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## Concept 1: Levels of Organization in the Human Body

### Definition

The human body is organized in levels from simple to complex.

Cells form tissues, tissues form organs, organs form organ systems, and organ systems form the body.

### Level 1: Cell

#### Definition

Cell is the basic structural and functional unit of life.

#### Examples

Muscle cell

Nerve cell

Blood cell

#### Functions

Cells perform specific tasks.

Muscle cells contract.

Nerve cells transmit signals.

Red blood cells carry oxygen.

### Level 2: Tissue

#### Definition

A group of similar cells performing a specific function.

#### Types of Tissues

Epithelial tissue

Covers body surfaces and lines internal organs.

Muscular tissue

Responsible for movement.

Nervous tissue

Transmits electrical signals.

Connective tissue

Supports and connects body parts. Example: bone, blood.

### Level 3: Organ

#### Definition

A structure made of different tissues working together to perform a function.

#### Examples

Heart

Lungs

Stomach

Brain

#### Example explanation

Heart contains muscle tissue, connective tissue and nervous tissue and pumps blood.

### Level 4: Organ System

#### Definition

A group of organs working together to perform a major body function.

#### Major Organ Systems in Class 5 Level

Digestive system

Respiratory system

Circulatory system

Skeletal system

Muscular system

Nervous system

### Level 5: Organism

All organ systems together form a complete human being.

#### Cell Specialization

Cells are specialized for different functions.

Example

Red blood cell has no nucleus and is shaped to carry oxygen efficiently.

Nerve cell has long extensions to transmit signals.

Coordination Among Systems

Respiratory system provides oxygen.

Digestive system provides nutrients.

Circulatory system transports oxygen and nutrients.

Nervous system controls activities.

All systems are interdependent.

Common Examination Traps

Heart is a tissue. Incorrect. It is an organ.

Blood is an organ. Incorrect. It is connective tissue.

Stomach works alone. Incorrect. It works as part of digestive system.

Advanced Understanding

Complexity increases from cell to organism.

Damage to cells affects tissues, organs and systems.

Human body maintains internal balance called homeostasis.

## Concept 2: Digestive System

Definition

The digestive system breaks down food into simple soluble substances that can be absorbed and used by the body.

Purpose of Digestion

To convert complex food into simple nutrients.

To absorb nutrients into blood.

To remove undigested waste.

Main Organs of Digestive System

1. Mouth

Functions

Ingestion of food.

Chewing by teeth.

Mixing with saliva.

Saliva

Produced by salivary glands.

Contains enzyme amylase.

Begins digestion of starch into simple sugars.

Teeth Types

Incisors

Cut food.

Canines

Tear food.

Premolars

Crush and grind food.

Molars

Grind food thoroughly.

1. Esophagus

Muscular tube connecting mouth to stomach.

Food moves through peristalsis (wave-like muscle movement).

1. Stomach

Muscular sac.

Churns food.

Mixes food with gastric juice.

Gastric juice

Contains hydrochloric acid and enzymes.

Begins digestion of proteins.

Kills harmful bacteria.

1. Small Intestine

Longest part of digestive system.

Major site of digestion and absorption.

Receives

Bile from liver.

Pancreatic juice from pancreas.

Bile

Breaks fats into small droplets (emulsification).

Pancreatic juice

Contains enzymes for digestion of carbohydrates, proteins and fats.

Inner surface has villi.

Villi increase surface area for absorption of nutrients into blood.

1. Large Intestine

Absorbs water and salts.

Forms feces.

1. Rectum and Anus

Rectum stores feces.

Anus expels waste.

Process Summary

Ingestion

Digestion

Absorption

Assimilation

Egestion

Types of Nutrients

Carbohydrates

Provide energy.

Proteins

Growth and repair.

Fats

Energy storage.

Vitamins

Regulate body functions.

Minerals

Support body processes.

Water

Transport and temperature regulation.

Balanced Diet

Definition

Diet containing all nutrients in correct proportion.

Importance

Proper growth.

Strong immunity.

Good health.

Common Digestive Disorders

Indigestion

Improper digestion due to overeating or unhealthy food.

Constipation

Difficulty in passing stool due to low fiber intake.

Diarrhea

Frequent loose stools.

Common Examination Traps

Digestion starts in stomach. Incorrect. It starts in mouth.

Bile digests fats chemically. Incorrect. It breaks fats physically into droplets.

Large intestine digests food. Incorrect. It absorbs water.

Advanced Understanding

Enzymes are biological catalysts that speed up digestion.

Surface area of small intestine is increased by villi for efficient absorption.

Peristalsis ensures movement of food even against gravity.

### Concept 3: Respiratory System

Definition

The respiratory system is responsible for breathing and exchange of gases.

It supplies oxygen to the body and removes carbon dioxide.

Importance of Oxygen

Oxygen is required for cellular respiration.

Cells use oxygen to release energy from food.

Main Organs of Respiratory System

1. Nose

Air enters through nostrils.

Nasal cavity contains hair and mucus.

Functions

Filters dust and germs.

Warms air.

Moistens air.

1. Pharynx

Common passage for food and air.

1. Larynx

Also called voice box.

Produces sound.

1. Trachea

Windpipe.

Supported by C-shaped cartilage rings.

Carries air to lungs.

1. Bronchi

Trachea divides into two bronchi.

Each bronchus enters one lung.

1. Lungs

Spongy organs in chest cavity.

Protected by rib cage.

Inside lungs

Bronchi branch into bronchioles.

Bronchioles end in tiny air sacs called alveoli.

Alveoli

Thin-walled sacs.

Surrounded by capillaries.

Large surface area for gas exchange.

Gas Exchange

Oxygen diffuses from alveoli into blood.

Carbon dioxide diffuses from blood into alveoli.

Breathing Process

Inhalation

Diaphragm contracts and moves downward.

Rib cage expands.

Chest cavity volume increases.

Air enters lungs.

## Exhalation

Diaphragm relaxes and moves upward.

Rib cage contracts.

Chest cavity volume decreases.

Air is pushed out.

## Breathing Rate

Average adult breathing rate is about 12 to 20 breaths per minute.

Breathing rate increases during exercise.

## Difference Between Breathing and Respiration

### Breathing

Physical process of taking in air and releasing air.

### Respiration

Chemical process in cells that releases energy from food.

### Cellular Respiration Equation (Simplified)

Glucose + Oxygen → Carbon dioxide + Water + Energy

## Respiratory Disorders

### Asthma

Narrowing of airways.

Difficulty in breathing.

### Common cold

Infection of nasal passages.

### Pneumonia

Infection of lungs.

### Smoking Effects

Damages lungs.

Reduces oxygen exchange.

Causes chronic diseases.

### Common Examination Traps

Gas exchange occurs in trachea. Incorrect. It occurs in alveoli.

Diaphragm moves upward during inhalation. Incorrect. It moves downward.

Respiration occurs only in lungs. Incorrect. It occurs in cells.

### Advanced Understanding

Alveoli provide very large surface area for efficient diffusion.

Thin walls allow rapid gas exchange.

Hemoglobin in red blood cells binds oxygen.

### System Linkage

Respiratory system works with circulatory system to transport oxygen.

Energy produced supports all body functions.

## Concept 4: Circulatory System

### Definition

The circulatory system transports oxygen, nutrients, hormones and waste materials throughout the body.

### Main Components

#### Heart

#### Blood

#### Blood vessels

##### 1. Heart

Muscular organ located in chest cavity slightly towards left side.

Pumps blood continuously.

#### Structure

Four chambers.

Right atrium

Right ventricle

Left atrium

## Left ventricle

### Function

Right side pumps deoxygenated blood to lungs.

Left side pumps oxygenated blood to body.

### Heartbeat

Normal adult heart rate is about 60 to 100 beats per minute.

Heart rate increases during exercise.

#### 1. Blood

Liquid connective tissue.

Circulates through blood vessels.

### Components of Blood

#### Plasma

Liquid part.

Carries nutrients, hormones and waste.

#### Red blood cells (RBCs)

Contain hemoglobin.

Transport oxygen.

#### White blood cells (WBCs)

Fight infections.

Protect body from pathogens.

#### Platelets

Help in clotting of blood.

#### 1. Blood Vessels

### Arteries

Carry blood away from heart.

Usually carry oxygenated blood.

Have thick elastic walls.

### Veins

Carry blood toward heart.

Usually carry deoxygenated blood.

Have valves to prevent backflow.

### Capillaries

Very thin vessels.

Connect arteries and veins.

Site of exchange of gases and nutrients.

### Types of Circulation

#### Pulmonary circulation

Blood flow between heart and lungs.

#### Systemic circulation

Blood flow between heart and rest of body.

### Flow Sequence

Body → Right atrium → Right ventricle → Lungs → Left atrium → Left ventricle → Body.

### Oxygenated and Deoxygenated Blood

#### Oxygenated blood

Contains high oxygen.

Bright red color.

#### Deoxygenated blood

Contains high carbon dioxide.

Darker red color.

### Blood Clotting

When injury occurs, platelets gather at wound.

Clot forms to stop bleeding.

### Blood Groups

#### Main types

A

B

AB

O

### Importance

Blood transfusion requires matching blood group.

### Common Circulatory Disorders

Anemia

Low hemoglobin level.

High blood pressure

Excess force of blood against artery walls.

Heart disease

Blockage of coronary arteries.

### Common Examination Traps

Arteries always carry oxygenated blood. Incorrect. Pulmonary artery carries deoxygenated blood.

Veins always carry deoxygenated blood. Incorrect. Pulmonary vein carries oxygenated blood.

Heart has three chambers. Incorrect. It has four chambers.

### Advanced Understanding

Capillaries have very thin walls for diffusion.

Double circulation ensures efficient oxygen supply.

Hemoglobin binds oxygen reversibly.

### System Linkage

Respiratory system provides oxygen.

Circulatory system transports oxygen.

Digestive system provides nutrients.

All systems work together for energy production.

## Concept 5: Skeletal System

### Definition

The skeletal system is the framework of bones that supports, protects and gives shape to the body.

### Functions

#### Support

Provides structure and shape to body.

#### Protection

Skull protects brain.

Rib cage protects heart and lungs.

Vertebral column protects spinal cord.

#### Movement

Bones work with muscles to enable movement.

#### Blood cell production

Bone marrow produces red blood cells and white blood cells.

### Main Parts of Skeleton

#### 1. Skull

Protects brain.

Forms structure of face.

#### 2. Vertebral Column

Also called backbone or spine.

Made of small bones called vertebrae.

Supports body and protects spinal cord.

#### 3. Rib Cage

12 pairs of ribs.

Protects heart and lungs.

#### 4. Limbs

Upper limbs: arms.

Lower limbs: legs.

## 5. Pelvis

Supports lower body organs.

### Types of Bones

#### Long bones

Example: femur, humerus.

Help in movement.

#### Short bones

Example: wrist bones.

Provide stability.

#### Flat bones

Example: skull, ribs.

Protect internal organs.

#### Irregular bones

Example: vertebrae.

### Joints

#### Definition

A joint is the place where two or more bones meet.

### Types of Joints

#### Hinge joint

Allows movement in one direction.

Example: elbow, knee.

#### Ball and socket joint

Allows movement in all directions.

Example: shoulder, hip.

#### Pivot joint

Allows rotation.

Example: joint between skull and first vertebra.

#### Fixed joint

No movement.

Example: skull bones.

#### Gliding joint

Allows limited sliding movement.

Example: wrist, ankle.

#### Cartilage

Soft tissue at ends of bones.

Reduces friction at joints.

#### Ligaments

Connect bone to bone.

### Common Disorders

#### Fracture

Break in bone.

#### Arthritis

Inflammation of joints.

#### Rickets

Soft and weak bones due to vitamin D deficiency.

### Common Examination Traps

Backbone is one single bone. Incorrect. It is made of many vertebrae.

Skull bones move freely. Incorrect. Most are fixed joints.

Wrist joint is hinge joint. Incorrect. It is gliding joint.

#### System Linkage

Skeletal system works with muscular system for movement.

Works with nervous system for coordination.

## Concept 6: Muscular System

### Definition

The muscular system consists of muscles that help in movement of body parts and internal organs.

#### Functions

Movement of body parts.

Maintaining posture.

Producing heat.

Helping in internal movements such as heartbeat and digestion.

#### Types of Muscles

##### 1. Voluntary Muscles

Also called skeletal muscles.

Work under conscious control.

Attached to bones.

Example: muscles of arms and legs.

#### Characteristics

Striated appearance under microscope.

Help in walking, running, writing.

##### 1. Involuntary Muscles

Work automatically without conscious control.

Found in internal organs.

Example: stomach, intestine, blood vessels.

#### Characteristics

Smooth appearance.

Control digestion and blood flow.

##### 1. Cardiac Muscle

Found only in heart.

Works involuntarily.

Striated structure.

Contracts rhythmically throughout life.

#### Muscle Movement Mechanism

Muscles can only pull, not push.

They work in pairs called antagonistic pairs.

#### Example

Biceps and triceps in arm.

When biceps contracts, forearm moves up.

When triceps contracts, forearm moves down.

#### Tendons

Connect muscles to bones.

#### Role in Posture

Muscles maintain upright position.

Continuous slight contraction maintains balance.

#### Muscle Fatigue

Occurs due to accumulation of lactic acid during strenuous activity.

Causes tiredness and pain.

#### Exercise and Muscles

Regular exercise strengthens muscles.

Increases endurance and flexibility.

#### Common Disorders

##### Muscle cramps

Sudden painful contraction.

##### Muscular dystrophy

Genetic disorder causing muscle weakness.

#### Common Examination Traps

Muscles push bones. Incorrect. They pull bones.

Heart muscle is voluntary. Incorrect. It is involuntary.

All involuntary muscles are smooth. Incorrect. Cardiac muscle is involuntary but striated.

#### System Linkage

Muscular system works with skeletal system for movement.

Controlled by nervous system.

Supplied with oxygen by circulatory system.

### Concept 7: Nervous System

Definition

The nervous system controls and coordinates all activities of the body.

It receives information, processes it and sends responses.

Main Parts

Brain

Spinal cord

Nerves

1. Brain

Located inside skull.

Control center of body.

Main Parts of Brain

Cerebrum

Largest part.

Controls thinking, memory, intelligence, emotions and voluntary actions.

Cerebellum

Controls balance and coordination of muscles.

Medulla

Controls involuntary activities such as breathing and heartbeat.

1. Spinal Cord

Long nerve cord extending from brain through vertebral column.

Carries messages between brain and body.

Controls reflex actions.

1. Nerves

Network of thin fibers.

Carry electrical impulses.

Types of Nerves

Sensory nerves

Carry messages from sense organs to brain.

Motor nerves

Carry messages from brain to muscles or glands.

Mixed nerves

Carry both sensory and motor impulses.

Reflex Action

Definition

Quick automatic response to stimulus without conscious thinking.

Example

Withdrawing hand from hot object.

Reflex Path

Receptor → Sensory nerve → Spinal cord → Motor nerve → Effector.

Sense Organs

Eyes

Detect light.

Ears

Detect sound and maintain balance.

Nose

Detect smell.

Tongue

Detect taste.

Skin

Detect touch, temperature and pain.

## Coordination

Nervous system works with muscular system for movement.

Works with endocrine system through hormones.

## Common Disorders

Head injury

May affect memory or movement.

Stroke

Interruption of blood supply to brain.

Epilepsy

Repeated seizures due to abnormal brain activity.

## Common Examination Traps

Cerebellum controls thinking. Incorrect. Cerebrum controls thinking.

Medulla controls memory. Incorrect. It controls involuntary actions.

Reflex action involves brain first. Incorrect. It is controlled by spinal cord.

## Advanced Understanding

Nerve impulses are electrical signals.

Neurons are structural units of nervous system.

Brain uses oxygen continuously; interruption can cause damage.

## Concept 8: Food and Nutrients

### Definition

Food provides energy and materials required for growth, repair and maintenance of the body.

### Nutrients

Nutrients are substances in food that perform specific functions in the body.

### Major Nutrients

#### 1. Carbohydrates

Primary source of energy.

Provide quick energy.

### Sources

Rice

Wheat

Potato

Sugar

### Deficiency

Weakness

Low energy

#### 1. Proteins

Body-building nutrient.

Required for growth and repair of tissues.

### Sources

Pulses

Egg

Milk

Meat

Soybean

### Deficiency

Poor growth

Weak muscles

#### 1. Fats

Provide concentrated energy.

Help in absorption of vitamins A, D, E and K.

Provide insulation and protection to organs.

### Sources

Butter

Oil

Ghee

Nuts

Deficiency

Low body weight

Poor energy reserve

1. Vitamins

Protective nutrients.

Regulate body processes.

Vitamin A

Good vision and skin health.

Deficiency: night blindness.

Vitamin B

Energy metabolism.

Deficiency: beri-beri.

Vitamin C

Wound healing and immunity.

Deficiency: scurvy (bleeding gums).

Vitamin D

Strong bones and teeth.

Deficiency: rickets.

1. Minerals

Required in small amounts for body functions.

Calcium

Strong bones and teeth.

Iron

Formation of hemoglobin.

Deficiency: anemia.

Iodine

Proper functioning of thyroid gland.

Deficiency: goitre.

1. Water

Essential for digestion, absorption and temperature regulation.

1. Roughage

Dietary fiber.

Helps in proper bowel movement.

Prevents constipation.

Balanced Diet

Definition

Diet containing all nutrients in correct proportion.

Components

Carbohydrates

Proteins

Fats

Vitamins

Minerals

Water

Roughage

Malnutrition

Condition caused by deficiency or excess of nutrients.

Types

Undernutrition

Lack of sufficient nutrients.

Overnutrition

Excess intake leading to obesity.

Deficiency Diseases

Rickets  
Deficiency of vitamin D.  
Scurvy  
Deficiency of vitamin C.  
Night blindness  
Deficiency of vitamin A.  
Beri-beri  
Deficiency of vitamin B.  
Goitre  
Deficiency of iodine.  
Anemia  
Deficiency of iron.  
Energy Hierarchy  
Carbohydrates are first used for energy.  
Fats serve as stored energy.  
Proteins are not primary energy source.  
**Common Examination Traps**  
Vitamin D strengthens teeth only. Incorrect. It strengthens bones and teeth.  
Iron deficiency causes rickets. Incorrect. It causes anemia.  
Proteins are main energy source. Incorrect. Carbohydrates are main energy source.  
**Health Linkage**  
Balanced diet supports immune system.  
Nutrients support organ systems.  
Proper nutrition improves growth and mental performance.

### Concept 9: Communicable and Non-Communicable Diseases

#### Definition

A disease is a condition that disturbs the normal functioning of the body.

#### Types of Diseases

##### 1. Communicable Diseases

#### Definition

Diseases that spread from one person to another through air, water, food or direct contact.

#### Causes

Bacteria

Viruses

Fungi

Protozoa

#### Modes of Transmission

Air

Example: common cold, tuberculosis.

Water

Example: cholera.

Food

Example: food poisoning.

Direct contact

Example: chickenpox.

Mosquito bite

Example: malaria, dengue.

#### Examples of Communicable Diseases

Common cold

Viral infection affecting nose and throat.

Tuberculosis

Bacterial infection affecting lungs.

Cholera

Bacterial infection due to contaminated water.

**Malaria**

Caused by Plasmodium parasite transmitted by female Anopheles mosquito.

**Dengue**

Viral disease transmitted by Aedes mosquito.

**Prevention**

**Vaccination**

Maintaining hygiene

Drinking clean water

Proper sanitation

Covering mouth while coughing

Using mosquito nets

#### 1. Non-Communicable Diseases

**Definition**

Diseases that do not spread from person to person.

**Causes**

Nutritional deficiency

Genetic factors

Lifestyle habits

Environmental factors

**Examples**

Rickets

Vitamin D deficiency.

Scurvy

Vitamin C deficiency.

Beri-beri

Vitamin B deficiency.

Anemia

Iron deficiency.

Diabetes

High blood sugar due to insulin problem.

Hypertension

High blood pressure.

Obesity

Excess body fat due to overeating and lack of exercise.

**Deficiency Diseases**

Occur due to lack of specific nutrients.

Night blindness

Vitamin A deficiency.

Goitre

Iodine deficiency.

**Prevention of Non-Communicable Diseases**

Balanced diet

Regular exercise

Avoid smoking and alcohol

Regular health check-up

**Immunity**

**Definition**

Ability of body to fight infections.

**Types**

Natural immunity

Present from birth.

Acquired immunity

Developed after infection or vaccination.

**Vaccination**

**Definition**

Introduction of weakened or dead microbes to stimulate immune response.

Importance

Prevents serious infectious diseases.

Common Examination Traps

Malaria spreads through dirty water. Incorrect. It spreads through mosquito bite.

Rickets is communicable. Incorrect. It is deficiency disease.

All communicable diseases are caused by bacteria. Incorrect. Some are caused by viruses and parasites.

System Linkage

Immune system works with circulatory system to transport white blood cells.

Proper nutrition strengthens immune system.

### Concept 10: Personal Hygiene and Health Care

Definition

Personal hygiene is the practice of keeping the body clean to prevent disease and maintain good health.

Importance

Prevents infection.

Reduces spread of communicable diseases.

Improves physical and mental well-being.

Daily Hygiene Practices

Bathing

Removes sweat, dirt and microbes from skin.

Prevents skin infections.

Hand Washing

Wash hands before eating and after using toilet.

Prevents transmission of germs.

Brushing Teeth

Brush twice daily.

Prevents tooth decay and gum diseases.

Trimming Nails

Prevents accumulation of dirt and germs.

Wearing Clean Clothes

Reduces risk of skin infections.

Safe Drinking Water

Boiled or filtered water prevents water-borne diseases.

Food Hygiene

Eat fresh and properly cooked food.

Avoid uncovered street food.

Wash fruits and vegetables before eating.

Oral Hygiene

Tooth decay

Caused by bacteria producing acids from food particles.

Can lead to cavities.

Prevention

Brushing regularly.

Avoid excessive sugary food.

Exercise

Regular physical activity strengthens muscles and heart.

Improves blood circulation.

Maintains healthy weight.

Rest and Sleep

Adults require about 7–8 hours of sleep.

Children require more sleep for growth.

Sleep helps in repair of body tissues.

Mental Health

Balanced routine reduces stress.

Positive thinking supports emotional health.

First Aid

Definition

Immediate help given to injured person before medical treatment.

Basic First Aid Steps

Clean wound with clean water.

Apply antiseptic.

Cover with sterile bandage.

For minor burns

Cool area under running water.

Do not apply oil or toothpaste.

Vaccination and Health Check

Follow vaccination schedule.

Regular health check-ups detect early problems.

Common Hygiene-Related Diseases

Ringworm

Fungal infection due to poor hygiene.

Dental caries

Due to improper brushing.

Food poisoning

Due to contaminated food.

Common Examination Traps

Hygiene is only about bathing. Incorrect. It includes hand washing, oral care and food safety.

Vaccination cures disease. Incorrect. It prevents disease.

First aid replaces doctor. Incorrect. It is temporary care.

Health Linkage

Good hygiene supports immune system.

Proper nutrition and hygiene together maintain overall health.

Prevention is more effective than treatment.