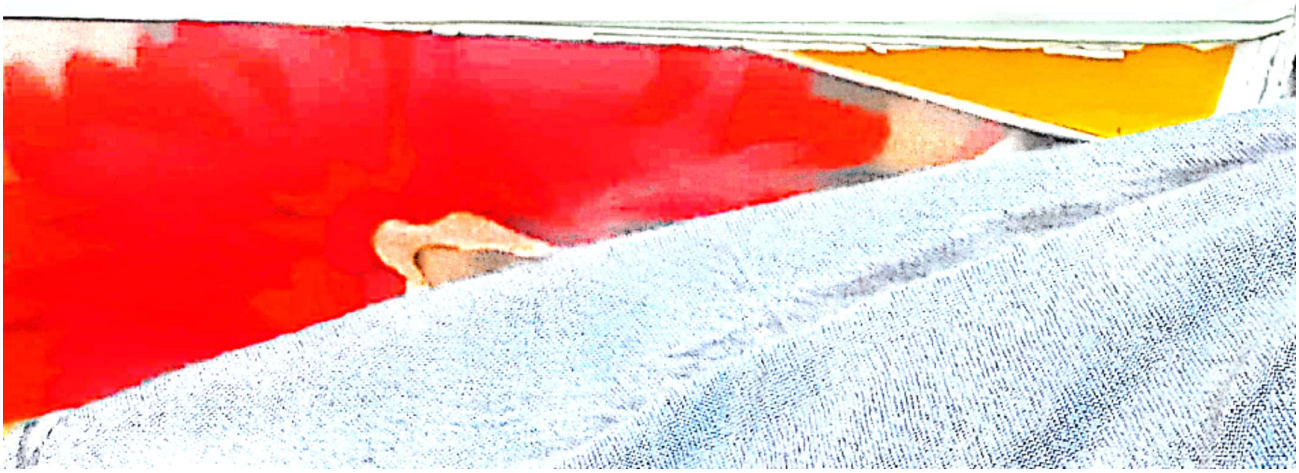
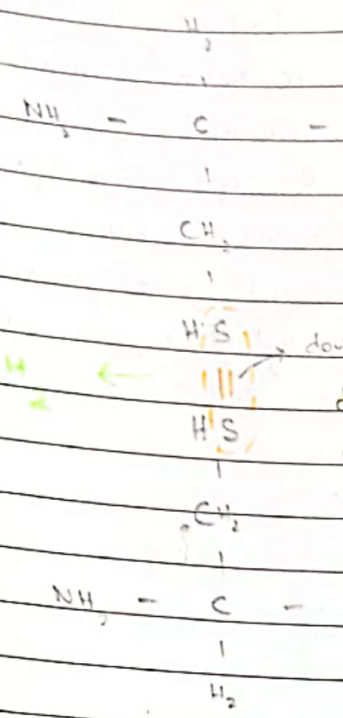


Day / Date

TABLE

- peptide & disulphide both are covalent, - both are lost / broken when heated
- thermally stable enzymes have more no. of disulphide linkages
- therefore larger no. of cysteine amino acid.



* if hydrogen is later on provided, the bond breaks since pH was formed in the deficiency of hydrogen / loss of hydrogen
* disulphide is the strongest bond like peptide
* pH has no impact

II → Hydrogen → hydrophilic / polar
Disulphide → hydrophobic / non-polar
→ change in pH affects since enzyme denature

Tertiary level :- contains a single polypeptide chain with 3 types of bonds
→ disulphide → ionic → hydrogen
- of 2 types of interactions ; hydrophilic & hydrophobic
- Protein has a 3D precise shape with hydrophilic exterior & hydrophobic exterior

Saj

Quaternary level :

→ more than 1 polypeptide

→ same bonds which were at tertiary level with the chains now are b/w the chains

→ same type of interactions. The result is the production of a bigger ball with hydrophilic exterior & hydrophobic interior having a 3D precise shape

* amino acid on active side of enzyme is hydrophilic

Prosthetic portion : non-protein → conjugated protein

eg. Fe / phosphate

examples of proteins :

globular

myoglobin

1. Contains a single polypeptide chain (tertiary level)
2. Small ball shaped structure with philic acids & phobic ones
3. contains a single Fe (also prosthetic gap)

haemoglobin

fibrous

collagen

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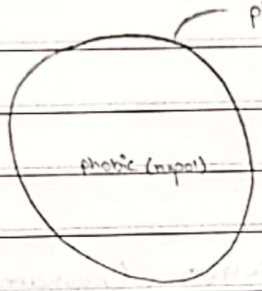
8th Sept '19 Tuesday

Protiens

Globular protien

↗ water soluble ∴ work in watery media

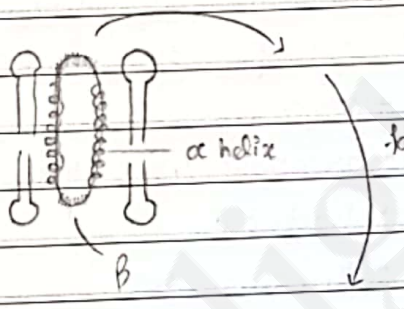


philic (pol) AAs → develop

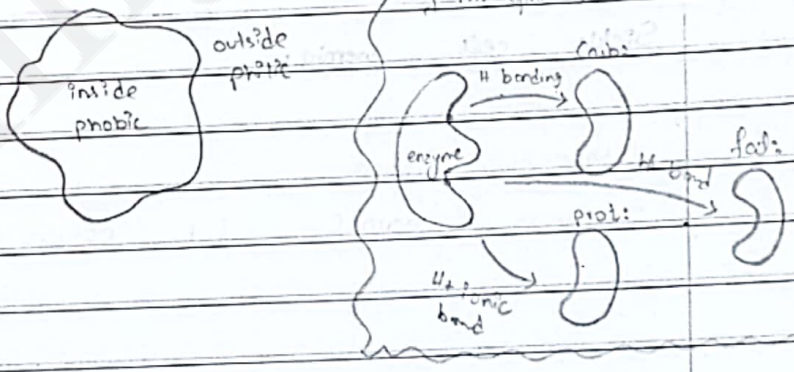
1. Ionic bond with something around
2. H bonding with H_2O molecules
3. phobic, Interaction within → b/w Npol R gp's

both involved in making protiens (functional)

outside structure inside



falls inside plasma



enzymes are protiens. The active side is a cluster of AA (philic)

haemoglobin

1) Contains 4 polypeptides (quartnery)
2) 2 α & 2 β (2 genes)
3) each polypeptide Single Fe^{2+}. 4 poly peptide $4Fe^{2+}$. 1 Fe^{2+} can bind with 1 mol of O_2

$4Fe^{2+} + O_2 \rightarrow$ 4 mol: of O_2 / 8 atoms of oxygen

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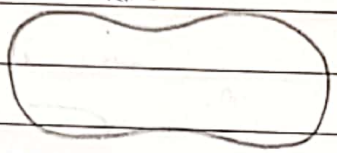
4) each RBC contains 4 million molecules of haemoglobin → each haemoglobin can bind with 4 molecules of O_2 → we can imagine amount of oxygen carried by 1 RBC



5) Fe^{+} binds with O_2 reversibly

$$Hb + 4O_2 \rightarrow 2H_2O_4 \text{ (oxyhaemoglobin)}$$

6) haemoglobin a bigger ball with hydrophilic exterior and hydrophobic interior. (which does not allow H_2O to enter in) → having 3D precise shape
- *globular
- * metabolically active
- * functional
- * H_2O soluble

Sickle cell anemia:

→ Genetic disorder

→ parents normal but carriers of gene

parental genotypes $Hb^N\ Hb^S$ × $Hb^N\ Hb^S$ (heterozygous ✓ heterozygous)

offspring genotypes $Hb^N\ Hb^N$ $Hb^N\ Hb^S$ $Hb^N\ Hb^S$ $Hb^S\ Hb^S$

↓ ↓ ↓ recessive

normal RBC ↳ biconcave disc shape homozygous having sickle cell ↳ gene mutation i.e Thalassemia

normal AA on surface glutamic acid (philic) replaced by Valine (phobic). → haemoglobin & RBC constricted

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→ SA reduces for carrying O_2.

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haemoglobin normal — sickle cell anemia

2α chain ✓ — 2β chain fit — 2α ✓ — problem with β chain

universal rule.

↓

1 triple / 3 nucleotides ↓ to 1 amino acid

haemoglobin fit

A T C G G C C T T A T T

single bond substitution

CAT code for valine ∴ hydrophobic R group

Thymine → Adenine

CTT code for A·A glutamic acid ↓ hydrophilic R group

A T C G G C C A T

2α + 2β ↓ protein

Full hydrophobic AA

valine ← H_2O pushes

H_2O insoluble hydrophobic ↓

biconcave disc shape

RBC sickle cell, carrying capacity affected

All haemoglobin molecule contains oxygen

Fibrous Proteins

⇒ Collagen

- 3 polypeptides (same types)
- 1 gene involved in it's making
- Primary level
- all AA are hydrophobic in nature

peptide

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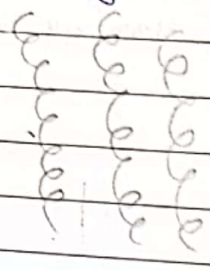
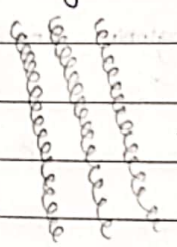
• Secondary level



3 helix
↓
many helices
↓
All AA phobic
• well develope

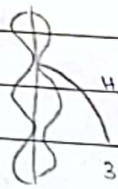
• teritiary



→ Disulphide (no ionic since hydrophobic are uncharged) ✓
→ hydrogen ✓
→ interaction hydrophobic ✓

cystein AA will → phobic be in large amounts

• Quartnerry level



collagen molecule
H bond — disulphide — phobic interaction
3 AA glycene / smaller size
↓
bcrove
↓
knot

• collagen is a structural protien found in bones and teeth, artery lining

bond develops b/w the open ends

Q diff b/w fibrous & globular

→ fibrous only has phobic, globular has both
→ fibrous doesn't change structure according to medium
→ fibrous are structurally, metabolically inactive, water insoluble
→ fibrous have no ionic bonds

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Q Give diff b/w cellulose & collagen

→ protein has 20 monomer, cellulose ?

→ cellulose is a carbohydrate → collagen contains helices

→ cellulose in plants → collagen both

→ no amino acids in cellulose, ~~[illegible]~~

→ cellulose makes cell wall, collagen bones, teeth & cartilage

→ one has glycosidic bonds but one has peptide → N_2 & S

functions of protien

1) Myoglobin → carries O_2 / oxygen reserve
2) haemoglobin → transfers O_2, single polypeptide
3) enzyme → metabolically active ~~[illegible]~~ more than 1 polypeptide
4) hormones → metabolically active ~~[illegible]~~ single polypeptide ~ ADA
   └ more than one insulin
5) antibody → defensive protien
6) Collagen → structural protien
7) storage protien → Casein in milk + Albumen of egg
8) contractile protien → muscle → myosin, actin

Keratin in hair

Q A polypeptide contains 2 kinds of AA xy

how many

a) dipeptides (4) xx yy xy yx

b) tripeptides can be made xxx yyy xxy xyx yxx yxy yyx (8)

Q If a polypeptide contains r kinds of amino acids, how many (polypeptides n) can be made

r^n

ay / Date

fats / triglyceride / lipids

1) elements C, H, O (compound ↓ oxygen less)

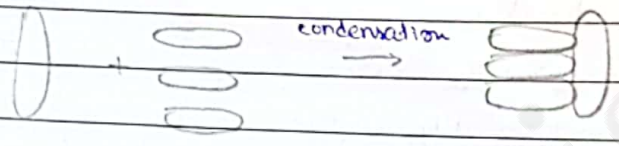
$C_6H_{12}O_6$ glucose

$C_{16}H_{34}O_6$ fats

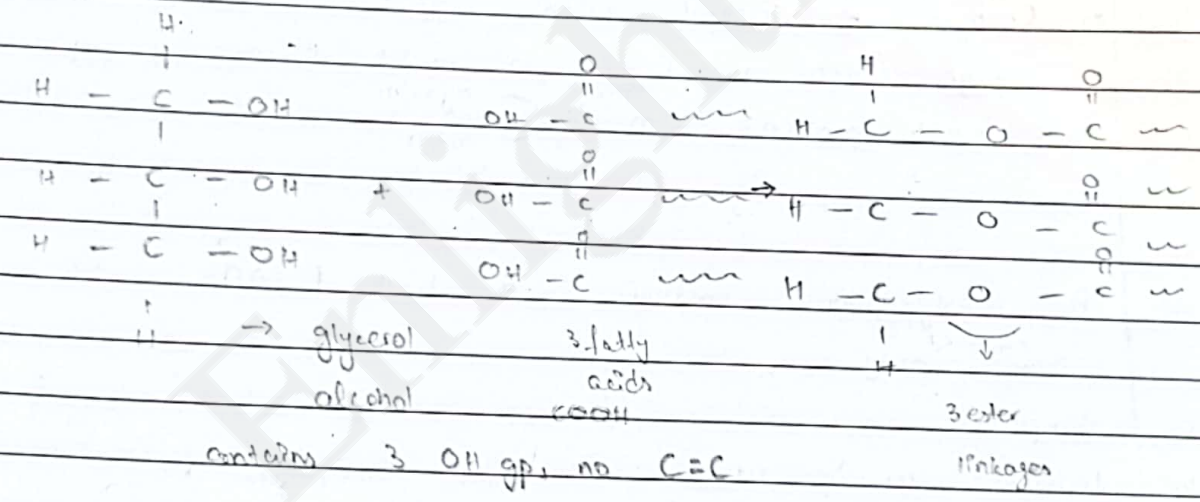
2) 1g → 38kJ

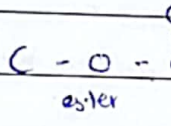
3) 3 fatty acids + 1 glycerol = 1 fat (not a polymer)

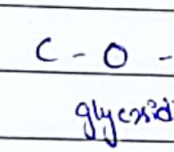
diatomic representation

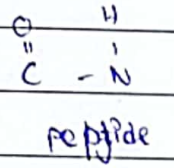


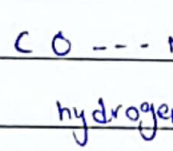
glycerol + 3 fatty acids → 1 fat / triglyceride

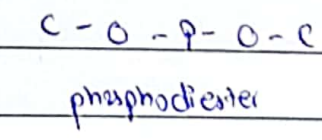












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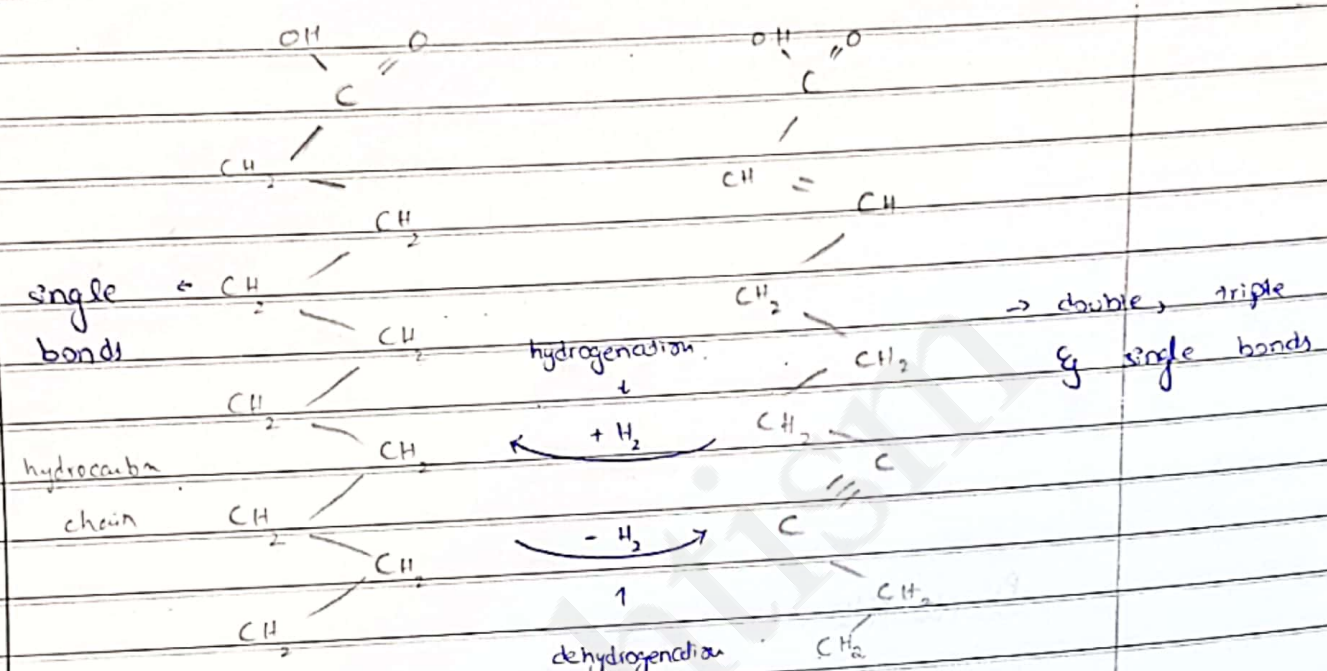
Fatty acids

solid at rtp
ghee
saturated

liq at rtp
oil
unsaturated



diff

→ double & triple bonds
→ unsaturated can be hydrolysed
→ H_2 is more in saturated
→ saturated has more energy due to (more H_2, more CH, more reduced (NAD)

sim

→ C, O, H
→ # of carbon
→ carboxylic acid
→ hydrocarbon chain
→ single bond
→ fatty acids

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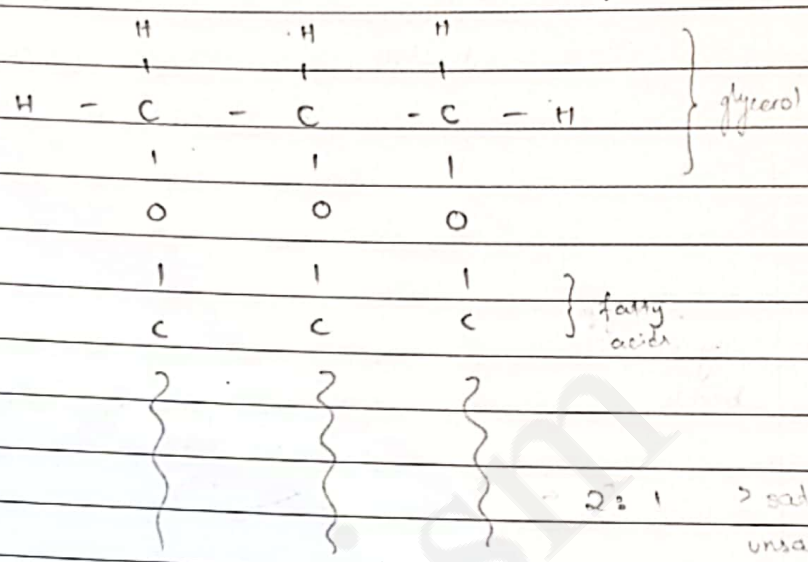
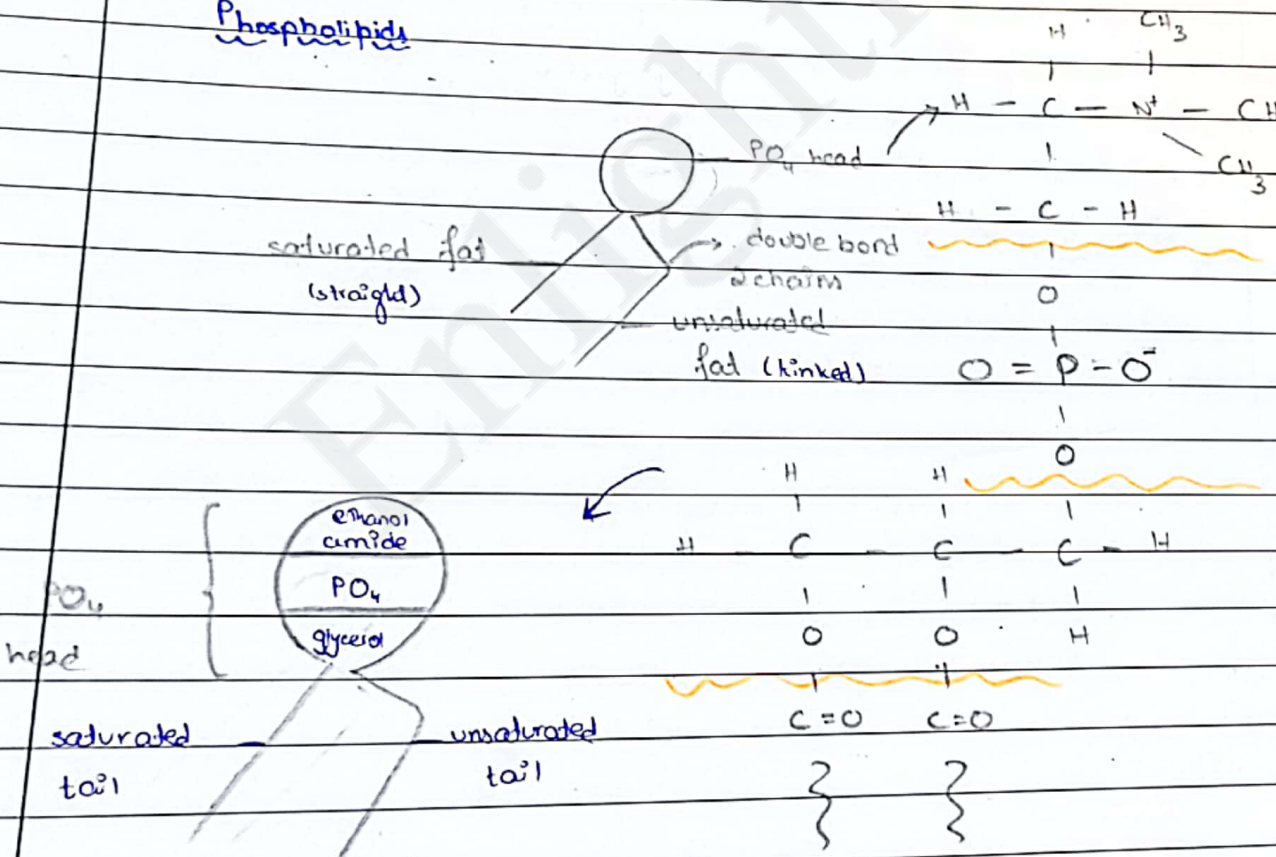
Triglyceride



Phospholipids



tails / hydrocarbon tails / fatty acid tail / R tail

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PO_4 head

↓ hydrophilic ↓ polar ↓ charged ↓ water soluble

tails → hydrocarbon chains / fatty acid chain

↓ hydrophobic ↓ non-polar ↓ uncharged ↓ water insoluble ↓ H_2O repelling

(alcohol soluble) → organic solvent

Q diff & sim: b/w triglyceride & phospholipids

diff

→ phosphate group in phospholipids

→ phospholipids are partially water soluble

→ phospholipids have 2 chains side by side, triglyceride has 3 tails

→ 2 ester, 3 ester linkage (triglyceride)

→ triglyceride is energy storage, phospholipid is structural

→ Nil in phospholipid

→ phospholipid is partially charged while triglyceride is uncharged

→ phospholipid has ethanol amide

sim

→ both contain glycerol

→ hydrocarbon chain

→ both have ester linkages

→ both are fats

→ both have saturated unsat

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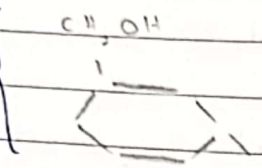
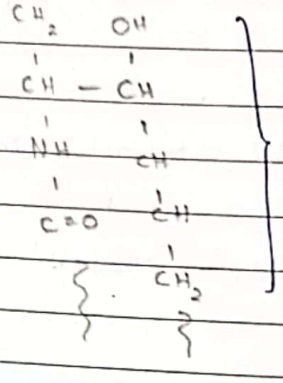
glucose



→ soluble

glycolipid



fatty acid chains

insoluble ←

Q diff sim b/w saturated & unsaturated tails.

(already done)

⇒ According to the weather, proportion of saturated & unsaturated tails keeps on changing. In winters, the proportion of unsaturated tails increases and in summers, proportion of saturated tails will increase to make the membrane rigid or fluid.

C-H is a strong bond. Therefore saturated fats are rigid.

⇒ Phospholipid is a modified form of triglyceride in which 1 tail has been replaced by phosphate head.

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ethanol emulsion test

5cm³
Add ethanol and shake vigorously, Cloudy emulsion for fats present. Clear solution as negative result.

functions of fats:

→ storage of energy
→ insulation
→ structural component (cell membrane)
→ stores fat soluble vitamins (D)
→ protection of organs
→ steroid synthesis
→ glycolipids as receptor
→ reserve of water in desert animals
→ cuticle in plants prevents transpiration
→ cell repair (membrane)

Properties of Water

① Universal solvent
↓
maj: of solutes are soluble in water
↙ ↘
Plasma → tissue fluid → glucose + AA + salts + O_2/CO_2
Plants → H_2O → sucrose + other things → phloem media

② hydrolytic media
↓
imp: for working of all enzymes
imp for diff metabolic reaction
↓
high temp enzymes don't get denatured

③ Raw material for photosynthesis

$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} C_6H_{12}O_6 + 6O_2$$

④ high specific heat capacity
↓
gives thermal stability
↓
not inactive at low temp

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⑤ high heat of vapourization

Takes alot of energy when ↓g liquid → vapours

transpiration — cooling effect

sweating — cooling effect

panting in dogs, producing, cooling effect

⑥ strong cohesive & adhesive forces

Cohesion b/w H_2O molecules

Adhesion b/w H_2O & lignin

capillary action

Plasma (90% H_2O)

xylem + phloem

H_2O moves in the form of column

⑦ Transparency

under water plants can get light show photosynthesis

⑧ higher surface tension

H_2O molecule on surface pulled by H_2O molec beneath

tension created

small insects can float of surface of H_2O

⑨ low density

H_2O on surface due to low temp →

↳ converted into ice (insulator),

↳ all aquatic life under it survives at high temp

ice is low dense than water, forms a layer, acts as an insulator, all aquatic life can survive without much temp change

⑩ neutral pH (7)

enzymes not denatured

↳ buffer zone

Blood helps to maintain pH of everything around.

Q Give 4 properties of H_2O [4]

Q What is the role of H_2O in plasma? [4]

Q Give 4 properties of H_2O in xylem and phloem [4]

Q What is cappilary action and how does it help in the movement of water in xylem [4]

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