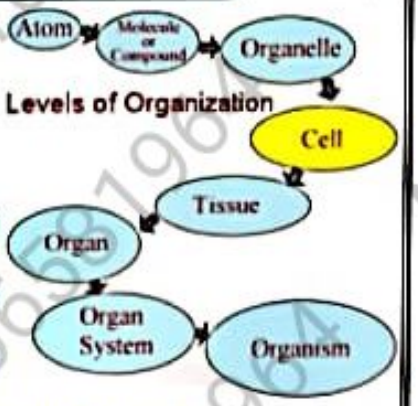
CH: 1
Lesson: 1

Chemical structure of living organism



- The human body

consists of a group of **systems**,

each system consists of a group of **organs** (The organ level)

each organ consists of group of **tissues** (The tissue level)

each tissue consists of a group of **cells** (The cell level)

each cell consists of a group of **organelles** (The organelle level)

each organelle consists of a group of **molecules** (The chemical level)

each tissue consists of a group of **atoms**.

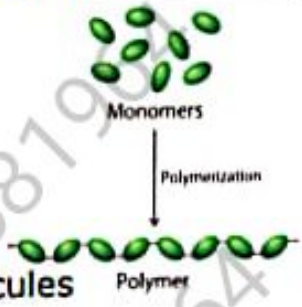
The living cell consists of two types of mplecules

- **Organic compounds (such as biological macromolecules)**
- **Inorganic compounds (Such as water and minerals s NaCl)**

Compare between the organic and inorganic molecules in the cell.

Organic compounds	Inorganic compounds
- They are large molecules. - Mainly contain carbon (C) and hydrogen (H) atoms. - May contain other elements, such as oxygen (O) and nitrogen (N). - They are called biological macro-molecules. Examples: Carbohydrates, lipids, proteins and nucleic acids.	They are molecules that don't contain carbon (atoms) Examples: Water (H2O) and mineral salts (e.g. NaCl)

Biological macro-molecules (Polymers)



Definition:

They are large-sized compounds formed by smaller molecules (monomers) combined together through **polymerization process.**

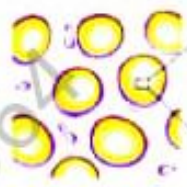
- **Practical activity:**

Detection of lipids

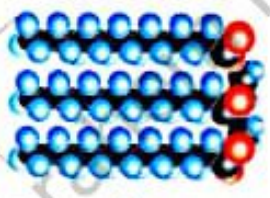
- **Sudan-4 reagent** is used for detecting fats in different foods (G.R).
- Lipids change the colour of Sudan-4 stain into **red**.
- Sudan-4 is used to detect the fats in various foods, such as oils. Milk and peanut butter (G.R) because Sudan-4 is soluble in fats, where it turns into red colour in the presence of fats (lipids)

Importance of carbohydrates:

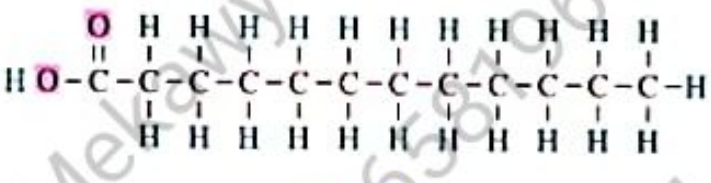
Obtaining energy	- Lipids (fats) are an important source for obtaining energy. - The body does not begin to get energy from the stored fats unless in case of absence of carbohydrates. - The energy obtained from lipids is **more** than that obtained from the same amount of carbohydrates.
Building cells	- They represent about **5%** of organic materials of the cell. - Lipids (Phospholipids) are involved in the structure of cell membranes.
Work as thermal insulator	- Lipids (fats) form insulator layer under the skin of human and some animals (as polar bear) **(G.R)** to keep their body temperature in the severe cold regions.
Work as a protective cover	- Lipids (waxes) cover the surface of several plants, especially the desert plants **(G.R)** for reducing the water loss in transpiration process.
Works as hormones	- Lipids (Steroids) work as hormones, such as steroids.



Fat cells



Fats



Fatty acid

Fat cells consist of fats which are made up of fatty acids

Lipid	Nature	Reaction of formation	Example
Oils	Liquid (at ordinary temperature)	Unsaturated fatty acids + glycerol	Oils that cover the feathers of water birds (G.R) to prevent water penetration to their bodies which hinders their movement.
Fats	Solid (at ordinary temperature)	Saturated fatty acids + glycerol	The stored fats under the skin in some animals (polar beer) (G.R) to act as thermal insulator (عازل حرارى) for keeping their body temperature in the severe cold (polar) region.
Waxes	Solid (at ordinary temperature)	**Fatty acids** (high molecular weight) + **Alcohol** (monohydric, contains only one OH^- group)	The waxes covering the desert plant leaves (G.R) to keep water inside their tissues and reduce its loss during transpiration.

Complex lipids

Structure	- Their structure involves carbon, hydrogen, oxygen, phosphorous and sulphur.
Example	- Phospholipids
Importance	- Present in cell membranes of animal and plant cells.
Molecular structure	- It is similar to the structure of fat molecules with a phosphate group $(PO_4)^{-3}$ and choline group replacing the 3rd fatty acid in fats. i.e. It consists of two fatty acids, glycerol molecule, $(PO_4)^{-3}$ and choline group.

Lipids derivatives

Synthesis	- They are derived from both simple and complex lipids by hydrolysis (adding water).
Example	- Cholesterol. - Some hormones, e.g. Steroids
Importance	- Steroids are involved in composition of some hormones such as sex hormones

CH: 1
Lesson: 2

Second **LIPIDS**

Definition:

They are biological macromolecules (polymers) that are made up of many smaller molecules (monomers) called **fatty acids.**
Lipids consist of large group of heterogeneous compounds.

Monomers	Fatty acids
They include	Oils, Fats, Waxes, Steroids and cholesterol.
Atoms	Carbon (C), Hydrogen (H) and Oxygen (O) atoms.
Molecular structure	**Lipids are formed by the union of:** Fatty acids + Glycerol Glycerol: an alcohol containing 3 hydroxyl groups.
Solubility	- Insoluble in **polar solvents** (as water). - Soluble in **non-polar solvents** such as benzene and carbon tetrachloride.
Classification	• Lipids are classified into 3 types: - Simple lipids. - Complex lipids. - Derived lipids

- **Classification of lipids:**

Lipids are classified according to **their chemical structure** into:

Classification of lipids
- **Simple lipids** (divided into oils, fats and waxes)
- **Complex lipids** (such as phospholipids)
- **Derived lipids** (as Cholesterol and some hormones (steroids))

Simple lipids

- Formed by the reaction of fatty acids with alcohol.
- They are divided into oils, fats and waxes, **according to:**

The saturation degree of the fatty acids. and The type of alcohols.

Fatty acids + **alcohol** → **simple lipids** → **oils**, **fats**, **waxes**

Role of monosaccharides in energy transferring processes inside the cells:

- Oxidation of glucose occurs inside mitochondria.
- The energy that is stored in chemical bonds of glucose is released to be stored in a ATP molecule (compound called adenosine triphosphate).
- ATP is then transferred to other places in the cell to use the stored energy in it for performing all vital processes inside the cell.

Importance of carbohydrates:

Obtaining energy	They are one of the basic and fast resources for obtaining energy
Storing energy	They are used for storing energy in organisms until be needed, as: 1- **Plants** store carbohydrates in the form of **starch.** 2- **Human and animals** store carbohydrates in the form of **glycogen** in cells of liver and muscles.
Building cells	They are basic component of some parts of the cell, as: - **Cellulose, enters** in the structure of **cell walls of plant cells.** - **Carbohydrates enters** in the structure of in **cell membranes and protoplasm.**

• Practical activity:

Detection of simple sugars

- By using **Benedict' reagent** where: its color turns from **blue** into **orange.**
- Benedict' reagent is used to detect mono- and di-saccharides.
- Benedict' reagent is used to detect simple sugars in urine and blood.
- Benedict' reagent is used to detect simple sugars in foods.

Detection of starch:

- By using **iodine solution** where: its colour turns from **orange** into **dark blue.**
- Iodine solution is used to detect starch in food samples.
- The degree of the colour of iodine solution depends on the amount of starch in the food samples.

N.B) Diabetic (مرضى السكر) and obese patients (مرضى السمنة) must keep themselves away from taking sugary and starchy substances.

<table>
<tr><th colspan="2">Simple Sugars</th><th>Complex Sugars</th></tr>
<tr><td colspan="2">1- Water soluble</td><td>1- Insoluble in water.</td></tr>
<tr><td colspan="2">2- Having a law molecular weight</td><td>2- Have a high molecular weight.</td></tr>
<tr><td colspan="2">3- Having a sweet taste</td><td>3- Do not have a sweet taste.</td></tr>
<tr><td colspan="2">4- They are two types:
Monosaccharides and Disaccharides</td><td rowspan="2">- They are made up of many monosaccharides linked together.

<u>Examples</u>
- Starch
- Cellulose
- Glycogen
-Each of these molecules conists of glucose molecules linked together.
$(C_6H_{12}O_6)_n$</td></tr>
<tr><td>Monosaccharides</td><td>Disaccharides</td></tr>
<tr><td>- No. of carbon atoms 3 to 6, each atom is connected to oxygen and hydrogen atoms in a certain way.
- The simplest type of sugars (G.R).
- Formed of one molecule.
<u>Examples :</u>
- Glucose (grape sugar)
- Fructose (fruit sugar)
- Ribose (pentose sugar)(5 C atoms)
- Galactose. (made in the glands that produce milk)</td><td>-Each molecule is made up of two molecules of monosaccharides linked together.
<u>Examples :</u>
- Maltose (malt sugar) :- Formed of glucose + glucose.
- Lactose (milk sugar) :- Formed of glucose + galactose
- Sucrose (cane sugar) :- Formed by glucose + fructose</td></tr>
</table>

9- Proteins
10- DNA
11- RNA

Biology

1st Secondary

D)Choose the correct answer:

1-Animals and humans store carbohydrates in .....

A- Liver B- Kidneys C- Muscles D- A&C

2- Starch is from .....

A- simple sugars B- complex sugars C- Waxes D- Steroids

3- ..... forms the cell walls of plant cells

A- Cellulose B- Starch C- Galactose D- Glucose

4- A process which breaks some molecules to release energy from them is called .....

A- Oxidation B- Reduction C- Anabolism D-catabolism

5- Casein is a protein which contains ..... element

A- Iron B- Iodine C- Phosphorus D- Sulphur

6- ..... are the basic component of lymph and blood in human body.

A- Proteins B- Carbohydrates C- Lipids D- Nucleic acids

7- Polymers of proteins are composed of monomers called .....

A- Nucleic acids B- Amino acids C- Citric acids D- Uric acid

8- ..... reagent is used for detecting lipids .

A- Biuret B- Bendict C- Sudan 4 D- Starch

1st Secondary

Question

A) Complete the following:

1- Carbohydrates are from…….. molecules, while salts are from …molecules.

2- The general formula of carbohydrates is …

3- Biological macromolecules are formed by …… Process

4- Sucrose polymer consists of ……. molecule and ……one bound together

5- …… and …….. are from derivative lipids

6- Lipids forming hormones are called ……

7- Lipids are formed from ……. linked with …….. molecule .

8- The acidic functional group forming an amino acid is called……., while that basic one forming it is called……

9 - Proteins are formed from groups of amino acids linked together by ……bond

10-Haemoglobin protein is found in blood and it contains …… element, while thyroxin contains …… element.

11- A nucleotide consists of ……. , …… and ……..

12- …… sugar molecule forms RNA, while ……. Sugar forms DNA molecule

13- Building proteins from amino acids is an example on …… process, while breaking up glucose molecule to get energy is called ……..

Biology 1st Secondary

me enzymes work in acidic medium such as……., while some of work in basic medium such as ……

ost enzymes work at pH of ……

B)Give reason for:

Q15: What type of reaction involves the addition of water to break the bond between two monosaccharides?

- A Insertion
- B Oxidation
- C Hydrolysis
- D Condensation
- E Reduction

Q13: The following is a list of carbohydrates:

1. Alpha-glucose
2. Beta-glucose
3. Lactose
4. Fructose
5. Sucrose

For the following statements, state the carbohydrate from the list that is being described.

- Cellulose is formed from many repeats of this carbohydrate.
  - A Beta-glucose
  - B Lactose
  - C Alpha-glucose
  - D Sucrose
- Starch is formed from many repeats of this carbohydrate.
  - A Alpha-glucose
  - B Fructose
  - C Lactose
  - D Beta-glucose

Q14: Glucose is a hexose sugar that takes the form of two isomers; the basic structure of these isomers is outlined in the diagram provided.

5- Anabolism and catabolism.

Biology

F)What is meant by:

1- Enzymes

2-Metabolism

3- Cell theory

G)Give an example on:

1- Monosaccharides

2- Disaccharides

3- Polysaccharides

4- Simple lipids

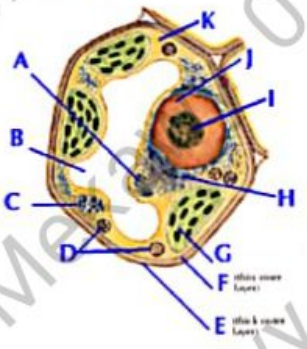
5- Complex lipids

6- Derivative lipids

7- Simple protein.

8- Conjugated protein.

H)1- This is the diagram of a typical plant cell, answer the following question:



Biology

1- Label the previous cell

2- This is the diagram of a typical anima cell, answer the following

14- Transmission electronic microscope

Biology

D)Choose the correct answer:

1-Animals and humans store carbohydrates in .....

A- Liver B- Kidneys C- Muscles D- A&C

2- Starch is from .....

A- simple sugars B- complex sugars C- Waxes D- Steroids

3- ..... forms the cell walls of plant cells

A- Cellulose B- Starch C- Galactose D- Glucose

4- A process which breaks some molecules to release energy from them is called .....

A- Oxidation B- Reduction C- Anabolism D-catabolism

5- Casein is a protein which contains ..... element

A- Iron B- Iodine C- Phosphorus D- Sulphur

6- ..... are the basic component of lymph and blood in human body.

A- Proteins B- Carbohydrates C- Lipids D- Nucleic acids

7- Polymers of proteins are composed of monomers called .....

A- Nucleic acids B- Amino acids C- Citric acids D- Uric acid

E)Compare between:

1-Simple sugars and complex sugars.

2- Fats and oils.

3- Structure of DNA and RNA.

4- Simple proteins and conjugated proteins.

5- Anabolism and catabolism.

1- Choose the correct answer

1- ..... are from organic molecules forming living organisms
A- Carbohydrates B- Acids C-Bases D- Salts

2- ..... are from inorganic molecules in living organisms
A- Salts B- Nucleic acids C- Carbohydrates D- Proteins

3- Biological macromolecules whose general formula is $(CH_2O)_n$ are called.....
A- Nucleic acids B- Carbohydrates C- Proteins D- Lipids

4- Carbohydrates are stored in plants in the form of.....
A- Starch B- Oils C- Glycogen D- Alcohols

5- Carbohydrates are stored in animals and humans in the form of .....
A- Starch B- Oils C- Glycogen D- Alcohols

6- Animals and humans store carbohydrates in .....
A- Liver B- Kidneys C- Muscles D- A&C

7- ..... polymers consist of one molecule
A- Monosaccharides B- Disaccharides C- Polysaccharides
D- Oligosaccharides

8- ..... Polymers consist of two molecules each
A- Monosaccharides B- Disaccharides C- Polysaccharides
D- Oligosaccharides

9- ..... is from monosaccharides.
A- Sucrose B- Cellulose C- Glucose D- Maltose

10- ..... Is from disaccharides
A- Sucrose B- Fructose C- Cellulose D- Lactose

11- starch is from .....
A- simple sugars B- complex sugars C- Waxes D- Steroids

12- ..... is from complex sugars
A- Glycogen B- Maltose C- Glucose D- Fructose

13- ..... is a disaccharide whose polymer is composed of one glucose molecule and another fructose one
A- Sucrose B- Cellulose C- Maltose D- Lactose

14- ..... is a disaccharide whose polymer is composed of two glucose molecules bound together
A- Maltose B- Sucrose C- Lactose D- Fructose

15- Lactose polymer consists of a glucose molecule bound to ..... one
A- Fructose B- Galactose C- Lactose D- Glucose

16- ..... sugar is found in fruits
A- Lactose B- Starch C- Glycogen D- Fructose

17- ..... forms the cell walls of plant cells
-llulose B- Starch C- Galactose D- Glucose

dissolve in non polar solvents such as...
n tetrachloride B- Water C- Hydrochloric acid
ine solutions

7- Plasma membrane plays an important role in cell

Biology

C)Mention the importance of:-

1- Carbohydrates

2- Starch

3- Glycogen

4- Lipids

5- Cellulose

6- Phospholipids

7- Steroids

8- Proteins

9- DNA

10- RNA

11- Light microscope

12- Electronic microscope

13- Scanning electronic microscope

14- Transmission electronic microscope

Biology

D)Choose the correct answer:

1-Animals and humans store carbohydrates in .....

Biology

Part (1)
Question

A) Complete the following:

1- Carbohydrates are from…….. molecules, while salts are from …molecules.

2- The general formula of carbohydrates is …

3- Biological macromolecules are formed by ……. Process

4- Sucrose polymer consists of …….. molecule and ……one bound together

5- fats can be also called……., while oils can be called…….

6- ……. and …….. are from derivative lipids

7- Lipids forming hormones are called ……

8- Lipids are formed from ……. bound to …….. molecules

9- The acidic functional group forming an amino acid is called……., while that basic one forming it is called…….

10- Proteins are formed from groups of amino acids linked together by ……bond

11-Hemoglobin protein is found in blood and it contains …….. element, while thyroxin contains …… element.

12- A nucleotide consists of ……. , …… and ……

13- …… sugar molecule forms RNA, while ……. Sugar forms DNA molecule

14- Building proteins from amino acids is an example on …… process, while breaking up glucose molecule to get energy is called ……