

## REVISION: CHEMISTRY OF LIFE

19 MARCH 2014



### Lesson Description

In this lesson we revise:

- The Chemistry of Life
- Food tests



### Summary

#### Inorganic Nutrients

Water	Nutrients
<ul style="list-style-type: none"> <li>• Solvent</li> <li>• Medium in which chemical reactions occur</li> <li>• Transport agent</li> <li>• Regulates body temperature</li> <li>• Lubricant</li> <li>• Reagent during hydrolysis</li> <li>• Gives shape and rigidity</li> </ul>	<p><b>Macro-nutrients</b> – needed in large quantities. E.g. calcium, potassium, phosphorous, sodium</p> <p><b>Mirco-nutrients</b> – needed in small quantities. E.g. iron and iodine</p>

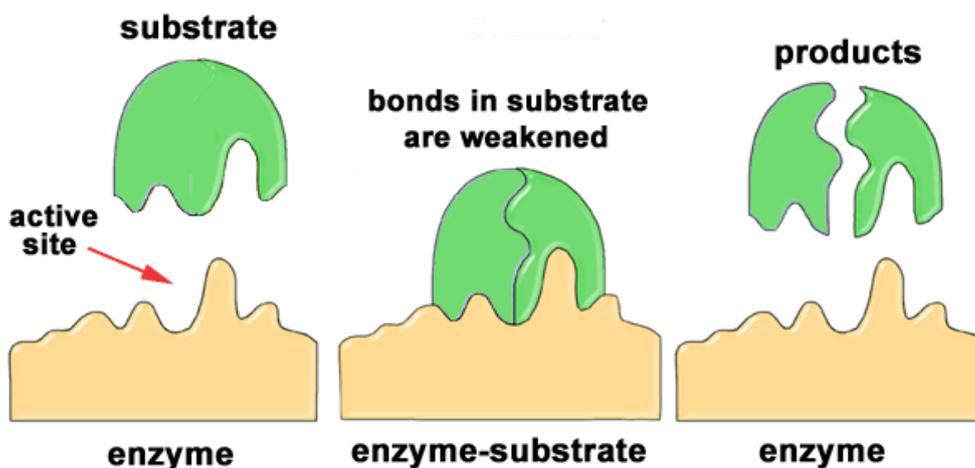
#### Organic Nutrients

	Carbohydrates	Lipids	Proteins
Elements	<ul style="list-style-type: none"> <li>• C, H, O</li> </ul>	<ul style="list-style-type: none"> <li>• C, H, O</li> </ul>	<ul style="list-style-type: none"> <li>• C, H, O, N and sometimes Fe and P</li> </ul>
Monomers	<ul style="list-style-type: none"> <li>• Monosaccharide (glucose, fructose, galactose)</li> <li>• Disaccharides. (maltose, sucrose, lactose)</li> <li>• Polysaccharides (starch, cellulose, glycogen)</li> </ul>	<ul style="list-style-type: none"> <li>• 3 fatty acids and 1 glycerol</li> </ul>	<ul style="list-style-type: none"> <li>• Amino acids</li> </ul>
Bonds	<ul style="list-style-type: none"> <li>• Glycosidic bonds</li> </ul>	<ul style="list-style-type: none"> <li>• Ester bond</li> </ul>	<ul style="list-style-type: none"> <li>• Peptide bond</li> </ul>
Biological Importance	<ul style="list-style-type: none"> <li>• Most common source of <b>energy</b> e.g. glucose</li> <li>• Polysaccharides are stored as a <b>reserve energy</b> source</li> <li>• Cellulose is the major component of cell walls</li> </ul>	<ul style="list-style-type: none"> <li>• Fats are a reserve source of energy</li> <li>• Insulation – under skin</li> <li>• It acts as a packing tissue between internal organs</li> <li>• It is an important part of cell membrane</li> </ul>	<ul style="list-style-type: none"> <li>• Protoplasm is made up of many proteins</li> <li>• Form the outer layer of cell membranes</li> <li>• Reserve energy</li> <li>• Enzymes are proteins</li> <li>• Many proteins have a structural function – keratin,</li> </ul>

			muscle, chromosomes, haemoglobin, collagen, bone • Some hormones are proteins
Properties	• Monosaccharides and disaccharides are sweet to the taste, polysaccharides are NOT • Monosaccharides and disaccharides dissolve in water, polysaccharides are NOT (osmotically inactive)	• They do not dissolve in water • They do dissolve in or in alcohol • Fats are in a solid form at room temperature • Oils are in a liquid state at room temperature	• They are sensitive to changes in temperature and pH

### Enzymes

Enzymes are organic catalysts, as they speed up and control chemical reactions in living organisms without being changed by the reaction



(Taken from: <http://waynesword.palomar.edu/molecu1.htm>)

- They are proteins and therefore they:
  - a) Are inactive at low temperatures, denatured (changes shape) at high temperatures. Optimum temperature is 37°C
  - b) Enzymes are sensitive to changes in pH (acidity and alkalinity)
- Enzymes are specific in that they will only work on one kind of substrate. E.g. maltase will break down maltose, because of the shape

### Vitamins

- Vitamins are essential for the normal growth, metabolism and development of the body
- Water -soluble vitamins – vitamins B and C. Absorbed by body together with water. Not stored in body and are excreted
- Fat-soluble vitamins – vitamins A, D, E and Absorbed when dissolved in fat. Stored in the body

## Food Tests

To do food tests collect small samples of different food types which will serve as test material. If the test material is solid, rather grind it finely into small pieces

The test mediums that indicate the presence of a certain substance are known as **reagents**

Food tests for Carbohydrates			
Compound	Example	Chemical	Results obtained
Glucose	glucose powder/ grape juice/Energade/Oros	Benedict's solution OR Fehling's A and B	orange – red
Starch	starch powder/ bread/potato	Iodine	blue-black
sucrose	sucrose powder/table sugar	Benedict's solution OR Fehling's A and B and HYDROCHLORIC ACID	orange -red

Food tests for Proteins			
Compound	Example	Chemical	Results obtained
Protein	egg white/beans/soup powder/milk powder	Millons Reagent OR the Biuret test – copper sulphate and sodium hydroxide solution	purple/violet

Food tests for Lipids			
Compound	Example	Chemical	Results obtained
Lipids	peanuts/ olive oil	ether / ethanol alcohol	translucent greasy spot

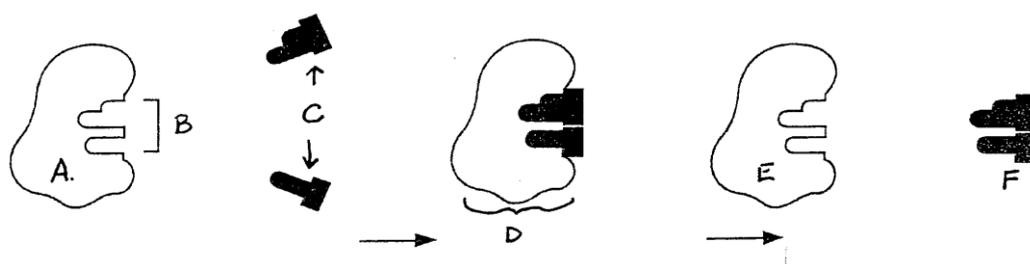


## Improve your Skills

### The Chemistry of Life

#### Question 1

Study the diagram given and answer the questions on the answer sheet



1.1. Provide labels for the parts indicated A, B, C and F respectively. (4)

1.2. What characteristic of enzymes is visible in the diagram? (1)

### Question 2

The following table shows an analysis of the nutrients found in 100g portion of breakfast. The breakfast was made up of eggs, bread and butter.

NUTRIENTS IN A 100 g PORTION	FOOD TYPES		
	Eggs	Bread	A specific brand of butter
Carbohydrates (g)	0,0	20,2	0,10
Fats (g)	12,5	0,2	85,20
Protein (g)	11,8	2,5	0,00
Calcium (mg)	56,0	3,3	13,80
Iron (mg)	2,8	0,6	0,15
Vitamin A (mg)	675,0	12,0	2 344,00
Vitamin C (mg)	0,0	,0	0,20

Use the information in the table to answer the following questions:

- 2.1 Name a vitamin deficiency disease that could result from a diet that consists mainly of bread.
- 2.2 Identify the food type that would be best for a person who suffers from night-blindness. Give a reason for your answer.
- 2.3 This breakfast provides very little vitamin C. What food would you recommend to correct this?

### Question 3

Match the carbohydrate compounds from the following list with the statements listed below. Some statements require more than one answer. Write the letter or letters only of the appropriate carbohydrate next to the question number.

Letter to use	Carbohydrate	Letter to use	Carbohydrate
A.	glycogen	F.	fructose
B.	sucrose	G.	maltose
C.	glucose	H.	lactose
D.	starch	I.	cellulose
E.	galactose		

Statements:

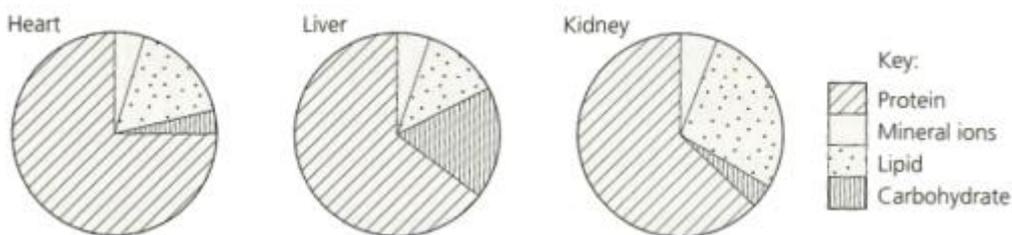
1. storage carbohydrate found in liver and muscle tissue.
2. cane sugar, also found in sugar beet.
3. monosaccharide.
4. the main carbohydrate in milk.
5. disaccharide
6. structural carbohydrate found in plant cells.
7. combines with glucose to form lactose.
8. insoluble in water.

notes for...

**Food Tests**

**Question 1**

The pie charts below show the composition of three different organs from the body of an ox. The figures are percentages.

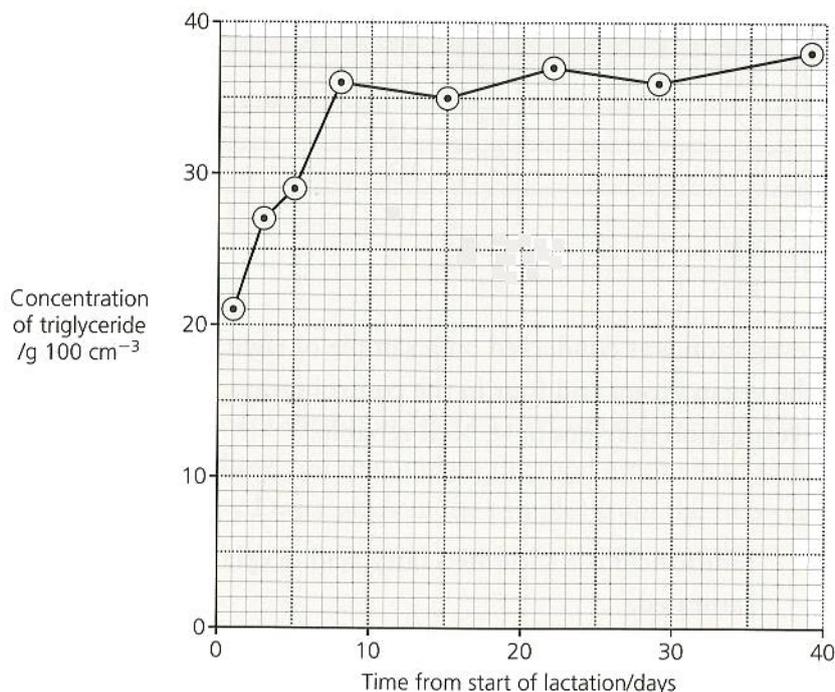


Describe how you could demonstrate that a sample of heart contains protein. (6)

**Question 2**

Milk provides a young mammal with all the nutrients it needs for its early growth and development. Milk contains proteins, carbohydrates and lipids. It also provides essential vitamins and minerals. The composition of milk, however, varies enormously. It varies from one species to another, from one individual to another, and even within a single individual.

The graph below shows how the concentration of triglyceride in human milk changes as lactation (the period of milk production) progresses.



The preamble states that 'milk contains proteins, carbohydrates and lipids'. Draw up a table in which you state the tests used, the expected results and a conclusion of your results.