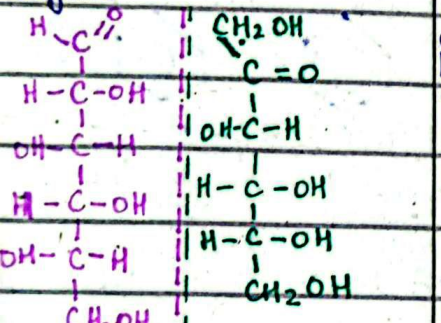
Chapter #13:- Biochemistry

Carbohydrates:-
-most abundant class
-Gen formula:- $C_x(H_2O)_y$
$6H_2O + 6CO_2 \longrightarrow C_6H_{12}O_6 + 6O_2$
-monomers and polymers of aldehydes & ketones with numerous hydroxyl groups attached.

Classification:-
1) **Monosaccharides:-**
-simplest carbohydrates
-cannot be hydrolyzed
formula = $(CH_2O)_n$
∴ n = 3 to 6 carbons.
classified as trioses, tetroses pentoses & hexoses etc.
Glucose & fructose are simple sugars.



Dextrorotatory sugars:- Some monosaccharides can rotate the plane of polarized light to right (clockwise).
Example:- glucose, mannose, galactose.
-characteristics of monosaccharides
-white crystalized solids.
- soluble in water & sweet
-cannot be hydrolyzed
-reducing in nature.

-oligosaccharides:- Carbohydrates upon hydrolysis form 2-10 molecules of monosaccharide a simple sugars.
Prefixes di, tri, tetra indicate no. of monosaccharide unit.
-white crystalline solids
- sweet taste, soluble in water.
Glucose, Galactose, Raffinose

Polysaccharides:- carbohydrates upon hydrolysis form 100-1000 units of simple sugars are polysaccharides.

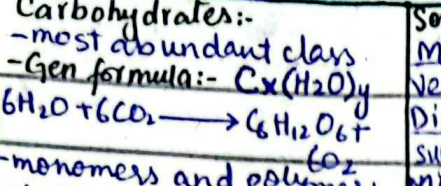
Sources of carbohydrates:-
Monosaccharide → fruits vegetables, cereals, honey
Disaccharides: sucrose → sugarcane, sugar beet, fruits
maltose → cereals
lactose → dairy products
cellulose → plants, cotton
Starch → cereals, wheat, barley, rice, maize, potato, sweet potato etc.

Uses of carbohydrates:-
-store & transport energy. 1g of glucose gives 15.6KJ energy.
-serve as food source
-serve as structural materials for plants. cellulose is fibre in human diet. we can't digest it but it is imp. helps our intestines move food efficiently & absorbs toxic chemicals. lower cholesterol, regulates blood pressure.
- Sucrose is used as common table sugar
-Glucose stored in animals muscle & liver cells as glycogen. It serves as long term energy reservoirs & can be converted into glucose when needed
Plants store energy as starch.
-Starch to make rectified spirit by fermentation process
-Starch is converted to dextrin as adhesive for stamps & paper glue.
-cattle, termites derive nutrition from cellulose.

Proteins:- complex nitrogenous substances that produce amino acids on complete hydrolysis.

Functions:- -transport & store oxygen & nutrients.
-act as catalyst.
- regulate imp. systems in our bodies.

Characteristics:- -high molecular weight polymers.
- produce amino acids on hydrolysis.



Sources:-
-meat, fish, eggs, milk, cheese.
-Pulses, beans etc.

Uses:- -make muscles, hair, enzymes & repair body tissues.
-essential for formation of protoplasm & components of cell.
-physical & mental growth.
- gelatin obtained by heating bone & tendons in water used in bakery goods.
-enzymes catalyze specific biological reactions.
- antibodies help to fight against diseases are large protein molecules.

Commercial use of enzymes:-
-amylase used in bread making.
- Protease & amylase used in detergents to remove food stains from clothes.
-Lactase in infant foods.

Lipids:- component of plant or animal tissues that is insoluble in water but soluble in solvents of low

Fatty Acids:-
-Fats & oils refer to as simple lipids
-Esters of fatty acids with trihydroxy alcohol, glycerol for this they are called glycerides, glycerides.
-long chain carboxylic acids
-building blocks of lipids
Stearic Acid:- (beef fat)
$CH_3-(CH_2)_{16}-COOH$.
-more than 1 OH group is glycerol.

Sources:-
-animals, plants marine organisms such as salmons & whales.
-milk, butter ghee, cheese seeds such as sunflowers, corn, cotton. & vegetable oils. Cod liver oil is obtained from salmon & whales.

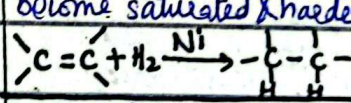
Functions:-
-butter, ghee. oils used for cooking
-in animals layer of fat is present which acts as thermal insulator.
-protect delicate organs from shocks & injury
-vitamins ADEK which are essential for health. There are

Fats
A lipid is fat if it is solid at room temp contains larger portion of saturated fatty acids units.

Oils
A lipid is oil if it is liquid at room temp contain larger proportion of unsaturated fatty acid units

soap etc. **Functions**
-vegetable oils are converted into vegetable ghee by catalytic hydrogenation
-manufacture of nail polishes & varnishes.
-Cholesterol is essential in our bodies for synthesis of several hormones. vitamin D & bile acids.

Hydrogenation:-
Addition of hydrogen to an alkene.
-takes place in presence of Ni, Pd, Pt as catalyst
-used to make ghee, or margarine.
-Fatty acid component of vegetable oils contain C-C bonds (double) when H is added they become saturated & harder



-Nucleic Acid:-
-nitrogen containing compounds obtained from pus of infected wounds were called nucleic acid.
-vital components of all life.
-found in every living cell.
-serve as information & control centers
-long chains made up of nucleotides
Nucleotide components
i) Nitrogeneous base
ii) pentose sugar
iii) Phosphate group.

DNA	RNA
(Watson & Francis Crick in 1953)	Walter Siegfried in 1969.
two strands twisted around each other	Single stranded structure

water.

Glucose, Galactose, Raffinose

Polysaccharides:- carbohydrates upon hydrolysis form 100-1000 units of simple sugars are polysaccharides.
- Starch & cellulose.
- amorphous solids - tasteless
- insoluble in water
- non-reducing in nature

- regulate imp. systems in our bodies.

Characteristics:- - high molecular weight polymers.
- produce amino acids on hydrolysis.

Amino Acids:- Building blocks of protein

Amino acids our body can synthesise are non-essential rest are essential amino acids.

infant foods.

Lipids:- component of plant or animal tissues that is insoluble in water but soluble in solvents of low polarity.
- fats & oils
- cholesterol
- sex hormones
- phospholipids
- vitamin (A, D E, K)

organs from shocks & injury
- vitamins ADEK which are essential for health. These are insoluble in water but soluble in lipids.
- provide energy
- manufacture of materials such as

DNA
J. Watson & Francis Crick in 1953
two strands twisted around each other called double helix.
made up of deoxyribose sugar, phosphate unit & nitrogen base.
carries genetic information

Guanine - cytosine
Adenine - Thymine

RNA
Walter Siegfried in 1969
- Single stranded structure
made up of ribose sugar, phosphate unit & a nitrogen base
decides genetic information & decoder in synthesis.
Adenine - Uracil
Guanine - cytosine

Vitamins:-

In 1987, C. Ejikman discovered.
- accessory growth factors.

⇒ specific organic compounds required by our body to prevent diseases but cannot be produced by our bodies.
- taken from diet.

Fat Soluble
- Dissolves in fat.
- Vitamin A, D, E, K.
- Excess can be harmful. Too much causes diseases
- toxic in excess

Water Soluble
- Dissolves in water.
- Vitamin B, C
- If taken in excess, secreted/excreted out of body
- not toxic in excess.

Vitamins	Sources	Uses	Diseases
A	Milk, butter, fish oil, egg, fresh green vegetables	eyes & skin	Night blindness, Dry skin
B (group of vitamin)	whole meal bread, rice, yeast, liver, soybeans, vegetable.	energy production in cells, nerves, skin	skin disease, tongue inflammation, anemia, bleeding gums.
C	Oranges, lemons, tomatoes, fresh green vegetables.	Blood vessel gums, healing wounds, prevent colds	Scurvy
D	Milk, butter, eggs, fish oils	Bones, teeth	Rickets, osteomalacia.
E	Whole meal bread, rice, eggs, butter, Vegetables	Antioxidant	Haemolysis of red blood cells, sterility.
K	Fresh green vegetables, liver.	Clotting of blood.	Haemorrage, delayed blood clotting.

Side boxes:-

- some ~~vitamins~~ lose their vitamin contents beans etc. foods while boiling such as rice, pulses
- Scientists take the human insulin gene for insulin production & paste it to the DNA of E. coli, a bacterium found in our digestive tract.
- 5% m/v aqueous solution of dextrose is used in drips. 5% m/v aqueous solution means 5g of dextrose dissolved in 100cm of water to form solution. This given to a patient who is dehydrated or not allowed to eat.

SLOS Questions:-
Q:- what is protoplasm?
Q:- How vegetable oil is converted to ghee?
- Differentiate b/w fats & oil? Q:- Differentiate b/w DNA & RNA?
Q: Differentiate b/w water & fat soluble vitamins:
Q:- Write sources & uses of vitamins

Q1- What are polysaccharides? what are their properties?
Q:- How is glucose stored in our body?