chemistry of life Scope

Chemistry of life of life 28 Marks Molecules for life: Organic molecules made up of proteins, carbohydrates, lipids, nucleic acids and vitamins. (only basic structural detail required) Inorganic compounds Water : 2 H and 10 INVESTIGATION Food test for starch Minerals: e.g. Na, K, Ca, P, Fe, I, nitrates, phosphates. Macro and micro elements. Main functions and deficiency diseases Organic compounds INVESTIGATION Food test for starch Organic compounds INVESTIGATION Food test for proteins. Organic compounds INVESTIGATION Investigation to test the enzymes. Organic scompounds INVESTIGATION Investigation to test the enzymes. Upidig (fats and oils) – 1glycerol and 3 fatty acids: unsaturated and saturated fats. Cholesterol in foods. <i>Heart disease</i> OR Fresh pineapple juice, egg white in plastic drinking straw. Diserve, measure and record the results of the above experiment done at different temperatures. INVESTIGATION Use a microscope or micrographs to observe and draw the structure of a: plant cell (wet mount of onion epidermis), and animal cell (cheek cells)	Торіс	Topic breakdown	Investigations	
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chemistry of life

Organic molecules are made up of carbon (C), Hydrogen (H) and oxygen (O) and some contain other elements, such as nitrogen (N) and phosphorous (P). Cells are made up of proteins, carbohydrates, lipids, nucleic acids and vitamins.

<u>Inorganic compounds do not contain the element carbon and are not produced by living</u> <u>organisms e.g. water, gases and minerals.</u>

water

Water is the most important inorganic compound that is essential for life.

• Water molecules consist of one oxygen (1 O) bonded to two hydrogen

molecules (2 H).

 $\boldsymbol{\cdot}$ The formula for water is H_2O

Minerals

Minerals can be divided into two groups i.e. macro elements and micro elements.

- Macro elements are nutrients that are needed in large quantities
- Micro elements are nutrients that are needed in small quantities.

ELEMENT		FUNCTION		DEFICIENCY DISEASE			
		PLANT	ANIMAL	PLANT	ANIMAL		
	MACRO-NUTRIENTS						
Sodium N	Na		-water-salt balance -nerve & muscle function		-muscular cramps		
Potassium K	¢	-forms protein & enzymes	-salt-water balance -heart, muscle & nerve function	-chlorosis -slow growth	-muscle weakness -irregular heartbeat		
Calcium (Ca	-forms cell walls -root development	-bone & teeth formation -nerve & muscle function	-chlorosis -poor root growth	-rickets		
Phosphorous P		-forms cell membranes -root development	-bone & teeth formation -forms cell membranes	-poor root growth -brown leaves	-bone & teeth weakness -nerve & muscle malfunctioning		
Magnesium N	٨g	-forms chlorophyll	-bone formation -nerve & muscle function	-chlorosis	-bone weakness -nerve & muscle irritability		
Nitrogen N	1	-forms amino acids & chlorophyll	-forms amino acids & proteins	-chlorosis	-kwashiorkor in young children		
MICRO-NUTRIENTS							
Sodium N	Na	-water-salt balance in cell sap		-reduced growth			
Iron F	Fe	-forms chlorophyll	-forms haemoglobin- transport oxygen	-chlorosis	-anaemia		
lodine I	I)	-energy release	-thyroid gland function- controls metabolism	-poor growth	-goitre		

chemistry of life Organic compounds

carbohydrates

Molecules found in food that provide energy. Divided into three:

- Monosaccharides
- Disaccharides
- Polysaccharides

Monosaccharides

Single sugar molecules. Monomers(building blocks) of complex sugars. Dissolve in water Examples: Glucose, Fructose & Galactose

Disaccharides

Made of two monosaccharides Dissolve in water Examples: Maltose, Sucrose & Lactose

Glucose + Glucose = Maltose Glucose + Fructose = Sucrose Glucose + Galactose = Lactose

Lipids

Molecules that are found in oil or butter Made of monomers (3 Fatty acids & Glycerol)

TWO TYPES OF FATS:

- Saturated fats
- Unsaturated fats

Saturated fats

Solid at room temperature. Derived from animal fat EG. Butter

Food test

TEST FOR FAT: • Observation: Greasy on filter paper

Polysaccharides

Made of many monosaccharides Dissolve in water Examples: Starch, Cellulose & Glycogen



TEST FOR GLUCOSE:

• Add solution(juice) into Benedict's solution and heat it up.

• Observation: Changes from blue to orange or brick red (positive)

TEST FOR STARCH:

- Add iodine solution to a piece of bread
- Observation: Changes to Blue-Black (positive) Remains yellow-brown (negative)



UnSaturated fats

Liquid at room temperature. Derived from plant fat EG. Sunflower oil



Saturated fats may increase cholesterol levels in the blood which block arteries. Arteries transport oxygen and a blockage in arteries (atherosclerosis) may cause heart disease

chemistry of life Organic compounds

Proteins

Proteins are large organic molecules made up of carbon, hydrogen, oxygen and nitrogen atoms.

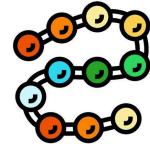
Made of monomers called amino acids.

Theres about 20 amino acids.

The sequence of amino acids determines the type of protein formed.

Amino acids are joined by peptide bonds to form a polypeptide chain called a protein.

<u>Proteins are sensitive to pH and temperature.</u> <u>At extreme temperatures or pH they</u> <u>denature (change shape) and lose function</u>



Foodtest

TEST FOR PROTEINS:

• Buiret reagent, a blue solution, is used to test for protein. A deep purple colour is a positive indication of the presence of protein in a solution. The darker the solution the more protein is present.

Vitamins

Vitamins are organic compounds known as micronutrients that are required in small quantities by animals to maintain health. Some vitamins are water-soluble ((Vit. C and B) and must be consumed daily and some are fat-soluble (Vit. A, D, E and K) and stored in the liver and fatty tissues of the body.

VITAMIN	FOOD SOURCE	FUNCTION	DEFICIENCY DISEASE
Α	Carrots, dairy products, fish liver oil	-good eye-sight -healthy skin	-poor night vision -dry, hard skin
B1	Whole grain cereals, lean meat, liver	 healthy appetite prevents constipation 	-beri-beri – nerve & heart disorders
С	Citrus fruit -lemons, oranges, tomatoes, green vegetables	-prevents infection -maintains blood vessel walls, gums, teeth	-scurvy – bleeding gums & under skin
D	Dairy products, fish liver oil, sunlight	-absorption of calcium - strong bones	-rickets – children -osteomalacia - adults
E	Wheatgerm, meat, dairy products	-healthy red blood cells -protection against cancer, heart disease	-infertility -anaemia



chemistry of life Organic compounds

Nycleic gaids

Nucleic acids are complex organic acids found in a cell's nucleus and are responsible for storing and transferring genetic information. There are two types of nucleic acids found in cells:

- Deoxyribonucleic acid (DNA)
- Ribonucleic acid (RNA)

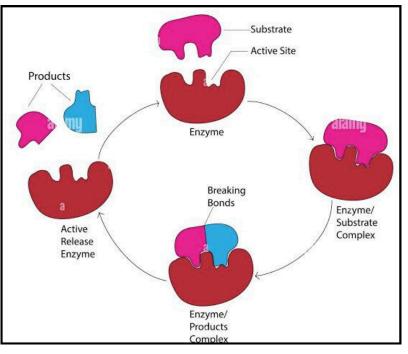
Enzymes

Enzymes are protein molecules that control metabolic reactions. They act as catalysts because the increase the rate of the reaction or slow down the rate of the reaction. <u>Enzymes</u>:

 $\boldsymbol{\cdot}$ regulate almost every reaction in the human body

• are specific in their action; each enzyme regulates one particular reaction or type of reaction

 are not altered by the reaction and can function over and over again



<u>The lock-and-key model</u>: a theory of how specific enzymes act on specific substrate molecules. Each enzyme targets a specific substrate that fits into its active site.

Enzymes work best at an optimum temperature and in the human body it is 37°C.

• At temperatures higher than 37°C, the reaction rate will slow down. At extremely high temperatures the structure of the enzyme will be destroyed, and the enzyme will not be able to bind with the substrate molecule.

• At low temperatures, the enzyme becomes inactive and the tempo of the reaction will slow down. The structure of the enzyme will not be permanently destroyed.

Enzymes are sensitive to pH. Most enzymes work the most in pH-neutral conditions. Extreme conditions of pH can denature enzymes permanently.

Enzymes are used in:

• Biological washing powders. These enzymes break down stains caused by food, blood, fat or grease. They are extremely effective at low temperatures.

• Meat tenderisers.





Biological term	Description	
Active Site	a specific region within the enzyme where the substrate binds	
Atherosclerosis	a disease where plaque, a buildup of fatty substances accumulates in arteries	
Amino acid	Monomers of a protein	
Atom	Basic unit of matter	
Catalyst	A substance that speeds up a chemical reaction without being part of the reaction	
Compound	Two or more elements chemically joined	
Cholesterol	A waxy fat-like substance/fatty deposits in body cells	
Deficiency	Lack of something	
Disaccharide	Two monosaccharides/ Two sugar molecule	
Element	A pure substance that cannot be broken down into anything simpler	
lodine solution	A yellow-brown solution used to test for the presence of starch	
Macro nutrient	Nutrients needed in large amounts	
Micro nutrient	Nutrients needed in small amounts	
Monomer	A building block	
Monosaccharide	Single sugar molecules	
Molecule	Two or more atoms bonded together	
Peptide bond	Bonds between amino acids in a protein molecule	
Polysaccharide	Many monosaccharides/A molecule with More than two sugars	
Saturated fat	Lipids derived from animal fat	
Substrate	A molecule that an enzyme acts upon	
Unsaturated fat	Lipids derived from plant fat	

