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A Project of Dove Group

Notes for Class 9<sup>th</sup>

# Biology

Chapter 1-2

NAME: \_\_\_\_\_

F.NAME: \_\_\_\_\_

CLASS: \_\_\_\_\_ SECTION: \_\_\_\_\_



## Chapter # 01

### Introduction to Biology

**Q1: Define Biology. Describe various branches of biology.**

Ans: **Word “Biology”**

In 1736 Swedish scientist Carl Linnaeus for the first time used the word biology.

**Meaning:**

The word biology has been derived from two Greek words.

- “**Bios**” meaning life or living things.
- “**logos**” meaning to study, knowledge or thoughts.

**Definition:**

Biology is the natural science which deals with the study of living organisms

**Main branches of Biology:**

There are three main branches of Biology

- **Botany:** The study of plants.
- **Zoology:** The study of animals
- **Microbiology:** The study of microorganisms such as viruses and Bacteria etc.

**Other branches of Biology:**

i. **Morphology (Morph: Form):** The branch of biology which deals with the study of form and structure of living organisms.

ii. **Anatomy (Ana – up – tomy - cutting):**

The branch of biology which deals with the study of internal structure of living organisms is called anatomy.

iii. **Histology:**

The Microscopic study of animal and plants tissues is called histology.

iv. **Physiology (Physic-function):**

The branch of biology which deals with the study of the function of different parts of living organisms is called physiology.

v. **Embryology**

The branch of biology which deals with the study of development of a new individual from a fertilized egg (zygote) is called embryology.

**vi. Taxonomy (Taxa – arrangement + namia - distribution):**

The branch of biology which deal with the study of naming and classification of organisms into group and sub-groups on the basis of similarities and difference among them is called taxonomy

**vii. Cell biology/cytology:**

The study of the structure and function of cell, cell organelles and division is called cell biology or cytology.

**viii. Palaeontology (Paleous – ancient, anta- beings):**

The study of fossils of the extinct organisms is called palaeontology.

**Sub Branches of Palaeontology:**

There are two sub branches of palaeontology

a) Palaeobotany

b) Paleozoology

**ix. Immunology:**

The branches of biology which deals with the study of immune system of animals and plants is called immunology.

**Immune system:**

The defines system of living organisms which fight against disease causing microbes is called immune system.

**x. Entomology(entomon-insect):**

The branch of biology which deals with the scientific study of insects called entomology.

**xi. Genetics:**

The branch of biology which deals with the study of heredity character transmitted through genes from parents' offspring is called genetic

**xii. Microbiology:**

The scientific study of microorganisms is called microbiology

**Microorganism:**

Those organisms which cannot be seen through naked eyes and can studied only under microscope are called microorganisms e.g. bacteria viruses etc.



**xiii. Biotechnology:**

The branch of biology which deals with the study of practical application of living organisms for the welfare of human being.

**Example:**

Use of yeast, synthesis of drugs & antibiotics, preservation of food and cloning.

**xiv. Environmental Biology/Ecology (eikos - house):**

The branch of biology deals with the study of inter-relationship between the organisms and their environment is called ecology. ie Relation between biotic and abiotic components of ecosystem.

**xv. Parasitology: -**

The branch of biology deals with the study of parasites.

**Parasites:**

Those organisms which take food and shelter from living hosts and harm them are called parasites e.g. mosquito, bacteria etc.



**xvi. Social biology:**

The branch of biology deals with the study of social behaviour of some animals such as bees, Ants, Flocking birds etc.

**xvii. Pharmacology:**

The branch of biology deals with the scientific study of drugs, their formation and effects on the system of human body.

**Q2: Briefly establish the linkage between biology with physics chemistry, Geography, Statistic and Economics**

**Ans:** - Biology is not an isolated subject but it is a multidisciplinary science which means that it has great relationship with other fields of study. Some of the emerging fields are as follows.

**i. Biophysics: -**

**Definition:**

The study of biological processes using the principles of physics is called Biophysics.

**Development**

The understanding of physics for a biologist helps in using the principles and techniques of physics in biological phenomena. Biophysics developed after world war II.



**Example:**

- There is a similarity between the working principles of lever in physics and limbs of animal in biology.
- Use of x- ray, MRI, CT scan for diagnosis purpose.
- Used in physiology, bioenergetics, neurosciences and pharmacology etc.

**ii. Biochemistry:**

**Definition:**

It is concerned with chemical substance and processes that occur in living organism is called Biochemistry

**Example:**

- Photosynthesis, Respiration etc.
- Biochemistry is also related with the study of molecular components such as carbohydrates, Protein, Fats etc.

**iii. Biogeography: -**

**Definition:**

The study of distribution of various living organisms in different geographical region of the world is called Biogeography

**Explanation:**

Scientist study of animal distribution to understand the spread of animals borne diseases. it is Concerned with the study of distribution of plants and animals' preservation of rare species and changing geography.

**Example:**

In biogeography we study why polar bears are found only in certain part of the arctic region.

**iv. Bio-statistics or Biometry or Biomathematics:**

**Definition:**

It deals with the study of biological processes using statistical and mathematical formulas and techniques.

After experimental work biologist apply the rule of statics or mathematics to design, analyze and interpret of research data.

**Example:**

- Used in various research field.
- Used for agricultural and medical application

**v. Bio- economics:**

**Definition:**

The study of organisms with economics point of view is called bio-economics. Both plants and animals play a vital role in the economy of the country. In bio-economics scientist Calculate and compare the cost and profit of the biological project. Plants as well as diseases directly and indirectly affect the economic sphere of humanity.

**Example:**

Production of new varieties of crops.

**Q 3: Describe different careers plants in the field of Biology.**

**Ans:** Biological science is related to a wide range of professions. Some of these career paths are,

**Field of medicine and surgery:**

- The profession of medicine is related with the diagnosis and treatment of human diseases.
- In surgery the part of the body may be removed, repaired or replaced i-e the removal of stones through renal surgery Transplantation of kidney, heart and liver etc
- After studying biology in higher secondary level, a student can choose to become a medical doctor (MBBS)\

**Fisheries:**

- This profession is related to the production of fish.
- In this field biologist study the various aspects of fish such as habitat, requirement population, life cycle, disease and effect of pollutant
- Fisheries manager serves for enhancing the quality and quantity of fish production
- One can adopt this career after completing a bachelor or master degree in zoology

**Agriculture:**

- The science of farming includes the growing of crops and rearing of animals is called agriculture
- Agriculturalist study the crop like wheat, rice corn etc and livestock like buffalo, cow
- In Pakistan there are many Agricultural Universities which offer professional





courses in agricultural department, veterinary and pharmaceutical industries, food industries, farming and agricultural banks etc

### **Animal Husbandry:**

- It is also called Animal science
- It is concerned with the care and breeding of domestic animals (lice stock) e.g. cattle, sheep etc
- Student of animals, science can get degree in veterinary science after the higher secondary education in biology.
- Graduate in animals science work in veterinary and pharmaceutical industries, livestock and farming etc.

### **Horticulture:**

- It is the professional study of gardening.
- It is a skill to work for the betterment of commercial nurseries, ornamental plants in parks and work for the creation of green belt ornamental plants in parks and work for the creation of green belt along the high ways, parks, residential areas etc.
- Horticulturist can open business and find jobs in fruits and vegetables production, landscape design, nurseries, gardens and pest management etc.

### **Forestry:**

Forestry is the art and science of managing forests it concerned.

- Growing forests to provide timber.
- For developments of natural resources.
- For protection of wildlife habitat.
- For recreation

Many universities offer professional courses in forestry after the higher secondary education in biology.

### **Farming:**

- In farming farms are developed and maintained for animal breeding, poultry, fruit and vegetables.
- A student can adopt this field after getting professional training agriculture and animals husbandry.



**Forensic science:**

- The use of scientific methods in the investigation of crimes is known as forensic science.
- Forensic biologists work with police department and other process evidence that can be used to detect crimes.

**Example:** DNA Fingerprinting

**Health care:**

Biologist work to prevent many health problems such as tuberculosis, cancers and heart diseases

**Q.4: Discuss five kingdom system of classification.**

**Ans:** According to five kingdom system of classification as organisms are classified into five kingdoms. In 1969 Robert Whittaker introduced this system. These five kingdoms are,

**i. Kingdom Monera (Prokaryotes):**

**Characteristics:**

- They contain prokaryotic organisms.
- All these organisms are unicellular and microscopic.
- Nuclear-membrane and membrane bounded organelles are also absent.
- Their cell wall is made up of murine (Sugar + amino acid also called peptidoglycan)
- They are simplest in all living organisms.

**Examples:**

Bacteria, blue green Algae (cyanobacteria).

**ii. Kingdom Protista (Gr-Protista \_ very first)**

**Characteristics:**

- It includes eukaryotic unicellular and simple multicellular organisms.
- Usually live in aquatic habitat.
- Some contain chlorophyll and prepare their own food while some lack chlorophyll and cannot prepare their own food.
- Some organisms are plant like, some are animal like and some are fungus like

**Examples:**

Plant like	Chlamydomonas
Fungus like	slime molds
Animal like	Amoeba etc



“Then we made the sperm into a clot of congealed blood. Then of that clot We made a (fetus) lump. We made out of that lump bones and clothed the bones with flesh then we developed out of it another creature so blessed Allah, the best to create”

“We made from water every living thing. Will I they not then believe?”

“And in the earth are the tracts (diverse though) neighbouring, gardens of vines and field sown some with corn and palm trees-growing out of single roots or otherwise. Watered with the same water. Yet some of them we make more excellent than other to eat”

“And Allah created every animal from water. Some creep up on their bellies other walks on two legs and others on four. Allah creates what he pleases (wills) he has power over all things”

**Q.6: Describe the contribution of Muslims scientist in the field of Biology.**

**Ans: Contribution of Muslim scientist:**

**i. Jabir Bin Hayyan**

**Name:** He is also known in Europe by the name Geber.

**Date of Birth:** He was born in 721 A.D in Iran and practiced medicine in Iraq.

**Father of chemistry:** He is also known as father of chemistry.

**Contribution:** His most important contribution is in the field of chemistry especially practical application of chemistry like discovery of sulphuric acid and vinegar. He was also an astronomer, pharmacist physician, philosopher and engineer.

**Books:** He wrote a number of books are.

**Al-Nabatat:** In this book he discussed various aspects of plants life and forms.

**Al-Hayawan:** In this book he has described variety of animals, their structure and habitat.

**Date of death:** Jabir was died in 815 A.D

**ii. -Abdul Malik Aasmai:**

**Date of birth:** He was born in 740 A.D in Busra

**Contribution:** He contributed for advancement in zoology, botany and animal husbandry.

**Animal Sciences:** Abdul Malik Aasmai was regarded as the specialist of animal sciences.

**Famous books:**His famous books are as follows.

### iii. Kingdom Fungi:

#### Characteristics:

- They are eukaryotic multicellular organisms.
- They are heterotrophs because they cannot synthesize their own food.
- The food is stored inside the body in the form of glycogen.
- Their cell wall is made up of chitin.
- They take their food by absorption (saprophyte)

#### Example:

Bread mold, mushroom, puffballs and yeast etc.

### iv. Kingdom Animalia:

#### Characteristics:

- They include eukaryotic multicellular animals.
- Centrioles are present in the cells.
- They have no chlorophyll and cannot prepare their own food.
- This kingdom contains both vertebrate and invertebrate animals.

#### Example:

**Vertebrates:** They have back bone e.g. fish, birds and mammals etc.

**Invertebrates:** They have no back bone e.g. insect, Ant, Jellyfish, worm etc.

### v. Kingdom plantae:

#### Characteristics:

- They include eukaryotic multicellular plants.
- They are autotrophic and can prepare their own food in the process of photosynthesis.
- Their cell wall is made of cellulose.
- Centrioles are present in the cells.
- Mostly lack of centrioles inside their cells.
- They reserve food in the form of starch.

#### Example:

**Wheat, Pinus, Mango, Mulberry, Ferns etc.**

#### Q.5: Discuss Biology in the light of Holy Quran.

**Ans:** According to the Quranic teachings Allah, is the ultimate creator of every living and non-living things. Some of the Quranic verses in this regard are quoted below

#### Translations:

“Allah created man from sounding clay like the clay of pottery”

- **Al-ibil :** The book was written on the camels.
- **Al-kheil:** The book about horses.
- **Al-wahoosh:** The book about wild animals
- **Al –sha:** The book about sheep
- **Khalaq-ul-Insan:** The book about human being

**Date of Death:** He died in 828 A.D

**iii. Bu Ali sina:**

**Other Name:** He is also called Avicenna in west.

**Date of birth:** He was born in Bukhara, city of Iraq in 980 AD.

**Contribution:** His valuable contribution was in the field of medicine. He is also known as father of medicines. He was an expert in mathematics, astronomy, physics and palaeontology. He discovered 760 various type of drugs.

**Famous Book:**

His famous book "AL-Qanoon-fil-tibb" as known as canon of medicine in west He described 130 disease of eye in his book.

**Date of death:** He died in 1037 A.D

**iv. Abu Usman Umar Al-jahiz:**

**Date of Birth:** He was born in Basra, city of Iraq in 766 A.D

**Contribution:** He was a well-known zoologist. He described the life system of ants and his own observation on seasonal migration of fishes in Tigris River.

**Book:** He famous books was Al Haywan. In this book he described the characteristics of 350 species of animals especially about life of ants.

**v. Al-Farabi: (870-950AD):**

**Date of Birth:** He was born in 870 A.D

**Contribution:** He has a contribution in the field of Hikmat and biology and he was the renowned Hakim and biologist of the Islamic world.

**Books:** He wrote two well – known books,

- Kitab – ul –Nabatat about plants.
- Kitab – Ul – Haywanat about animals.

**Date of death:** He died in 950 A.D

**vi. Abdul Qasim Ali Zahravi (936 AD – 1004AD)**

**Date of Birth:** He was born in 936 A.D.

**Contribution:** He was regarded as the renowned surgeon of Islamic world. He was famous for the removal of stone from urinary bladder. He was expert in the making of various types of dissecting equipment.

**Date of death:** He died in 1004 A.D

**vii. Ibn – Ul – Haitham(965-1039 AD):**

**Date of Birth:** He was born in 965 A.D.

**Contribution:** He was a great optician. He corrected the Greek conception of vision. He located retina as a site of vision.

**Books:**

- Kitab – ul – Manazir about eye
- Mizan – ul – Hikma deals with medicines.

**Date of Death:** He died in 1039 A.D

**viii. Ali Bin Isa:**

**Date of Birth:** 940 A.D

**Contribution:** He was a well – known eye specialist (ophthalmologist). He worked on the structure, function and diseases of eyes. He described 130 disease of eye in his books.

**Date of Death:** 1010 A.D.

**ix. Ibn – AL – Nafees:**

**Date of birth:** 1210 A.D.

**Contribution:** He was a renowned biologist of 13<sup>th</sup> century A.D. He described the circulation of blood in human body.

**Date of Death:** 1288 A.D.

**Q.7: Describe various level of biological organization.**

**Ans: Levels of Biological Organization:**

In order to understand the various phenomena of life, biologist study biological organization at different level.

**i. Atomic and Sun-atomic level:**

All type of matter is made up of elements and each element contain a single kind of atoms.

**Atom (a-not,tom-cut):**

The smallest particle of matter is called Atom. Atoms are made of many sub atomic particles.

**Sub atomic particles:**

Atom is composed of sub atomic particles such as proton, electron and neutrons.

. **Proton:** It has positive charge and present in the nucleus.

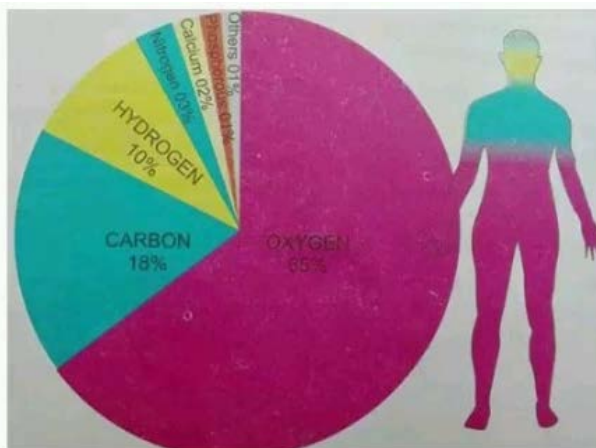
. **Electron:** It has negative charge and present in shells around the nucleus.

. **Neutron:**It has no charge (neutral) and present in the nucleus.

**Bio elements:**

Out of 92 natural occurring elements, 16 elements are called bio elements. These take part in making the body mass of a living organisms in these 16 bio elements Only O, C,H, Ca, and P make 99% of the total mass of protoplasm while other ten bio elements potassium, Sulphur , chlorine, sodium, magnesium, iron copper, manganese, zinc and iodine make 1 % of the total mass of the protoplasm.

- a) Oxygen = 65%
- b) Carbon = 18%
- c) Hydrogen = 10%
- d) Nitrogen = 03%
- e) Calcium = 02%
- f) Phosphorous = 01%
- g) Other elements = 01%



## ii. Molecule level:

### Definition:

A group of atoms bonded together is called molecule e.g.  $H_2$ ,  $N_2$ ,  $O_2$  etc

## i. Biomolecule:

### Definition:

In Organisms bio elements do not occur in isolated from they combine through ionic or covalent bonding. The stable particle formed by such bonding is also called Bio molecule.

### Type of Biomolecules:

#### a. Micro molecules:

The molecules which have low molecular weight are called micro molecules.

#### Example:

Glucose, water amino acid etc

#### b. Macro molecules:

The molecules which have higher molecular weight

#### Example:

Carbohydrates, protein and lipid etc

## ii. Compounds:

### Definition:

The chemical combination of two or more than two elements is called compound.

### Type:

#### a-Organic compounds:

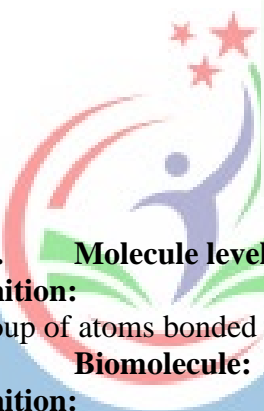
The compounds containing carbon, oxygen and hydrogen except  $CO$ ,  $CC_2$ ,  $HCO_3$ ,  $CO_3C$ ,  $N$  and Carbide are called Organic compounds.

#### Example:

Carbohydrates, protein fats etc.

#### B. Inorganic compounds:

The compounds except organic compounds are called inorganic compounds.



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**Example**

H<sub>2</sub>O, CO<sub>2</sub>etc

**iii. Organelles level:**

Different bio molecules combine in a particular way to form the sub cellular structure called organelles. Each organelle performs a particular function.

**Example:**

Mitochondria provide energy to cell. Ribosome prepares proteins.

**iv. Cellular level:**

It is the basic structural and function unit of all living organisms.

**Example:**

In unicellular organism a single cell makes the whole body like amoeba. While in multicellular Organisms consists of trillion of cells like human beings, plants etc.

**v. Tissue:**

In multicellular organisms' similar cells which perform similar function reorganized into group called tissue.

**Example:**

**Plant tissue:** epidermal tissue, ground tissue, mesophyll tissue etc.

**Animal's Tissue:**

Nervous tissue, muscular tissue, glandular tissue

**vi. Organ:**

More than one type of tissues combines together to perform a specific activity Such group of related tissues is called an organ.

**Example:**

Kidney, liver stomach, etc.

**vii. Organ system:**

Different organs combine together to perform related function to form an organ system.

**Example:**

Digestive system Respiratory system etc.

**viii. Organism**

Different organ system combines to form a whole organism. In an organism the function of different organ system is coordinated.

**Example**

In case of man, different organ systems such as blood circulatory system respiratory system, digestive system etc work in coordination.

**ix. Species:**

A group of similar organisms that can interbreed and produce fertile off spring is called species.

**Example:**

Human, Brassica

**x. Population:**

A group of organisms of the same species living together in the same place at the same time is also called population.

**Example:**

Human population and maize population

**xi. Community:**

Different populations interacting with one another in a given Habitat form community

**Example:**

Desert community consists of lizard, snakes, mice, Rabbit, birds etc.

**xii. Ecosystem:**

The natural area where the living organism and their environment interact and exchange materials between them is called ecosystem.

**Example:**

Desert ecosystem, pond ecosystem etc

**xiii. Biosphere:**

The part of the earth in which life exists including land, water, and atmosphere. It is also called zone of life on earth.

**Basic zones of biosphere:**

There are three basic zones of biosphere.

**a. Lithosphere:**

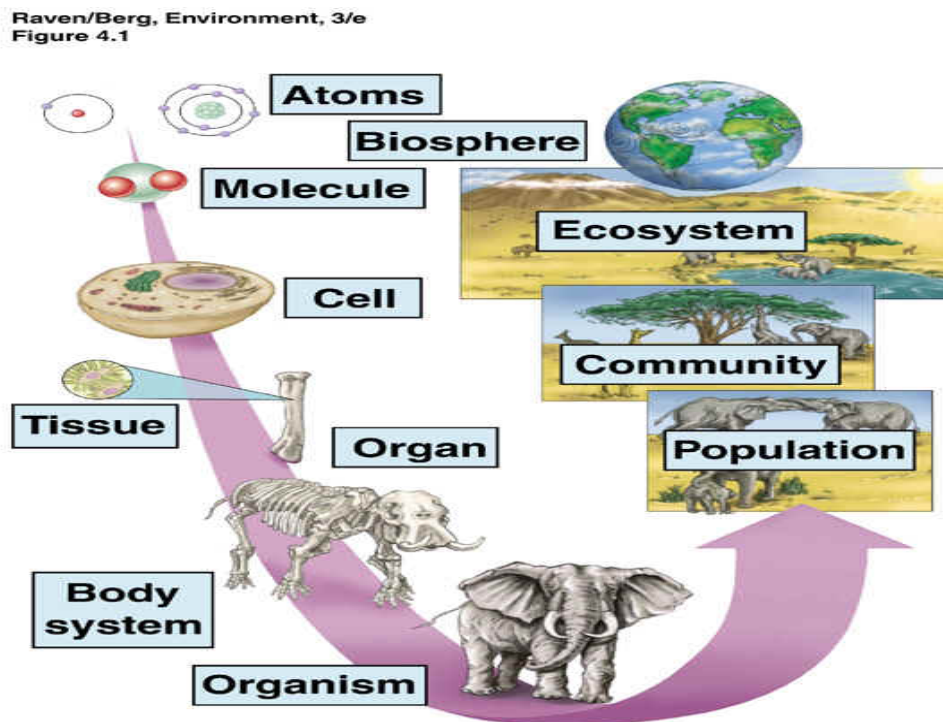
It is the solid portion of the earth surface.

**b. Hydrosphere:**

It is layer of the water

**c. Atmosphere:**

It is the gaseous portion surrounding the earth.



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**Q (8): Define cellular organization? Describe various type of cellular Organization.**

**Ans: Cellular Organization:**

**Definite:**

In living organisms' single cell or many cells organize to form an organism called cellular organization.

**Type of cellular organization:**

There are three types of cellular organization.

**i. Unicellular Organization:**

The organisms made from a single cell are called unicellular organisms. In unicellular organisms all of the life activities have the division of labour among different organelles. Their single cells are capable of respiration, digestion, excretion, reproduction etc.

**Example:**

Euglena, Amoeba and Paramecium etc.



ii. **Colonial organization:**

Many unicellular organisms live in the form of colony are called colonial organization. Each unicellular organism in a colony lives its own life and does not depends on other cells for its vital requirements.

**Example:**

Volvox is a green alga found in water that shows colonial organization. Hundreds of volvox cells make a small volvox colony.

iii. **Multicellular organization:**

Multicellular organisms are made from more than one cell. These cells are organized in the form of tissues, Organs and organ system.

**Example:**

Mustard plant and frog are familiar example etc.

**Mustard plant:**

**Botanical name:**

Brassica campestris.

**Plant body:** plant body is divided into two parts.

a. **Vegetative parts:**

Those part which do not take plant in sexual Reproduction.

**Example:**

Roots, stems, branches, leaves.

b. **Reproductive parts:**

It takes parts in the sexual Reproduction of plant.

**Example:** Flowers.

**Frog:**

**Zoological name:** Rana tigrina

The body of frog consists of well- developed organ system these organs system work together in close coordination.

**Example:**

Digestive system, respiratory system, blood circulatory system, nervous system, reproductive system etc.







## EXERCISE MULTIPLE CHOICE QUESTIONS

A. Encircle the best suitable answers.

- Ms Aisha was busy in dissecting and analyzing the heart of frog probably she is  
a. Cell biologist      b. taxonomist      c. **Histologist**      d. palaeontologist
- How many people get lung cancer by smoking? This question can be answered through:  
a. Biometry      b. biophysics      c. **Bio – economics**      d. palaeontology
- Al.Qanun-fil-Tibb is the famous book of:  
a. **Bu Ali sina**      b. Jabir Bin Hayyan      c. Abdul Malik Aasmai. Ibn Nafees
- One of the following contains large number of cells but not a multicellular.  
a. Frog      b. **Volvox**      c. mushroom      d. Chlamydomonas
- According to five kingdom system of classification mushrooms belong  
a. Plantae      b. **Fungi**      c. Animalia      d. Protista
- The level of organization which is represented by the heart of frog is:  
a. **Organ**      b. Tissue      c. Organism      d. Organelle
- One of the following is not a macromolecule:  
a. Glucose      b. **Sucrose**      c. Fatty acid      d. protein
- The number of plants in desert are scarce this could be the statement of:  
a. Palaeontologist      b. Social biologist      c. **Biogeographic**      d. Taxonomist
- Which bio-element makes most of the composition of organism's body?  
a. Hydrogen      b. Carbon      c. **Oxygen**      d. nitrogen
- Which of the following cellular organization represents volvox?  
i. Unicellular      b. Multicellular      c. Bi-cellular      d. **Colonial**

### SHORT QUESTION

**Q1. How the understanding of physics can help the biologist?**

**Ans: Biophysics:**

**Definition:**

The study of biological processes using the principles of physics is called Biophysics.

**Development:**

The understanding of physics for a biologist help is using the principles and techniques of physics.

In biological phenomena Biophysics developed after world war II.

**Example:**

- There is similarity between the working principles of lever in physics and limbs of animal in Biology.
- Use of x-ray, MRI, CT scan for diagnosis purpose.
- Used in physiology, bioenergetics, neurosciences and pharmacology etc.

**Q.2: Which career would you like to adopt after studying biology and why?**

Ans. I want to become a medical doctor and serve the humanity. Being a doctor, it is very honourable and responsible profession. I want to do specialization in cardiology because heart diseases are very common now and a lot of people die of it. That is why I will prefer medical profession for carrier.

**Q3. Write the translation of any three verse of the holy Quran related to the creation of mankind?**

Ans: See Q No.5

**Q4. Name few Muslim scientists and their contributions in the field of biology and Medicine?**

Ans: See Q No. 6

**Q5. What level of organization is represented by Volvox?**

Ans: Volvox represents colonial organization. In colonial organization many unicellular organisms live in the form of a colony.

**Habitat:**

Volvox is a green algae found in water.

**Size:**

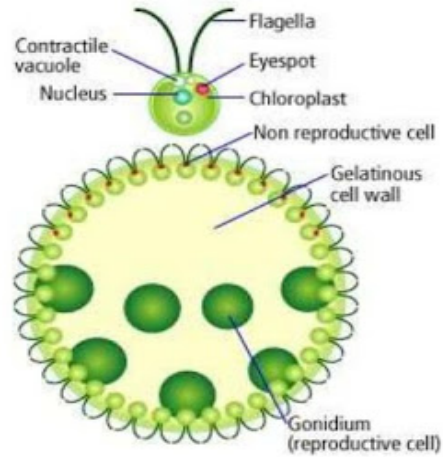
Each colony is the size of pin-head.

**Number of cells:**

There are 500 to 60000 cells presents in a single colony. The cells are connected to each other by Cytoplasmic strands. Vegetative cells are ciliated and are concerned with nutrition and locomotion.

### Volvox

- Structure:
  - Individual cells form colonies (level of organization= multicellular) up to 50,000 cells!!!!- cannot live alone
  - Eyespots that allow them to swim near light
  - Flagellates –locomotion  
Similar to Euglena





## LONG QUESTION

Give Detailed answers to the following Questions.

**Q1. Briefly establish the linkage between biology with physics geography and statistics?**

Ans: See Q.2

**Q2. Define biology How can you describe your own body under different branches of biology?**

Ans. See Q.1

**Q3. Enlist the various levels of biological organization and explain it with an example?**

Ans. See Q No Q 5

**Q4. Explain the role of Bio-elements for living organisms?**

Ans. Bio elements:

**Definition:**

The elements which make the body mass of a living organism are called Bio-element. Out of 92 natural occurring elements. In these 16 Bio elements only six elements oxygen, carbon Hydrogen, Nitrogen Calcium and phosphorus make 99 % of the total mass of protoplasm while other ten bio elements potassium Sulphur, Chlorine, sodium, magnesium, iron, copper, manganese, zinc and iodine make 1% of the total mass of protoplasm.

- i. Oxygen = 65%
- ii. Carbon = 18%
- iii. Hydrogen = 10%
- iv. Nitrogen = 03%
- v. Calcium = 02%
- vi. Phosphorous = 01%
- vii. Other ten element = 01%

**Importance of Bio elements:**

**i. Hydrogen:**

Important elements of water and organic compounds

**ii. Oxygen:**

Essential for Aerobic Respiration, breathing, growth, Reproduction and heredity.

**iii. Carbon:**

It is a key element of organic compound and carbon dioxide e.g.  $\text{CH}_4$ ,  $\text{CO}_2$

**iv. Phosphorous:**

- It is essential for growth of roots.
- It promotes fruit ripening.
- It gives rigidity to the bones and teeth.
- It is an important component of ATP, DNA, RNA and phospholipids.

v. Calcium:

- It plays an important role in bones development
- It is also essential for tooth formation.
- It is responsible for holding together the cell walls of plants.

**VI. Sulphur:**

- It is essential components of vitamin B1(thiamine)
- Sulphur is a key component in most proteins.
- It is also essential for the synthesis and break down of fatty Acids.

**vii. Nitrogen:**

It plays important role in metabolism, growth, Reproduction and heredity.

**viii. Sodium:**

Sodium helps control blood pressure and regulates the function of muscles and nerves.

**ix. Potassium:**

It is essential for the process of photosynthesis and respiration



**x. Magnesium:**

It is an important component of chlorophyll. It acts as activator for enzyme in carbohydrates metabolism.

**xi. Manganese:**

The best function of manganese is in the reaction in which oxygen is produced from water during the process of photosynthesis.

**xii. Iron:**

It plays important role in the formation of Haemoglobin.

**Haemoglobin:**

Transport oxygen to all body cells.

**xiii. Copper:**

It is essential for photosynthesis

**xiv. Zinc:**

In plants it is required for chlorophyll synthesis. While in animal it plays important role in growth.

**xv. Iodine:**

it plays a role in the production of thyroxin hormone.

**Thyroid gland:**

It is a gland present on the front of trachea it secretes a hormone called thyroxin hormone.

**Function:**

It regulates growth, maturation, sexual and mental development.

**xvi. Chlorine:**

Chlorine is required for the water-splitting reaction of photosynthesis in which oxygen is produced. It is also required for cell division in leaves and roots.

**Q5. Who classified the living organisms into five kingdoms? Explain each kingdom with the living organisms included in it.**

Ans: See Question 4

a place of hope



Like a few things in life, you can surely trust on, "Dove Group"

Notes for Class 9<sup>th</sup>

# Biology

## Chapter 2

NAME: \_\_\_\_\_

F.NAME: \_\_\_\_\_

CLASS: \_\_\_\_\_ SECTION: \_\_\_\_\_





## **CHAPTER NO 2.** **SOLVING A BIOLOGICAL PROBLEM**

**Q1: What is science? How does science work?**

**Ans: Science:**

**Meaning:**

The word science is derived from Latin word "Scientia" meaning knowledge.

**Definition:**

The knowledge which is based on observation and experiment is called science.

**Scientific method:**

A systematic method uses to solve a problem with the help of observation, information and experimentation is called scientific method.

**Science work:**

In science first observation is done and then after observation experiment is conducted to check the reality of the observation.

**Q2: What is Biological method? Give its importance.**

**Ans: Biological method:**

**Definition:**

The scientific method, in which biological problems are solved is termed as biological method.

**Importance:**

It has played a very important role in biological research from the last 500 years. It has contributed a lot to the progress of biology and up to the current Advancement in all the biological fields such as medicine, ecology and technology etc.

**Steps of Biological method:**

For solving biological problem, biologists take the following steps.

**Step (1): Recognition of biological problem:**

Biologists go for adopting biological method when they encounter some biological problem. A biological problem is a question related to living organism. It either asked by someone or comes in biologist mind by himself.

**Step (2): Observation and previous research:**

After recognizing the biological problem. The biologist makes observation. He also recalls his old observation and also studies previous research on the same problem.

Observation are made with five senses i-e, vision, hearing smell, taste and touch. There are two type of observation.

S/No	Quantitative Observations	Qualitative Observation
1	It deals numbers	It deals with description
2	It can be measured	It can be observed but not measured
3	Length, height, area, temperature, volume, weight, cost etc	Colour, texture, smell, taste etc
4	<p><b>Examples:</b></p> <p>The freezing point of water is 0C<sup>0</sup> and the boiling point is 100 C<sup>0</sup></p> <p>A liter of water weight 1000 grams and liter of ethanol weighs 789 grams</p>	<p><b>Examples:</b></p> <p>The freezing point of water is colder than the boiling point.</p> <p>A liter of water is heavier than a liter of ethanol.</p>



### Step (3): Hypothesis:

Hypothesis is an unaltered before experimentation "so tentative explanation of observation is called hypothesis" Biologist reasoning to formulate a hypothesis. Hypothesis consists of two type reasoning

#### I. Deductive Reasoning (deduce – take away from total):

Deductive Reasoning is the observation from general to specific.

##### Example:

If all organisms have cells and human is also an organism then conclude that human should have cells.

#### II. Inductive Reasoning (induct-lead in):

Inductive reasoning is the observation from specific to general.

##### Example:

We observe cell in Micro-Organisms so we can conclude that all living organism have cell in their body

##### Characteristic of a good Hypothesis:

- It is based upon observation made by the biologist
- It is a proposed statement to answer the problem.
- It is testable through experiments.
- It should be kept as simple as possible.
- There is always a way to disprove the hypothesis after experimentation.

### Step (4): Deduction:

In this step biologist draw deduction from hypothesis deduction is the logical consequences of hypothesis as true and draw out the expected results called deduction. It involves the use of "if" and "then".

##### Example:

If all birds have wings then pigeon is a bird

### Step (5): Experiment:

The most important thing of biological method is experimentation. Biologist perform experiments on his hypothesis and checks the deductions.

Through experiment he can find that deduction of some hypothesis has come true while others have not. In this way, the hypotheses are proved as true or false hypothesis are rejected while the true ones are accepted.

In science when doing the experiment, it must be a controlled experiment. The scientist must contrast an experimental group with a control group.

For example,

- Experimental group (patients)
- Control group (Healthy person)

### Step 6: Conclusion and Reporting:

Biologist collects data from his experiments. He analyze the data statistically to reach some conclusion. He publishes his conclusion in the form of research articles in scientific journals and books. Publishing of result is an essential part of scientific method.

### Q3. Describe the steps involved in biological method taking malaria as an example?

Ans: Malaria

Malaria is a common disease in many countries including Pakistan.

##### Naming:

The word malaria is the combination of two Italian words:

- "Mala" Mean
- "Area" Mean "air"

### **Biological problem 1: what is the cause of Malaria**

#### **Step 1: Observation:**

- Malarial patient experienced recurring attacks of chills and fevers.
- The disease was more common among people who lived in low marshy area.
- Drinking the water of marshes does not cause malaria.

These observations did not help much for solving the problem i-e "what is the cause of malaria" In 1878 a French physician Laveran examined the blood of a malaria patient under microscope. Five year late, the same microorganisms were observed in the blood of malaria patient and these microorganisms were given the name of "Plasmodium"

#### **Step 2: Hypothesis and Deduction:**

##### **Hypothesis**

Biologist further build upon the ancient observation and the discovery of Laveran the hypothesis made in this case was,

"Plasmodium is the cause of Malaria"

##### **Deduction:**

Biologist does not know whether his hypothesis is true or not, but he accepts it may be true and make deduction. One of deduction from above hypothesis was,

If plasmodium is the cause of malaria, then all malarial patients should have plasmodium in their blood

#### **Step 3: Experiment and Result:**

##### **Experiment:**

The next step was to test the deduction through experiments which were designed as, "Blood of 100 malaria patient was examined under microscope. For the purpose of having a control group, the blood of 100 healthy persons was also examined under microscope"

##### **Result:**

It was observed that all the malarial patients have plasmodium in their blood; whereas the blood of healthy persons was free from plasmodium.

#### **Step 4: Conclusion**

The result was quite convincing and proved that the hypothesis "Plasmodium is the cause of malaria" was true.

### **Biological problem 2: How is plasmodium transmitted to human beings?**

#### **Step 1: Observation:**

Biologist were having following observations

- Malaria is associated with marshes
- Drinking water of marshes does not cause malaria.

From these observations it can be concluded that plasmodium was not in the marsh water. But it must be carried by something that comes to marsh water.

In 1883 a physician A.F.A king listed twenty observation. Some important observation of A.F.A king were:

- People who slept in open places suffered from malaria more than the people who slept indoors.
- Individuals who slept near a smoky fire usually did not get malaria.
- Those people who used mosquito nets suffer less from malaria as compared to those who did not use mosquito nets.

#### **Step 2: Hypothesis:**

On the basis of this observation king suggested a hypothesis:

"Mosquitoes transmit plasmodium and so are involved in the spread of malaria"

#### **Step 3:**

Following deductions were made considering the hypothesis as true:

"If mosquitoes are involved in the spread of malaria then, plasmodium should be present in mosquitoes" OR



“A mosquito can get plasmodium by biting a malarial patient”

**Step4: Experiment:**

Ronald Ross was British army physician who worked in India 1880s. He performed important experiment to test the above deduction He allowed a female Culex mosquito to bite sparrows suffering from malaria. Some of the mosquitoes were killed and studied at various time Ross found that plasmodium multiplied in the wall of the mosquito’s stomach and then moved into mosquitoes salivary glands. He kept some mosquitoes need the blood of mammals or birds for the maturation of the eggs. Ross found that the saliva of the infected mosquito contained plasmodium and in these previously healthy sparrows, he found many plasmodium.

**Result:**

It was observed were sparrows had plasmodium in their blood.

**Step 4: Conclusion:**

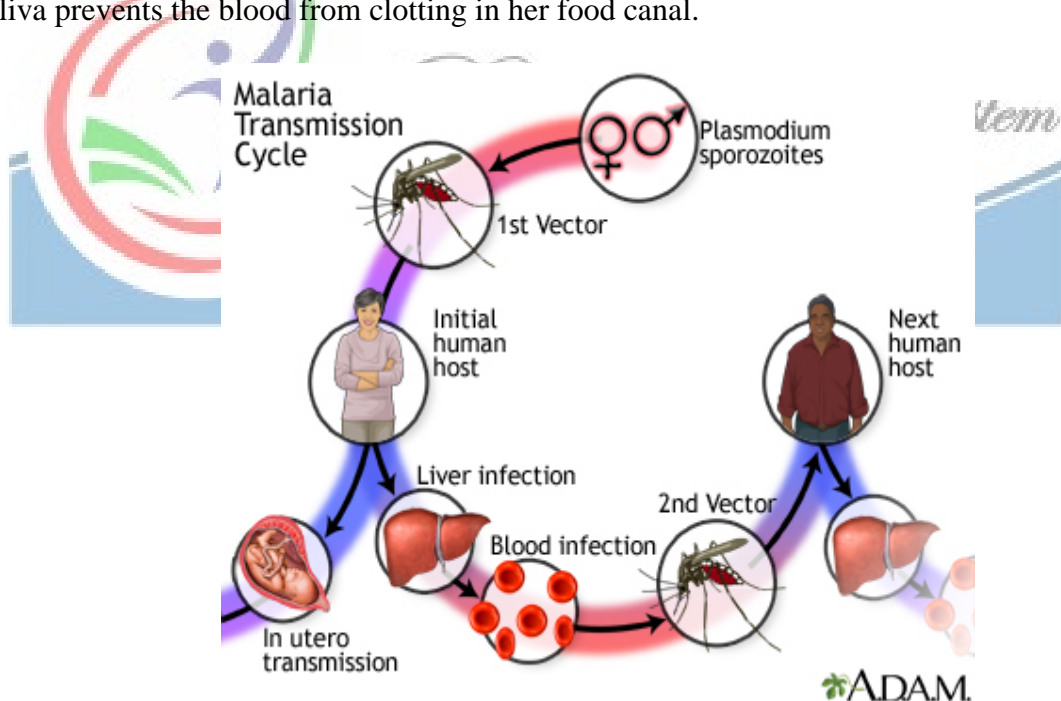
The results were quite convincing and proved that the hypothesis “How plasmodium transmitted to human beings” was true.

**Q4: Explain the experiment of malaria on Human?**

**Ans.**In the end hypothesis was tested by direct experimentation human beings. In 1898 Italian biologists allowed an anopheles mosquito to bite a malarial patient. The mosquito was kept for a few days and then it was allowed to bite a healthy man. This person late got malaria. In this way, it was confirmed that mosquitoes transmit plasmodium and spread malaria.

**Transmission of plasmodium:**

When a female mosquito pierces the skin with her mouthparts, she injects a small amount of saliva prevents the blood from clotting in her food canal.



**Q5: Write a comprehensive definition of theory, law or principle.**

**Ans: Theory: -**

When more research is carried out on a hypothesis and all the available evidence favours it, then it becomes theory.

**Explanation: -**

We know that when a hypothesis has been proved by experiments. Scientists keep on trying to do more experiments on it. When a hypothesis is proved by many experiments, scientists develop more hypothesis is proved by many experiments, scientists develop more hypotheses from it and test them experimentally, If the new hypotheses are again proved the original hypothesis becomes a theory.



**Example: -**

- Darwin theory about evolution
- Lamarck theory about evolution

**Law or scientific principle: -**

When a theory is accepted again and again and become a universal truth is called law. It must be simple, universal and absolute.

**Explanation: -**

Many biologists take it as a challenge and exert greater efforts to disprove the theory. If a theory survives such doubtful approach and continues to be supported by experimental evidences, it becomes law or principle. A scientific law is a uniform or constant fact of nature.

**Example:**

Hardy Weinberg principle and Mendel's laws of inheritance.

**Q6: Discuss data organization and data Analysis?**

**Ans:** Data organization and data analysis are important steps in the biological method.

**Data organization:**

**Data:**

Data can be defined as

"Data can be defined as

"A piece of information such as name, date or values taken from observation and experimentation"

In order to formulate and then to test the hypotheses scientist collect and organize data through the use of variables and controls, results can be determined.

**a. Variable:**

Variable are those factors being tested in an experiment and usually compared to a control.

**control:**

A control is a known measure to which scientist can compare their results. Prior to conducting an experiment, it is very important for a scientist to describe the data collection methods. It ensures the quality of the experiment. Data is organized in different formats like graphics, tables, flow charts, maps and diagrams.

**Data analysis:**

Data analysis is necessary to prove or disprove hypothesis by experimentation. The methods involved in testing or analyzing the data are also important since an experiment should be repeated by others to ensure the quality of results. Depending on the type of data and the biological problem, this might include application of statistical methods i.e., ratio and proportion.

**a.Ratio:**

When a relation between two numbers e.g. 'a' and 'b' is expressed in terms of quotient (a/b), such a relation is the ratio of one number to the other. A ratio may be expressed by putting a division ( $\div$ ) or Colon (:) mark between the two numbers.

**Example:**

The ratio between 50 malarial patients and 150 normal persons is 1: 3.

**proportion:**

Proportion means to join the equal ratios by the sign of equality (=).

**Example:**

$$a: b = c: d$$

is a proportion between the two ratios. This proportion may also be expressed as

$$a: b::c: d.$$

In every proportion of two ratios have four terms i.e., the first and fourth terms are called extremes, the second and third are called means.

So, in the above proportion 'a' and 'd' are extremes while 'b' and 'c' are means.



The basic rule used to solve problems through ratio and proportion is that the product of the extremes is equal to the product of means. When three values in a proportion are known, the fourth one (X) can be calculated by using this rule.

**Example: -**

If a biologist wants to know how many sparrows would be infected with malaria if he allows Culex mosquito to bite 50 sparrows. Previously in one of his findings he already noticed that if allowed Culex mosquito to bite 10 sparrows 6 out of them got malaria.

**Rule:** **a: b::c: d**

**Sparrow: -**

$$\begin{array}{ccc}
 10 & \swarrow & \searrow 6 \\
 50 & \swarrow & \searrow x \\
 10x & = & 50 \times 6
 \end{array}$$

Dividing both sides by 10.

$$\frac{10x}{10} = \frac{300}{10}$$

$$x = 30$$

It means that 30 out of 50 sparrows will get malaria. Proportions are used to draw the conclusion.

**Q7: what is the relationship of biology with Mathematics?**

**Ans: Mathematics as integral part of science:**

Mathematics is used in biology in many fields.

**Applied mathematics:**

Biological method also involves the use of applied mathematics to solve biological problems. Major biological Problems in which knowledge of mathematics is used include gene finding, protein structure and the modelling of evolution

**Bioinformatics:**

Bioinformatics refers to the use of algorithms, computational and statistical techniques for the analysis of biological data. Computational biology refers to hypothesis driven investigation of specific biological problem using computer

**For Example:**

It is used for calculation in Human genome project. This project is used to determine the gene sequence of a particular organization. Mathematics is also used in ecology and evolution.



## SHORT QUESTION

### B. Give short answers to the following question?

**Q1. What is science? How does science work?**

**Ans. See Q NO 1**

**Q2. Control group is important for scientific study, How?**

**Ans. Control group:**

It is a group that remains constant throughout the experiment to test a hypothesis. But other variables are compared with it.

**Importance:**

1. To find more accurate and acceptable result of the experiment.
2. To compare the result with it.
3. To know the effect of treatment.

**Q3. What deductions were developed during the study of Malaria?**

**Ans.** Biologist does not know whether his hypothesis is true or not, but he accepts it may be true and make deduction.

- i. "If Plasmodium is the cause of malaria, then all malarial patients should have plasmodium in their blood"
- ii. "if mosquitoes are involved in the spread of malaria then Plasmodium should be present in mosquitoes"
- iii. "A mosquito can get plasmodium by biting a malarial patient"

**Q4: How Ronald Ross conducted the experiment to prove that mosquitoes are involved in the spread of malaria?**

**Ans: Ronald Ross Experiment:**

Ronald Ross was a British army physician who worked in India in 1880's. He performed important experiment to test the above deduction. He allowed a female Culex mosquito to bite sparrows suffering from malaria. Some of the mosquito were killed and studied at various times. Ross found that Plasmodium multiplied in the wall of the mosquito's stomach and then moved into mosquitoes salivary glands. He kept some mosquitoes alive and allows them to bite healthy sparrows. Female mosquitoes need the blood of mammals or birds for the maturation of their eggs. Ross found that the saliva of the infected mosquito contained Plasmodium and these entered the sparrow's blood. When he examined the blood of these previously healthy sparrows, he found many Plasmodium's.

**Q5: At what stage of the biological method, Hypothesis, is accepted or rejected?**

**Ans:** The stage of biological method, in which hypothesis is accepted or rejected is experiment. The most basic step of biological method is experimentation. After experimentation the incorrect hypothesis are rejected and the one which proves correct is accepted.

## LONG QUESTION

**Give Detailed answers to the following Questions.**

**Q1: Differentiate between inductive reasoning and deductive reasoning?**

**Ans:** See Q No. 2

**Q2: Explain how biologists use scientific method to solve the mysteries of addressing the malarial problem?**

**Ans:** See Q No. 3

**Q3: Explain that how mathematics can be used to interpret the data obtained through experimentation.**

**Ans.** See Q No. 6(See ratio, proportion and solved example)