

THE BIOSPHERE

1. The biosphere.

The biosphere is the sum of all **living things** on the Earth. Life has developed on the Earth because of the following factors: optimal **temperature**, the **atmosphere** that has **gases** such as carbon dioxide and oxygen and the **ozone layer** and finally the presence of **liquid water**.

2. Living things.

2.1 What do all living things have in common?

- All living things have a **similar chemical composition**.
- All living things are made up of one or more **cells**.
- All living things also carry out three functions: **nutrition, interaction with the environment and reproduction**.

2.2. What are living things made up of?

The living matter that makes all organisms is made up of different elements found in Nature (**bioelements**). The most important are **Carbon (C)**, **hydrogen (H)**, **oxygen (O)**, and **nitrogen (N)**, because they make up more than 99% of the mass of living things.

Combinations of these elements form molecules of living matter called **biomolecules**. Living things are made up of two kinds of substances: **inorganic and organic**.

- **Inorganic biomolecules (or compounds or substances).**

They do not contain carbon. They are present in living things and non-living things. The principle inorganic substances are water and mineral salts.

Mineral salts have various functions: they make up different structures, like shells, bones and teeth. They are present in internal fluids, like tears, sweat and blood.

Water is the most abundant substance in living things. Living things obtain water directly by drinking it, or indirectly from substances that contain water. Plants obtain water from environment. Water is necessary for chemical reactions and to transport all other substances.

- **Organic biomolecules.**

They are unique to living things. Carbon is their principal element. Organic substances present in living things are:

Biomolecules	Example	Use/ Function
Glucides or Sugars	Glucose Cellulose	To provide energy To make structures
Lipids or Fats	Fatty acids Cholesterol	To provide energy reserves To make structures
Proteins	Haemoglobin Antibodies Queratine	To transport oxygen To fight microorganisms that cause disease To make structures: hair, nails
Nucleic acid	DNA, RNA	To control cell function and heredity

3. What functions do all living things carry out?

Nutrition refers to all the processes which enable living things to obtain energy and matter they need to live. For nutrition to take place, living things take in substances from their surroundings, transform them and use them. Finally they expel the waste matter. Living things can be classified into two groups depending on how they feed.

- **Autotrophs** produce the organic substances which they need from inorganic substances. They take substances like water, mineral salts and carbon dioxide from the soil and the atmosphere. To obtain these organic substances, autotrophs need energy. They get energy from sunlight through a process called **photosynthesis**. Chlorophyll enables them to do this. Plants, algae and some bacteria are autotrophs.
- **Heterotrophs** feed on organic matter which is already elaborated: for example, living things or their remains. Animals, fungi, some bacteria and all protozoa are heterotrophs.

Interaction with the environment: all the processes which enable living things to react to changes in their environment. For example, plants grow towards the light; animals flee from predators.

Reproduction: refers to all the processes which enable living things to create new living things. There are two basic types:

- **Asexual reproduction** involves one living thing. For example: a sponge can produce buds which give rise to new sponges.
- **Sexual reproduction involves living things of different sexes. Each one provides a sex cell or gamete. The two sex cells join to form the first cell of a new living thing, the zygote.**

4. What are cells?

Organic and inorganic biomolecules join together to make more complex structures called cells. Most cells are too small to see, so we need to use a microscope to see them. Cells are the smallest unit of life. They are structural and functional units for all living things.

- All living things are made up of one or more cells.
- Cells carry out the function of nutrition, interaction with the environment and reproduction.
- All cells come from other cells.

4.1 How is a cell organized?

- The **cell membrane** covers the whole cell. It is a thin layer that surrounds and protects the cell. It regulates which substances enter and exit the cell.
- **Cytoplasm** is the inside of the cell. It is a jelly-like substance. It is mainly made up of water, in which various salts are dissolved. Many of the chemical reactions of the cells take place here. **Organelles** are small structures in the cytoplasm. They are responsible for respiration, making and storing nutrients, digesting food substances, disposing of waste, etc.
- **Genetic material** controls and regulates how cells work. This **DNA** contains the hereditary information that is passed from one cell to the daughter cell. DNA makes up the chromosomes.

4.2 What are the two basic types of cells?

- **Prokaryotic cells** have no nucleus. They have no nuclear membrane. Genetic material is dispersed throughout the cytoplasm. They are simpler and smaller than eukaryotic cells. Bacteria are made up of prokaryotic cells.
- **Eukaryotic cells** have a nucleus, separated from the cytoplasm by the nuclear membrane. Algae, protozoa, fungi, animals and plants have eukaryotic cells.

Eukaryotic cells can be **plants or animal cells**. We know if they are plant or animal cells because plant cells have a **rigid cell wall** (made of cellulose) outside the plasma membrane. Plant cells also contain special organelles, called **chloroplasts**, where **photosynthesis** takes place.

5. Classification of living things.

Classification systems are used to organise and compare all living things on Earth. The first classification systems were **artificial**. They only included the visible, external characteristics of living things. This caused mistakes, such as including birds, flies and bats in the same group because they all had wings.

The system of classification we used today is a **natural** classification system based on **evolution**. This means the system is based on the real biological relationships that exist between living things.

Taxonomy is the science of classifying living things. Organisms are classified into groups called **taxa** (singular: taxon). The seven taxonomic levels from the largest to the smallest are: **Kingdom, Phylum, Class, Order, Family, Genus and Species. (PCOFGAS)**.

6. What are the five kingdoms?

Scientists classify all living things into five kingdoms by three main criteria: type of cells, how the cells are grouped and nutrition.

The American biologist **Lynn Margulis** (1938–2011) proposed the classification of organisms into **five kingdoms: Monera, Protocist, Fungi, Plants and Animals**. This is one of the most widely accepted classifications of living things.

Kingdom	Type of cell	Number of cells	Nutrition	Tissue?
Monera	Prokaryotic	Unicellular	Autotrophic Heterotrophic	NO
Protocist	Eukaryotic	Multicellular	Autotrophic Heterotrophic	NO
Fungi	Eukaryotic	Unicellular Multicellular	Heterotrophic	NO
Animals	Eukaryotic	Multicellular	Heterotrophic	YES
Plants	Eukaryotic	Multicellular	Autotrophic	YES

SUMMARY

1. Fill in the summary.

- a. Three characteristics all living things have in common are
- b. The principal inorganic substances in living things are
- c. The principal organic substances in living things are.....
- d. The three life functions are
- e. Based on nutrition, living things can be classified into two groups:
- f. Cells are
- g. The three basic structures all cells have in common are.....
- h. In..... cells, genetic material floats freely throughout the cytoplasm.
- i. In.....cells, genetic material is contained in a nucleus.
- j. Taxonomy is
- k. The five kingdoms of living things are