

BIOLOGY
SYLLABUS
FORM 1 - 4

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FORM 1

1. INTRODUCTION TO BIOLOGY

Definition of Biology

Branches of biology

The main branches

Botany

Zoology

Minor branches

Parasitology

Microbiology

Ecology

Importance of studying biology

Characteristics of living organisms

Movement and Locomotion

Reproduction

Irritability

Gaseous exchange

Respiration

Nutrition

Comparison of plants and animals

Apparatus used in studying biology (the learner should be able to identify them and state their uses)

- i. Hand lens,
- ii. Sweep net,
- iii. Pitfall trap,

2. CLASSIFICATION 1

Hand lens:

Calculation of magnification using a magnifying lens

External Features of plants and animals

Plants:

Leaves

Simple vs. Compound

Margin: Entire, smooth, Serrated

Venation: Network and parallel

Roots

Tap root system, Fibrous roots, prop roots,

Flowers

Complete or incomplete, male or female,

Bracts: Brightly colored or dull,

Taxonomy (science of classification)

History of classification

Carolus Linnaeus

Types of classification

Importance of classification

The Major units used in classification (Taxonomic units)

Kingdom, Phylum (Division), Class, Order, Family, Genus, Species

The Five kingdoms:

Monera, Protocista, Fungi, Plantae, Animalia (The examples in each case)

(For plantae and Animalia kingdoms, the 7 taxonomic units can be illustrated)

Binomial Nomenclature - Double naming system

3. CELLS

The cell theory:

Apparatus for studying cells:

Microscope

Light microscope

Parts of a light microscope and their functions:

Objective lens

Body tube

Revolving nosepiece

Mirror

Diaphragm

Stage – clips

Limb

Coarse and smooth adjustment knobs, and more

Electron microscope

Comparison between light and electron microscopes

The generalized and detailed plant and animal cell diagrams

Cellular organelles (Structure, distribution and Functions)

The Nucleus

Cell membrane

Cell wall (in Plants)

Mitochondria

Golgi apparatus (bodies)

Ribosomes

Rough Endoplasmic Reticulum

Smooth Endoplasmic reticulum

Plastids (Chloroplasts and chromoplasts)

Lysosomes

Centrioles (in animals)

Cilia and Flagella

Preparation of temporary slides of plant cells

Estimation of cell sizes

Cellular Inclusions: Starch grains, Fat (lipid) droplets

Cell Specialisation

Specialised cells in plants: Root hair cell, Guard cell etc

Specialised cells in animals: Sperm and Ovum, Neuron etc

The hierarchy in an organism (organelles>cells>tissue>organ>organ system>organism)

Tissues (Their Structure, Distribution and Functions)

Plant Tissues: Palisade tissue, Epidermal tissue, Parenchyma Tissue

Animal Tissue: Cardiac Muscles, Smooth Muscles, skeletal muscles,

Organs Plants: Flower, Leaves, etc

Animals: Heart, eye, ear, etc

Organ systems:

Transport, nervous, breathing etc

4. CELL PHYSIOLOGY

Definition of cell physiology

Cell membrane:

Structure

Properties

Sensitivity to temperature and pH

Polarity (possession of electric charges)

Selective permeability (Semi-permeability)

Functions

Review its uses from the topic on cells.

Physiological processes: (Definition, mechanism and roles in living organisms)

Diffusion

Definition of diffusion

Demonstration of diffusion

Roles of diffusion in living Organisms

Osmosis

Definition of osmosis

Mechanism of osmosis

Roles of osmosis in both plants and animals

Water relation in plant and animal cells: Turgor, Plasmolysis, deplasmolysis, wilting ,crenation, haemolysis

Active transport

Definition of active transport

Mechanism of active transport

Roles of active transport in both plants and animals

5. NUTRITION IN PLANTS AND IN ANIMALS

Definition of nutrition,

Importance of nutrition in living organisms

Modes of feeding: Autotrophismvs, Heterotrophism

Autotrophism: Photosyntheseisvs, chemosynthesis

Photosynthesis

Structure of chloroplast

Requirements of photosynthesis

The process itself

Light –dependent stage

Light – independent (Dark) stage

Importance of photosynthesis

Factors affecting the rate of photosynthesis

Light intensity

Carbon(IV) oxide concentration,

Water

Temperature

The leaf:

External and internal structure. Functions of different parts of the leaf.

Chemicals of life: (The properties and roles in living systems)

i. Carbohydrates

a) Monosaccharides

Glucose, fructose and galactose.

Condensation and hydrolysis and their products

Uses of monosaccharides

b) Disaccharides

Examples of disaccharides and where they are found

Uses of disaccharides

c) Polysaccharides

Examples of polysaccharides in plants and animals and their roles

ii. Proteins

Amino acids

iii. Lipids

iv. Enzymes

Properties

Functions

Factors influencing action of enzymes: temperature, pH, specificity,

inhibitors, cofactors

Nutrition in animals

Modes of feeding:

a. Herbivores

b. Carnivores

c. Omnivores

Predation, Parasitism, symbiosis,

Dentition: Dental formula of herbivores, carnivores, omnivores

Adaptations of herbivores, carnivores and omnivores

Mammalian tooth:

Internal structure

Dental diseases: Causes and treatment

Digestion:

The digestive system

Regions and glands: Mouth, Stomach, Small intestines, large intestines, etc

Organs associated with digestive system: Pancreas, liver, Bile duct, etc

Ingestion

Digestion

The Adaptations of ileum to absorption of food

Assimilation

Egestion

Importance of:

Vitamins

Mineral salts

Roughage

Water

Factors determining energy requirements in humans

FORM 2

1. TRANSPORT

Definition of transport,

Importance of transport

Transport in plants

Root: internal structure

Root hairs

Stem: Internal structure

Mechanism Absorption of water

Mechanism of uptake of mineral salts

Transpiration:

Definition

Transpiratory surfaces

The Xylem: structure function

Mechanism of transpiration

Forces involved in water movements in plants:

- i. Transpiration pull
- ii. Cohesive and adhesive forces
- iii. Capillarity
- iv. Root pressure

Factors affecting rate of transpiration:

Structural factors

Stomata: Location, number and distribution

Cuticle

Environmental factors

- i. Wind
- ii. Sunlight
- iii. Temperature
- iv. Atmospheric pressure

Translocation:

Definition

Phloem structure and function

Materials translocated

Transport in Animals

The open and closed circulatory systems: a comparison

A mammal's circulatory system

Blood vessels

- a. Veins
- b. Arteries
- c. Capillaries

The Blood

Blood cells (structure and functions)

- i. Leucocytes
- ii. Erythrocytes
- iii. Thrombocytes

Blood Plasma

Blood proteins

Blood clotting process and its significance

Blood typing:

ABO system

Rhesus system

The Heart

External structure

Internal structure

Pumping action of heart: Systole and Diastole

Adaptations of mammalian heart its function

Diseases and defects of the circulatory system:

- a. Varicose veins
- b. Thrombosis
- c. Arteriosclerosis

Immune responses:

Types of immunity

Allergic reactions

The vaccines for diseases and their importance

2. GASEOUS EXCHANGE

Importance of gaseous exchange to living organisms

Gaseous exchange in plants:

The mechanism of opening and closing of stomata

Gaseous exchange through leaves, stem and roots of plants

Terrestrial plants

Aquatic plants

Gaseous exchange in animals

Types of respiratory surfaces

Characteristics of respiratory surfaces

Mechanisms of gaseous exchange

Protozoa

Insects

Bony fish

Amphibians

Mammals

Factors affecting rate of breathing in humans

Respiratory diseases: causal agent, symptoms and treatment

3. RESPIRATION

Definition of respiration

Importance of respiration

Tissue respiration

The Mitochondrion: structure

Types of respiration

Aerobic respiration

Respiratory quotient: calculation and use

Anaerobic respiration

In plants

In Animals

Its application in industry and home

Comparison of energy output in anaerobic and anaerobic respiration

4. EXCRETION AND HOMOEOSTASIS

Definition of excretion

Excretion in plants

Methods of excretion in plants

The excretory products of plants and their uses

Caffeine

Quinine

Tannins

Rubber

Papain

Bhang and Khat extracts

Excretion and homoeostasis in animals

Distinction of excretion, egestion and homoeostasis

Excretion in Protozoa

Excretion in Higher organisms

Excretory organs and the compounds excreted

Kidney structure, function and Diseases

Liver structure,function and diseases

Skin structure and function

Homoeostasis

The hormonal and nervous systems' role in:-

Water balance

Blood sugar balance

Temperature regulation

FORM 3

1. CLASSIFICATION 2

Principles of classification

Survey of kingdoms:

- a) Monera
- b) Protocista
- c) Fungi
- d) Plantae

Divisions of kingdom Plantae:

Bryophyta
Pteridophyta
Spermatophyta

- e) Animalia

Phyla of Kingdom Animalia:

- i. Arthropoda

Classes in phylum Arthropoda:

Diplopoda
Chilopoda
Insecta
Crustacea
Arachnida

- ii. Chordata

Classes in Phylum Chordata:

- i. Pisces
- ii. Amphibia
- iii. Reptilia
- iv. Aves
- v. Mammalia

Dichotomous keys: how to construct and use them:

2. ECOLOGY

Definition of terms

Ecology:

Autoecology and Synecology

Habitat

Niche

Population

Community

Ecosystem

Biomass

Carrying capacity

Factors in and ecosystem

Abiotic Factors

- i. Light
- ii. Temperature
- iii. Atmospheric pressure
- iv. Salinity
- v. Humidity
- vi. pH
- vii. Wind – speed, direction and strength

Biotic factors

Interrelationships between organisms:

Competition (Interspecific and intraspecific)

Saprophytism

Parasitism

Symbiosis

Nutrient cycles

Nitrogen cycle

Energy flow in an ecosystem

Food chain

Food web

Decomposers

Pyramid: Numbers and biomass

Estimation of populations of organisms

Quadrat

Line transect

Belt transect

Capture-recapture

Adaptations of plants to various habitats

Xerophytes

Mesophytes

Hydrophytes

Halophytes

Effects of pollution on environment

Causes, effects and control of Air, soil and water pollution

Human diseases: causal agents, symptoms and treatment

Bacterial disease

Typhoid

Tuberculosis

Protozoan diseases

Amoebic dysentery

Malaria

Parasitic organisms in humans:

Ascarislumbricoides

Lifecycle,

Mode of transmission,

Effectson host

Control

Schistosoma spp

Lifecycle,

Mode of transmission,

Effects on host

Control

3. REPRODUCTION IN PLANTS AND ANIMALS

Definition of reproduction

Significance of reproduction in organisms

Chromosome: structure

Cell division types: Stages involved and the importance

Mitosis

Meiosis

Types of reproduction

Asexual reproduction

Binary and multiple fission

Sporulation

budding

Sexual reproduction

Sexual reproduction in plants

Flower: parts and their functions

Pollination

Agents of pollination

Adaptations of flowers to different pollination agents

Features hindering self-fertilisation and self-pollination

Fertilization process

Fruit and seed-formation

Dispersal of seeds,

Agents of dispersion

Sexual reproduction in animals

External vs. internal fertilization

External reproduction in amphibians

The reproductive system of humans

Functions of parts of the system

Fertilisation

Implantation

Placenta: its structure and role

Gestation period

Role of hormones in:

Development of secondary sexual characteristics

Menstrual Cycle

Sexually transmitted infections: causes, symptoms and prevention and treatment

a. Gonorrhea

b. Herpes simplex

- c. Syphilis
- d. Hepatitis
- e. Candidiasis
- f. HIV/AIDS

Sexual v.s. Asexual reproduction: comparison of advantages and disadvantages

4. GROWTH AND DEVELOPMENT

Definition of Growth and Development

Growth and development in plants

Dormancy

Causes

Breaking dormancy

Germination

Conditions necessary for germination

Types of germination

Epigeal germination

Hypogeal germination

Measurement of aspect of growth e.g in A germinating pea seedling

Primary vs. secondary growth

Role of hormones in plant growth:

Auxins (IAA)

Gibberelins

Absciscic acid

Florigens

Ethylene

Growth and development in Animals

Complete vs. incomplete metamorphosis in insects

Role of hormones in growth in insects

FORM 4

1. GENETICS

Definition of Genetics

The concepts of genetics

Variation

Continuous variation

Discontinuous variation

Chromosome structure

Deoxyribonucleic acid (DNA)

Laws of heredity

First law: Law of monohybrid inheritance

Mendel's experiments on garden peas

Complete vs. incomplete dominance

Backcross vs. testcross

Inheritance of ABO blood groups and Rhesus factor

Sex determination in humans

Linkage

Sex-linkage

Sex-linked traits

Hemophilia

Hairy ears and nose

Mutations

Types and causes of mutations

Chromosomal mutation

Point (gene) mutations: albinism, sickle-cell anaemia, colour blindness

Applications of genetics

Blood transfusion

Plant and animal breeding (artificial selection)

Genetic counseling

Genetic engineering

2. EVOLUTION

Definition of evolution

Theories of origin of life

Special creation

Chemical evolution

Evidences of organic evolution

Fossil records

Geographical distribution according to the Continental drift theory

Comparative embryology

Comparative anatomy

Convergent vs. divergent evolution

Homologous vs. analogous structures

Cell biology

Blood pigments and cell organelles

Mechanisms of evolution

Lamarckism (theory of use and disuse)

Evolution by natural selection

Natural selection in peppered moths

Resistance to drugs, pesticides and antibiotics

3. RECEPTION RESPONSE AND COORDINATION

Definitions of Stimulus, response and irritability

Reception, response and coordination in plants

Tropisms: types and significance

Tactic responses (taxism): types and significance

Effects of auxins on: tropic responses

Reception, response and coordination in animals

The nervous system: components and their functions

Neurons: types, structure and functions

The Central Nervous system: parts and functions

The Peripheral nervous systems: parts and functions

The generation and transmission of nerve impulse

Transmission of impulse over neurone

Transmission of impulse across a synapse

Transmitter substances

Reflex action:

Simple vs. conditioned reflex

The endocrine system: its role in Response in animals

Thyroxin:

Roles

Effects of under secretion (Hypothyroidism)

Effects of over secretion (Hyperthyroidism)

Adrenaline

Roles

Effects of under secretion

Effects of over secretion

Comparison of endocrine and nervous systems

Their Similarities

Their Differences

Drug abuse: effects on human health

Sensory organs

Eye:

Structure: functions of different parts

Accommodation

Image formation and interpretation

Cones and rods

Eye defects

Long-sightedness (Hypermetropia)

Short –sightedness (myopia)

Old-sight

Cataracts

Ear

Parts of the ear

Hearing process

Balancing and posture

Defects of the ear

4. SUPPORT IN ANIMALS AND IN PLANTS

Importance of support to plants

Root and stem tissues

Support in animals

Significance of support animals

Skeleton

Types and functions

Hydrostatic skeleton

Exoskeleton (in arthropods)

Endoskeleton (in vertebrate)

Locomotion in finned fish

Adaptations to movement in water

Bones in the axial and appendicular endoskeleton

Joints

Types and functions of movable joints

Hinge joint

Ball and socket joints

Muscles

Types, location and properties of

Cardiac muscles

Smooth muscles

Skeletal muscles

Role of muscles in movement of arm in humans