Pharma Unit

Human Anatomy & Physiology

Top 20 Most Important Questions with Answers

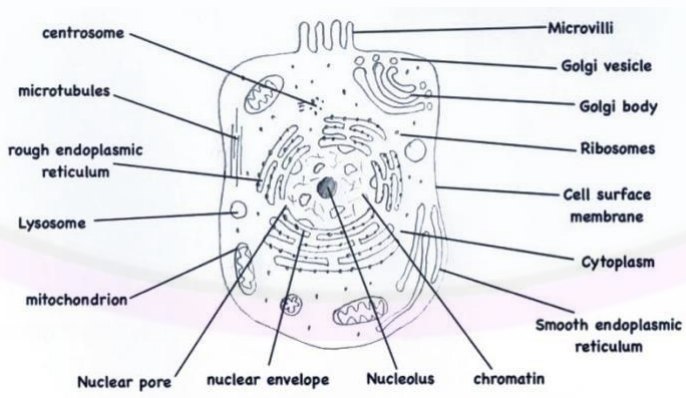
According to New Syllabus ER 2020-21

1st Year D. Pharmacy

1) Define cell and discuss in detail about the structure of cell with its components and functions?

Ans.

The cell is the basic structural and functional unit of life. All living organisms are made up of one or more cells.



a) Cell Membrane: The cell membrane is the outermost boundary of the cell. It separates the inside of the cell from the external environment. It is made up of a double layer of lipids and proteins. The lipids act as a barrier to control what enters or leaves the cell, while the proteins help in communication and transport.

b) **Cytoplasm:** The cytoplasm is a jelly-like substance that fills the cell. It contains various organelles, which act like small machines that help the cell carry out its functions.
c) **Nucleus:** The nucleus is the control centre of the cell. It contains the cell's genetic material (DNA), which controls growth, development, and all cellular activities. DNA contains the instructions needed for building and maintaining the cell.
d) **Mitochondria:** Mitochondria are known as the powerhouse of the cell. They break down glucose to produce ATP (adenosine triphosphate), which is the main energy source for cellular activities.
e) **Ribosomes:** Ribosomes are tiny organelles that make proteins. They read the genetic instructions from DNA and assemble proteins from amino acids.
f) **Endoplasmic Reticulum (ER):** The ER is a network of membranes that helps in the transport of proteins and lipids. **Rough ER** has ribosomes and helps in protein synthesis. **Smooth ER** lacks ribosomes and helps in lipid synthesis.
g) **Golgi Apparatus:** The Golgi apparatus modifies, sorts, and packages proteins for transport out of the cell. It works closely with the ER to ensure proteins are properly folded and processed.
h) **Lysosomes:** Lysosomes contain digestive enzymes that break down waste materials, damaged organelles, and unwanted substances inside the cell.

2) Define tissue with classification and discuss in detail about epithelial tissue and connective tissue?

Ans.

Definition of Tissue: A tissue is a group of similar cells that are organized together to perform a specific function. These cells have a common origin and work in a coordinated manner. When different tissues combine, they form organs, which further make up the organ systems of the body.

Classification of Tissues: The human body contains four major types of tissues:

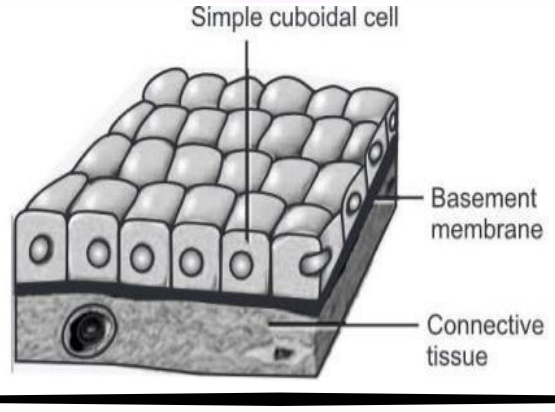
a) Epithelial tissue
b) Connective tissue
c) Muscle tissue
d) Nervous tissue

Epithelial Tissue

Epithelial tissue is the type of tissue that covers the body surface, lines organs, cavities, and forms glands. The cells are tightly packed with very little extracellular matrix, forming a protective barrier between the body and the external environment.

These cells rest on a basement membrane, which separates the epithelium from the underlying connective tissue.

Epithelial cells can be arranged in one layer (simple), many layers (stratified), or pseudostratified. The cell shapes include squamous, cuboidal, and columnar.



Classification of Epithelial Tissue

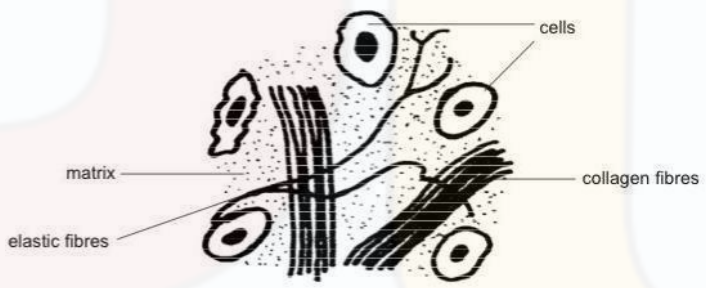
a) Squamous epithelium: Thin, flat cells in a single layer. Found in lining of blood vessels and lungs.
b) Cuboidal epithelium: Cube-shaped cells in a single layer. Found in kidney tubules.
c) Columnar epithelium: Tall, column-like cells in a single layer. Found in the digestive tract lining.
d) Transitional epithelium: Can stretch; found in the urinary bladder.
e) Pseudostratified epithelium: Appears multilayered but is not; found in the respiratory tract.

Functions of Epithelial Tissue

a) Protection: Shields the body from physical, chemical, and microbial damage.
b) Absorption: Absorbs nutrients and other substances.
c) Secretion: Produces mucus, enzymes, and hormones.
d) Sensory reception: Contains receptors that detect environmental changes.
e) Excretion: Helps in removal of waste products.

Connective Tissue

Connective tissue is a type of tissue that supports, connects, and protects other tissues and organs. It is made of cells (like fibroblasts, adipocytes, chondrocytes, osteoblasts) and an extracellular matrix, which includes collagen and elastin fibres and a gel-like ground substance.



Classification of Connective Tissue

a) Loose Connective Tissue: Contains loosely arranged fibres; provides support, elasticity, and fills spaces between organs.
b) Dense Connective Tissue: Has tightly packed collagen fibres; forms tendons and ligaments, giving strong attachment.
c) Cartilage: Firm, flexible tissue found in joints, ear, nose; provides cushioning and shock absorption.
d) Bone: Hard tissue that gives support, protection, and stores minerals like calcium.
e) Blood: A fluid connective tissue that transports oxygen, nutrients, and waste throughout the body.

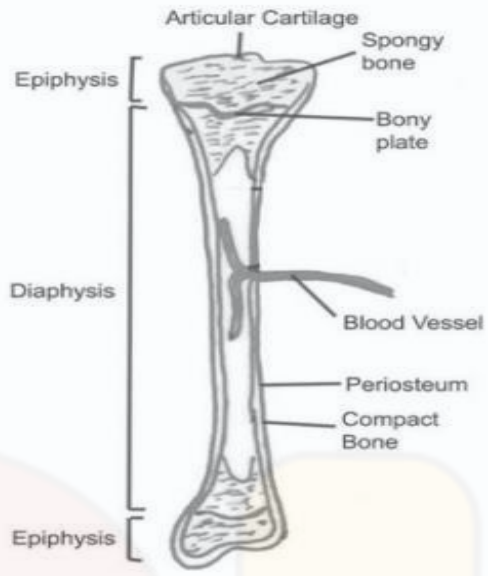
Functions of Connective Tissue

a. Provides structural support to organs and tissues.
b. Helps in movement and flexibility.
c. Acts as a cushion and shock absorber.
d. Stores energy in the form of adipose tissue (fat).
e. Plays a role in defence through immune cells present in the tissue.

3) Define Bone Draw neat, labelled diagram of bone and write function of bone?

Ans.

Bone: Bone is a strong and rigid connective tissue that forms the **skeletal framework** of our body. It is made up of specialized cells and a hard, honeycomb-like matrix that gives bones their strength and rigidity. This structure helps the body maintain shape, protect internal organs, and support movement.



Functions of Bone

a) **Support:** Bones provide a firm framework that supports the entire body and holds muscles, organs, and tissues in place.
b) **Protection:** They protect vital organs—such as the skull protecting the brain, the rib cage protecting the heart and lungs, and the vertebral column protecting the spinal cord.
c) **Movement:** Bones act as levers for movement. Muscles attach to bones, and when muscles contract, they pull on the bones to produce movement.
d) **Blood Cell Production:** Bone marrow inside bones produces **red blood cells, white blood cells, and platelets**, which are essential for oxygen transport and immunity.
e) **Mineral Storage:** Bones store important minerals like **calcium and phosphorus**. These minerals strengthen bones and can be released into the bloodstream when the body needs them.

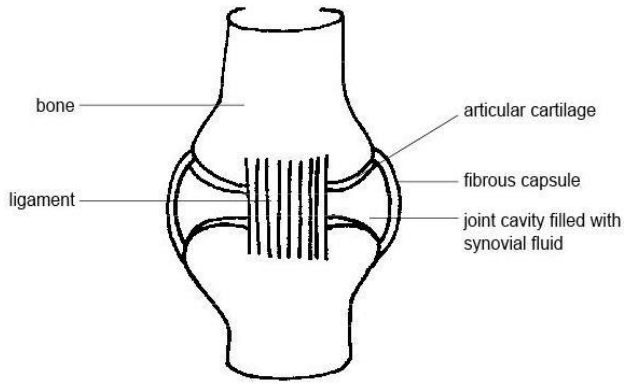
4) Discuss in detail about joints?

Ans.

Joints: A joint is the point where two or more bones meet. Joints are essential because they allow the body to move, bend, and perform various activities. They also provide stability and help maintain posture.

Classification of Joints

a) Fibrous Joints: In these joints, bones are connected by strong fibrous connective tissue. They do not allow movement. Example: joints between the bones of the skull.
b) Cartilaginous Joints: These joints are joined by cartilage, a firm and flexible tissue. They allow limited movement. Example: joints between the ribs and sternum, and between vertebrae.
c) Synovial Joints: The most common and most movable joints in the body. They have a synovial fluid–filled cavity and a surrounding joint capsule that reduces friction.
Types of synovial joints include Hinge, Ball-and-socket, Pivot, Saddle, Condyloid, and Gliding joints.



Functions of Joints

a) Facilitate Movement: Joints allow bones to move in different directions, enabling activities like walking, running, lifting, and bending.
b) Provide Stability and Support: Many joints, such as the hip and knee, bear body weight and help maintain posture and balance.
c) Absorb Shock: Joints like the knee and ankle act as shock absorbers, protecting the body during high-impact actions such as jumping or running.
d) Allow Flexibility: Joints provide a range of motions—from wide movements at the shoulder to precise movements in fingers and toes.
e) Protect Vital Organs: Certain joints, like those in the rib cage, help shield important organs such as the heart and lungs from injury.

5) Write about composition and function of blood?

Ans.

Blood: Blood is a fluid connective tissue that circulates throughout the body through the circulatory system. It consists of a liquid medium called plasma and various cellular and non-cellular components. Blood plays a vital role in transport, regulation, and protection.

Composition of Blood

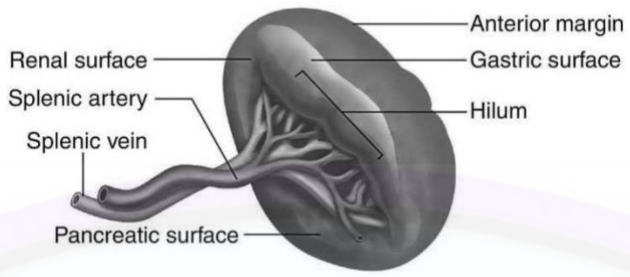
a) Plasma: Plasma is the liquid part of blood and forms about 55% of its total volume. It is mainly water and contains proteins, electrolytes, hormones, nutrients, and waste products.
b) Red Blood Cells (RBCs): RBCs make up about 41% of blood volume and are the most abundant cells. They contain haemoglobin, a protein that binds to oxygen and transports it from the lungs to body tissues.
c) White Blood Cells (WBCs): WBCs form around 4% of blood volume. They are part of the immune system and protect the body against infections, foreign particles, and diseases. Different types of WBCs perform different defence functions.
d) Platelets: These are small, disc-shaped cell fragments that help in blood clotting. They prevent excessive bleeding and assist in repairing damaged blood vessels.

Functions of Blood

a) Transport: Blood transports oxygen, nutrients, hormones, and enzymes to different parts of the body. It also carries waste materials such as carbon dioxide and urea to organs for removal.
b) Regulation: Blood helps maintain pH balance, regulates body temperature, and controls water and electrolyte balance.
c) Protection: WBCs defend the body against infections, and platelets help by forming clots to prevent blood loss during injury.

6) Write structure and function of spleen?

Ans.

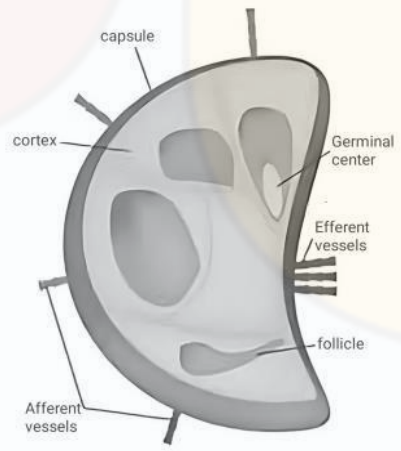


Functions of the Spleen

a) Filtration of Blood: The spleen acts as a filter by removing old or damaged red blood cells, platelets, and other unwanted particles from the blood.
b) Storage of Blood Cells: It stores a reserve of RBCs and platelets, which can be released into the bloodstream when the body needs them, such as during bleeding or injury.
c) Immune Response: The spleen plays an important role in immunity by producing lymphocytes (a type of white blood cell) that help fight infections.
d) Antibody Production: It also produces antibodies, which help the body recognise and destroy foreign substances like bacteria, viruses, and other pathogens.

7) Write structure and function of Lymph node?

Ans.



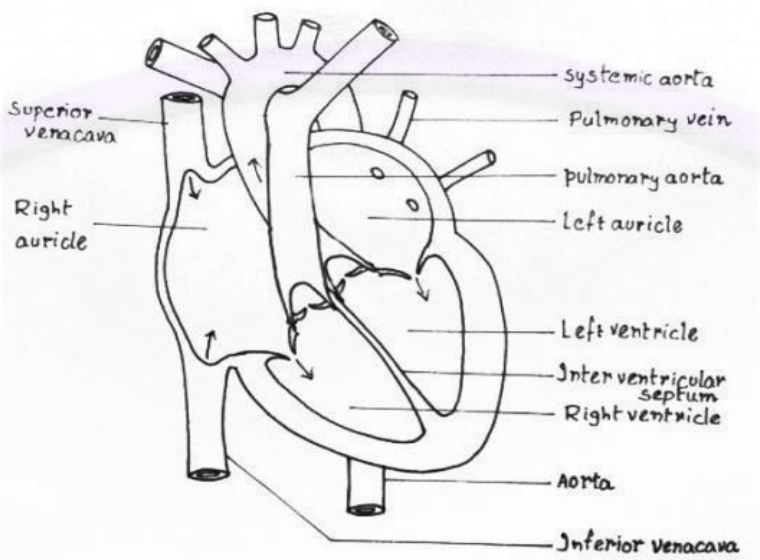
Functions of Lymph Nodes

a) Filtration of Lymph: Lymph nodes filter the lymphatic fluid by trapping and removing bacteria, viruses, and other foreign particles before the lymph returns to the bloodstream.
b) Immune Cell Activation: They serve as sites where lymphocytes and macrophages become activated. These immune cells help identify, attack, and destroy harmful pathogens.
c) Response to Infection: During an infection or inflammation, nearby lymph nodes often swell and become tender. This swelling indicates that the immune system is actively responding to a threat.
d) Transport Pathway: Lymph nodes are connected by a network of lymphatic vessels, which allows immune cells and other substances to move between nodes and reach different areas of the body.
e) Protection of Vital Organs: Some lymph nodes are located near major organs—like the lungs and intestines—to provide local defence against infections affecting these organs.

8) Explain anatomy of heart with a neat, labelled diagram?

Ans.

Anatomy of the Heart



The heart is a muscular, hollow organ responsible for pumping blood throughout the body. It is located in the thoracic cavity between the lungs and is slightly tilted to the left. Structurally, the heart is divided into four chambers: two atria (upper chambers) and two ventricles (lower chambers).

Chambers of the Heart

a) Right Atrium: Receives deoxygenated blood from the body through veins such as the superior and inferior vena cava. It then sends this blood to the right ventricle.
b) Right Ventricle: Pumps the deoxygenated blood to the lungs through the pulmonary artery, where the blood releases carbon dioxide and picks up oxygen.
c) Left Atrium: Receives oxygen-rich blood from the lungs through the pulmonary veins and sends it to the left ventricle.
d) Left Ventricle: Pumps oxygenated blood to the entire body through the aorta. This chamber has the thickest wall because it must pump blood with high pressure.

Conducting System of the Heart

The heart has its own electrical system that controls heart rate and rhythm.

a) Sinoatrial (SA) Node: Located in the right atrium, it acts as the natural pacemaker. It generates electrical impulses that trigger the heartbeat.
b) Atrioventricular (AV) Node: Located between the atria and ventricles, it delays the electrical signal slightly to ensure the atria empty blood into the ventricles before the ventricles contract.
    a. This conduction system ensures a coordinated and efficient pumping action.

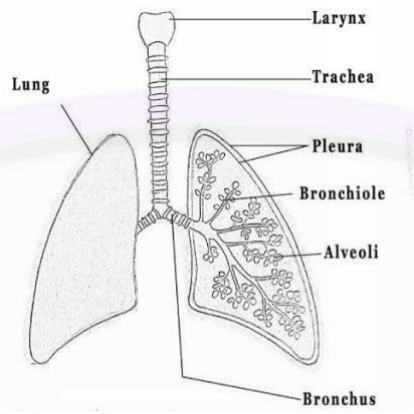
Blood Vessels Connected to the Heart

a) Arteries: Carry oxygen-rich blood away from the heart (except the pulmonary artery, which carries deoxygenated blood to the lungs).
b) Veins: Bring oxygen-poor blood back to the heart (except the pulmonary veins, which carry oxygenated blood from the lungs).

9) Explain anatomy and Physiology of respiration with their functions?

Ans.

Anatomy of Respiration



a) Respiration is the process by which the body takes in oxygen and removes carbon dioxide. It mainly depends on two systems working together: the respiratory system and the circulatory system.
b) The respiratory system includes the nose, mouth, pharynx (throat), trachea, bronchi, bronchioles, and lungs. Air enters through the nose or mouth and passes down the throat into the trachea. The trachea divides into two bronchi, one for each lung. Each bronchus further branches into smaller bronchioles, which finally end in tiny air sacs called alveoli.
c) The alveoli are covered by a rich network of capillaries from the circulatory system. This is the site of gas exchange. Oxygen from the air inside the alveoli diffuses into the capillaries and enters the blood. Carbon dioxide, which is produced by cells in the body, diffuses from the blood into the alveoli so it can be exhaled.

Physiology of Respiration

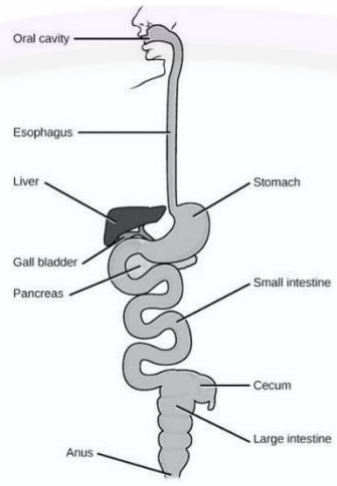
a) Breathing has two main phases: inhalation and exhalation.
b) During inhalation, the diaphragm moves downward and the intercostal muscles between the ribs contract. This expands the chest cavity and creates a negative pressure inside the lungs. As a result, air is drawn into the lungs.
c) During exhalation, these muscles relax. The chest cavity becomes smaller, pressure inside the lungs rises, and air is pushed out of the body.
d) Gas exchange between the alveoli and capillaries happens by diffusion. Oxygen moves from the alveoli into the blood, where it attaches to haemoglobin in red blood cells and is carried to all tissues. Carbon dioxide moves from the blood into the alveoli and is removed during exhalation.
e) Respiration is essential because it supplies oxygen required for cell functions and removes carbon dioxide, which can be harmful if it builds up in the body.

10) Explain anatomy and Physiology of gastrointestinal tract (GIT)?

Ans.

The gastrointestinal tract, or digestive system, is a long tube from the **mouth to the anus**. Its main function is to break down food into nutrients the body can absorb and use.

Anatomy of the GIT



a) Mouth: Digestion starts in the mouth. Teeth break food into smaller pieces, and saliva begins the breakdown of carbohydrates.
b) Pharynx: Located in the neck, it helps guide food into the oesophagus and prevents it from entering the trachea.
c) Oesophagus: A muscular tube that connects the mouth to the stomach. Food moves down through peristalsis.
d) Stomach: A J-shaped organ that stores food temporarily. It mixes food with acid and enzymes, breaking it further before sending it to the small intestine.
e) Small Intestine: The main site of nutrient absorption. It contains villi that increase surface area. Food mixes with enzymes from the liver and pancreas here.
f) Large Intestine: Absorbs water and electrolytes from leftover food and forms solid stool. Stool is stored in the rectum and passed out through the anus.

Physiology of the GIT

a) Digestion is a coordinated process controlled by enzymes and hormones. Enzymes break down food into smaller molecules, while hormones act as messengers that regulate different steps of digestion.
b) When we eat, the body releases various digestive enzymes and hormones to help in breaking down food and absorbing nutrients. For example, gastrin is released when food enters the stomach. It stimulates the production of stomach acid and digestive enzymes.
c) The pancreas also releases hormones. Insulin is produced in response to carbohydrates in the food. It helps control blood sugar by moving glucose from the blood into the cells.

11) Write in detail about muscle contraction?

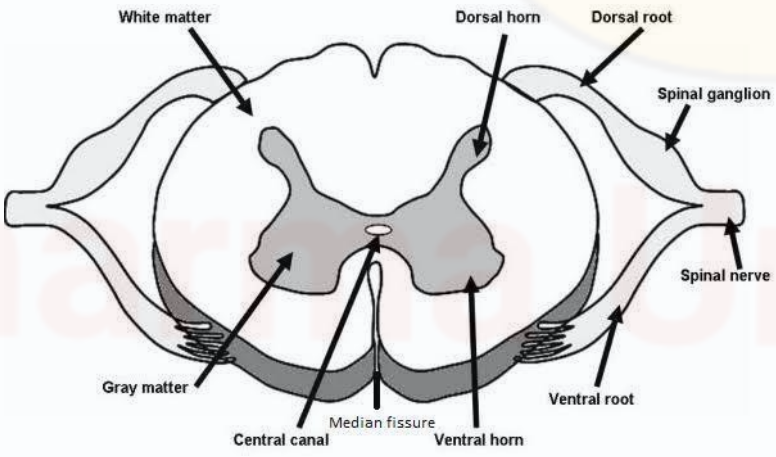
Ans.

a) Muscle contraction is the process by which muscles generate force to produce movement. There are three types of muscles in the human body: skeletal muscle, smooth muscle, and cardiac muscle.
b) Skeletal muscles are made up of many long, thin fibers. Each fiber contains smaller structures called myofibrils, which are made up of even smaller units called sarcomeres. Sarcomeres are the functional units that work together to contract the muscle fiber.
c) Sarcomeres contain two main proteins: actin (thin filament) and myosin (thick filament with a bulbous head). When a muscle fiber is stimulated by a nerve impulse, calcium ions are released from storage inside the cell.
d) The presence of calcium triggers a series of reactions that allow the myosin heads to bind to the actin filaments. This forms cross-bridges, enabling myosin to pull the actin filaments closer together. As actin slides past myosin, the sarcomeres shorten, causing the muscle fiber to contract.
e) This process occurs throughout the muscle fiber, leading to contraction of the whole muscle and generation of force. The amount of force produced depends on how many muscle fibers are stimulated and how frequently the nerve impulses are sent.
f) After contraction, calcium ions are pumped back into storage, and the myosin heads detach from actin. The muscle fiber then relaxes and returns to its original length.

12) Discuss in detail about structure of spinal cord and its function?

Ans.

Structure of the Spinal Cord



The spinal cord is a long, thin tube of nerve tissue that extends from the base of the brain to the lower back. It is part of the **central nervous system** and is protected by the **vertebrae** of the spine. It is made up of **neurons** and **glial cells**.
In cross-section, the spinal cord has:

a) **Grey Matter:** Butterfly-shaped area in the centre. Contains the **central canal** filled with CSF. Contains neuron cell bodies. Has dorsal (posterior) and ventral (anterior) horns.
b) White Matter: Surrounds the grey matter. Made of axons (nerve fibres). Forms **ascending tracts** (carry sensory signals to the brain) and **descending tracts** (carry motor signals from the

brain). The spinal cord connects to the body through **31 pairs of spinal nerves**, which carry sensory and motor information.

Meninges (Protective Layers): The spinal cord is covered by three layers:

a) **Dura Mater** – outer layer, epidural space lies outside it.
b) **Arachnoid Mater** – middle layer, subarachnoid space contains CSF.
c) **Pia Mater** – inner layer closely attached to the cord.

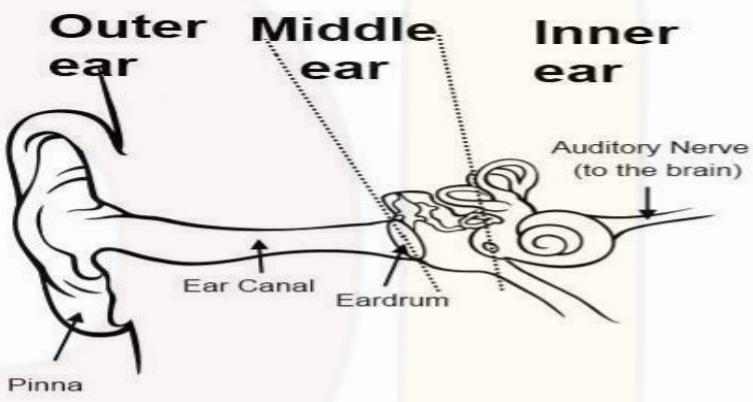
Functions of the Spinal Cord

a) Conducts sensory impulses from the body to the brain (ascending tracts)
b) Conducts motor impulses from the brain to muscles and glands (descending tracts)
c) Acts as a reflex center for quick, involuntary responses (reflex arcs)
d) Coordinates communication between the brain and the rest of the body

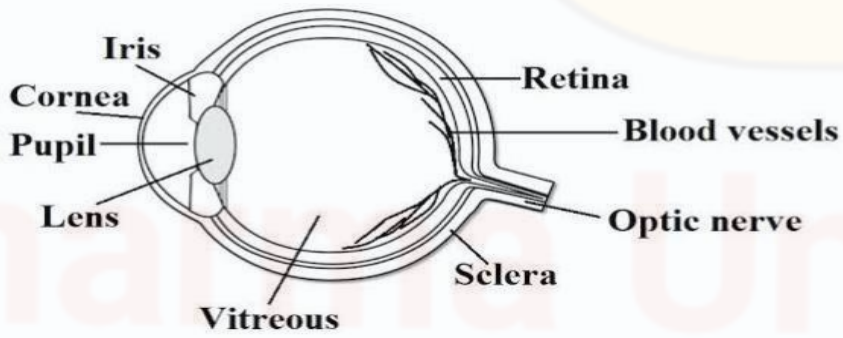
13) Draw the well labelled structure of ear, eye, skin and its layer?

Ans.

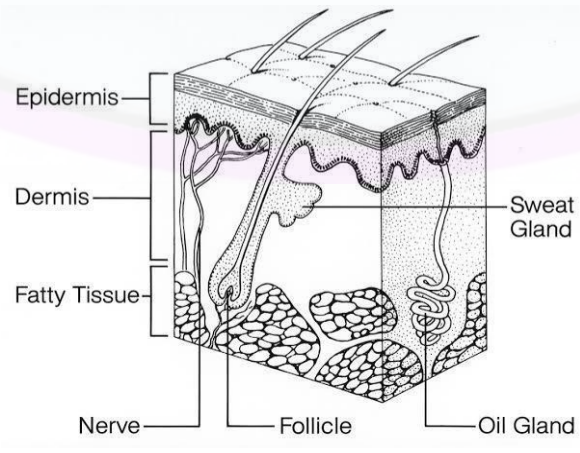
a) Structure of ear



b) Structure of eye



c) Structure of skin



14) Write Physiology of urine formation?

Ans.

Physiology of Urine Formation

Urine formation is a complex process carried out by the nephrons in the kidneys. It involves four main steps: filtration, reabsorption, secretion, and concentration.

a) Filtration

- Filtration is the first step and occurs in the glomerulus, a ball of capillaries present inside the Bowman's capsule.
- When blood enters the glomerulus under high pressure, water and small solutes such as electrolytes, glucose, amino acids, and urea pass through the filtration membrane into the Bowman's capsule.
- This filtered fluid is called the glomerular filtrate.

  Larger molecules like proteins and blood cells cannot pass through and remain in the blood.

b) Reabsorption

- The filtrate then enters the renal tubules, where reabsorption takes place.
- Reabsorption means the kidneys take back useful substances from the filtrate into the blood.
- This includes glucose, amino acids, water, sodium, and other electrolytes.
- Different parts of the tubule (PCT, loop of Henle, DCT) reabsorb different substances.
- The amount reabsorbed depends on the body's needs—for example, more water is reabsorbed when the body is dehydrated.

c) Secretion

- Secretion is the active transport of waste substances from the blood into the renal tubules.

  These are substances that were not filtered in the glomerulus or need to be removed in larger amounts.
- Examples include drugs, toxins, excess potassium, and hydrogen ions.

  This step helps maintain acid–base balance and removes unwanted chemicals from the blood.

d) Concentration of Urine

- The final step occurs in the collecting ducts.
- Here, more water is reabsorbed depending on the body's hydration level.
- When the body needs to conserve water, the hormone ADH increases water reabsorption, making urine concentrated.
- As water leaves, the concentration of electrolytes and waste products in the urine increases.

Flow of Urine

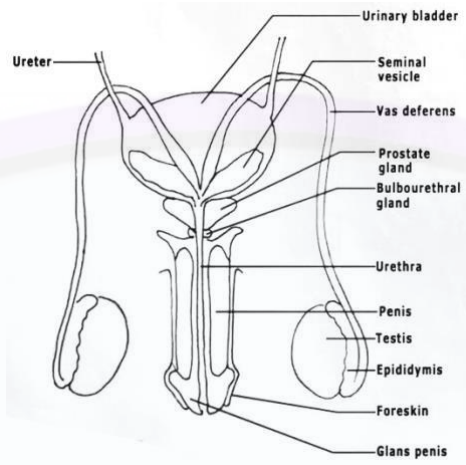
Once formed, urine moves from the collecting ducts → renal pelvis → ureters → urinary bladder.

From the bladder, it is expelled out of the body through the urethra during urination.

15) Write anatomy of male and female reproductive system with diagram?

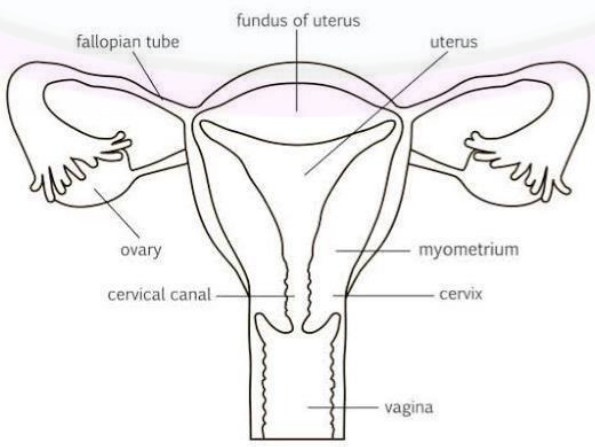
Ans.

Anatomy of male reproductive system:



a) **Testes:** The testes, also known as testicles, are two oval-shaped glands that produce sperm and the hormone testosterone. They are located in the scrotum, a sac of skin that hangs outside the body to keep the testes cooler than body temperature, which is necessary for sperm production.
b) **Scrotum:** The scrotum is a loose, sac-like skin bag that hangs below the penis. This part of the male reproductive system holds the testes (testicles) along with many blood vessels and nerves.
c) **Urethra:** The urethra is a tube that carries urine from the bladder to the outside of the body. In males, it also carries semen during ejaculation, so it performs an additional reproductive function.
d) **Epididymis:** The epididymis is a tightly coiled tube located behind each testis. Sperm produced in the testes move into the epididymis, where they mature and gain the ability to swim.
e) **Vas Deferens:** The vas deferens is a long, muscular tube that carries sperm from the epididymis to the urethra, the tube that carries semen and urine out of the body.
f) **Seminal Vesicles, Prostate Gland, and Bulbourethral Gland:** These three glands secrete fluids that form semen, which helps nourish and protect sperm. The seminal vesicles and prostate gland are located near the base of the bladder, while the bulbourethral gland is located at the base of the penis.
g) **Penis:** The penis is the male organ used for sexual intercourse and urination. It contains three cylinders of spongy tissue that fill with blood during sexual arousal, causing the penis to become erect.

Female reproductive system



a) **Ovaries:** The ovaries are two almond-shaped glands located on either side of the uterus. They produce and release eggs and also secrete the hormones estrogen and progesterone.
b) **Fallopian Tubes:** Also known as oviducts, the fallopian tubes are two narrow tubes that extend from the ovaries to the uterus. They serve as the pathway for the egg to travel from the ovary to the uterus. Fertilization typically occurs in the fallopian tubes.
c) **Uterus:** The uterus is a pear-shaped organ located in the lower abdomen. It provides a suitable environment for a fertilized egg to develop into a fetus. The inner lining of the uterus, called the endometrium, thickens each month in preparation for pregnancy. If pregnancy does not occur, the endometrium is shed during menstruation.
d) **Cervix:** The cervix is the lower part of the uterus that connects to the vagina. It produces mucus that helps protect the uterus from infection. It also dilates during childbirth to allow the baby to pass through.
e) **Vagina:** The vagina is a tube-like region that opens to the outside of the female body through the vulva. It is the passage through which sperm move toward the egg for fertilization. It is also called the birth canal, as it is the pathway through which the baby is delivered.

16) Describe various phases of menstrual cycle?

Ans.

The menstrual cycle is a reproductive cycle occurring in female primates. It consists of four distinct phases:

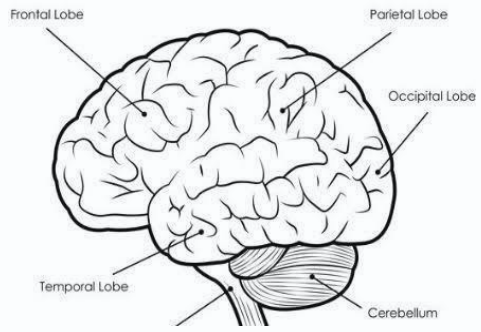
a) **Menstrual Phase (Day 1 to Day 4):** This phase occurs when fertilization does not happen. During this time, the endometrium of the uterus is shed, leading to menstrual bleeding. The expelled material includes secretions from endometrial glands, cellular debris, and an unfertilized ovum. Once this phase concludes, the pituitary gland resumes secreting follicle-stimulating hormone (FSH), initiating the growth of a new follicle.
b) **Follicular Phase (Day 5 to Day 13):** In this phase, the ovary transitions to a stage of follicular development, while the uterus enters the proliferative phase. Under the influence of FSH, a primordial follicle matures into a Graafian follicle, which begins producing estrogen. Typically, only one follicle develops during each cycle. The estrogen stimulates the repair and proliferation of the uterine lining, causing the endometrial glands to grow.
c) **Ovulatory Phase (Day 14):** Ovulation occurs during this phase, typically on the 14th day of the cycle. The mature Graafian follicle ruptures due to the luteinizing hormone (LH) secreted by the pituitary gland, releasing an ovum. This ovum, along with follicular fluid, is captured by the fimbriae of the infundibulum and transported through the fallopian tube. Fertilization may occur if a sperm meets the ovum in the fallopian tube; otherwise, the ovum degenerates.
d) **Luteal Phase (Day 15 to Day 28):** This phase coincides with the uterus's secretory phase. The ruptured Graafian follicle transforms into the corpus luteum, which secretes progesterone. If fertilization occurs, the corpus luteum remains functional, supported by luteinizing hormone (LH) and luteotropic hormone (LTH) from the pituitary. If the ovum is not fertilized, the corpus luteum degenerates into the corpus albicans. Progesterone causes the uterine lining to thicken, with the endometrial glands becoming secretory. Should fertilization take place, the fertilized ovum implants in the uterine wall, and the placenta forms. The corpus luteum continues producing progesterone until the placenta becomes functional. If fertilization does

not occur, progesterone levels drop, the endometrium sheds, and the next menstrual cycle begins.

17) Write in detail about anatomy and physiology of human brain with a well labelled diagram?

Ans.

Anatomy of the Brain



The human brain is the central organ of the nervous system, located inside the cranium (skull). It is divided into three main parts:

a) Forebrain

- Cerebrum: The largest part, divided into two hemispheres (left and right), each with four lobes (frontal, parietal, temporal, occipital). It is responsible for higher functions like thinking, memory, emotions, and voluntary muscle movement.
- Thalamus: Acts as a relay centre for sensory information (except smell).
- Hypothalamus: Controls homeostasis, hunger, thirst, emotions, and the endocrine system.

b) Midbrain

- Connects the forebrain and hindbrain.
- Contains centers for reflexes related to vision and hearing. Acts as a relay station for motor and sensory pathways.

c) Hindbrain

- Cerebellum: Located at the back, controls coordination, balance, and posture. Pons: Links different parts of the brain and plays a role in sleep and respiration.
- Medulla Oblongata: Controls involuntary activities like heartbeat, breathing, and digestion.

d) Protective Structures

- Meninges: Three protective layers (dura mater, arachnoid mater, pia mater).
- Cerebrospinal Fluid (CSF): Cushions the brain and removes waste.
- Cranium: The bony structure that encloses the brain.

Physiology of the Brain

The brain performs various complex functions through its neuronal networks. Key physiological functions include:

a) **Sensory Functions:** Processes information from sensory organs (eyes, ears, skin, etc.). The occipital lobe processes visual information. The temporal lobe processes auditory information.

b) **Motor Functions:** The frontal lobe controls voluntary muscle movement. The cerebellum ensures smooth and coordinated movements.

c) **Regulation of Homeostasis**: The hypothalamus maintains body temperature, hunger, thirst, and hormonal balance.
d) **Cognition and Memory:** The cerebrum is responsible for thinking, reasoning, problem-solving, and memory storage.
e) **Autonomic Functions:** The medulla oblongata controls vital involuntary activities like Regulation of heart rate, Control of breathing. Regulation of peristalsis.
f) **Reflex Actions:** The midbrain and spinal cord play a role in reflexes like blinking and knee-jerk reactions.
g) **Emotional and Endocrine Regulation:** The limbic system, including the hypothalamus, amygdala, and hippocampus, controls emotions and behaviour. The hypothalamus regulates the release of hormones through the pituitary gland.

18) Define Anatomy and physiology and write scope of Anatomy and physiology?

Ans.

Anatomy: Anatomy is the branch of science that deals with the study of the structure of the human body. It explains what different organs look like, where they are located, and how they are arranged.

Physiology: Physiology is the study of how the organs and systems of the body work. It explains the normal functions of cells, tissues, and organs.

Scope of Anatomy and Physiology

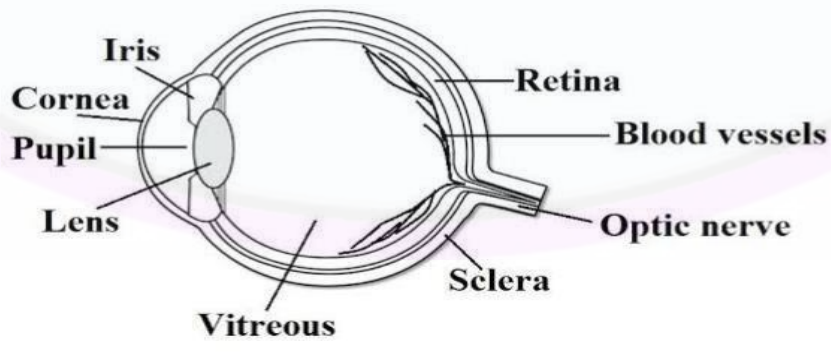
a) Helps in understanding the structure and location of different organs of the human body.
b) Explains how organs and body systems normally function.
c) Helps in understanding how different systems work together to maintain life.
d) Forms the basis for studying diseases, diagnosis, and treatment.
e) Useful for healthcare professionals to perform clinical examinations and procedures correctly.

19) Write anatomy and physiology of eye, ear, skin, tongue and nose?

Ans.

a) Eye

Anatomy



The eye is a spherical organ located in the orbit. It has three layers:

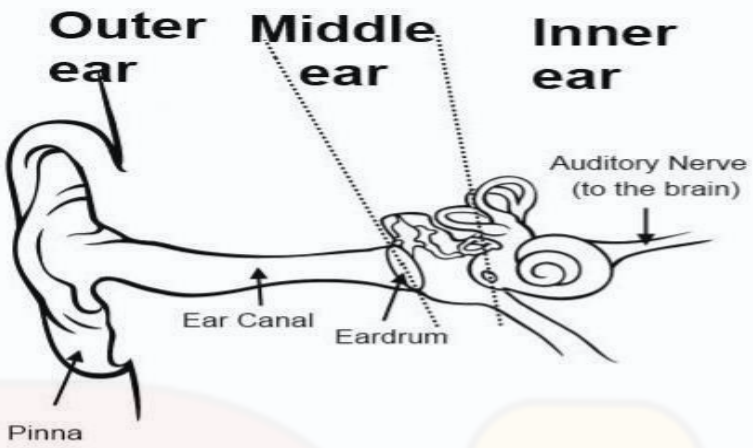
- Outer layer: Cornea (transparent front part) and sclera (white part).
- Middle layer: Choroid, ciliary body, and iris (controls pupil size).
- Inner layer: Retina, which contains rods and cones for vision.

Inside the eye are the lens, aqueous humor, and vitreous humor. Extraocular muscles help in eye movements.

Physiology: The eye helps in vision. Light enters through the cornea and pupil, gets focused by the lens onto the retina, and forms an image. The retina converts light into nerve impulses, which are carried by the optic nerve to the brain to create visual perception.

b) Ear

Anatomy



The ear has three parts:

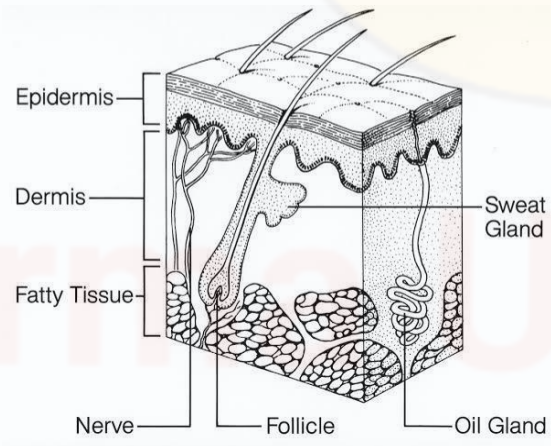
- External ear: Pinna and external auditory canal.
- Middle ear: Tympanic membrane (eardrum) and three ossicles—malleus, incus, and stapes.
- Inner ear: Cochlea (hearing), vestibule, and semicircular canals (balance).

Physiology

The ear performs hearing and balance. Sound waves are collected by the pinna, vibrate the eardrum, and pass through ossicles into the cochlea. The cochlea converts vibrations into nerve impulses. Semicircular canals and vestibule detect body position and help maintain balance.

c) Skin

Anatomy



Skin is the largest organ of the body, made of three layers:

- Epidermis: Outer protective layer.
- Dermis: Contains hair follicles, sweat glands, sebaceous glands, blood vessels, and nerves.
- Hypodermis (subcutaneous layer): Fat layer for insulation and protection.

Physiology

Skin protects the body from injury, germs, and dehydration. It regulates body temperature through sweating, allows sensation (touch, pain, pressure, heat), and helps in vitamin D synthesis.

d) Tongue

Anatomy

The tongue is a muscular organ covered with papillae. These papillae contain taste buds. It has intrinsic and extrinsic muscles that help in movement. It is supplied by multiple nerves responsible for taste and movement.

Physiology

The tongue helps in taste, speech, and swallowing. Taste buds detect five sensations—sweet, salty, sour, bitter, and umami. The tongue mixes food with saliva and pushes it for swallowing.

e) Nose

Anatomy

The nose has external nostrils that lead to the nasal cavity. The cavity is lined with mucous membrane and hair to filter air. The upper part contains olfactory receptors responsible for smell. The nasal septum separates the two sides.

Physiology

The nose helps in smell and respiration. It filters, warms, and moistens inhaled air. Olfactory receptors detect different smells and send signals to the brain. It also aids in voice resonance.

20) Explain spermatogenesis and oogenesis?

Ans.

Spermatogenesis

a) Spermatogenesis is the biological process by which the testes produce mature sperm cells, and it takes place inside the seminiferous tubules throughout a man's reproductive life.
b) The process starts with spermatogonia, which are the diploid male germ cells located on the basement membrane of the seminiferous tubules. These cells continuously divide by mitosis to maintain their population.
c) Some of the spermatogonia enlarge, accumulate cytoplasm, and transform into primary spermatocytes, which are the cells that will enter meiosis.
d) Each primary spermatocyte undergoes the first meiotic division (meiosis I), which reduces the chromosome number and produces two secondary spermatocytes, each carrying half the number of chromosomes.
e) These secondary spermatocytes quickly enter meiosis II, the second meiotic division, which results in the formation of four spermatids from the original primary spermatocyte.
f) The spermatids formed are immature, round cells that cannot fertilize an egg, so they undergo a process of maturation called spermiogenesis. During spermiogenesis, the

spermatids elongate, develop a distinct head containing the nucleus and acrosome, form a middle piece rich in mitochondria, and grow a long tail for motility.

g) The mature spermatozoa are then released into the lumen of the seminiferous tubules and later transported to the epididymis, where they gain full motility and the ability to fertilize an ovum.
h) Overall, one primary spermatocyte ultimately produces four mature sperm cells, making spermatogenesis a continuous and highly productive process.

Oogenesis

a) Oogenesis is the process by which the female ovaries produce a mature ovum, and it begins much earlier than spermatogenesis, starting during fetal development.
b) In the fetus, many oogonia are formed, and these cells actively divide by mitosis to increase their number until they eventually develop into primary oocytes.
c) Each primary oocyte starts meiosis I before birth, but it does not complete it; instead, it becomes arrested in prophase I, where it remains inactive until the girl reaches puberty.
d) The primary oocyte is surrounded by a layer of follicular cells, forming a primordial follicle that stays dormant until hormonal stimulation begins during the menstrual cycle.
e) After puberty, during each menstrual cycle, one primary follicle grows, and the primary oocyte inside it finally completes meiosis I, producing two unequal cells—a large secondary oocyte and a much smaller first polar body.
f) The secondary oocyte immediately begins meiosis II but stops again, this time at metaphase II, and it will remain in this arrested stage until fertilization occurs.
g) During ovulation, the secondary oocyte is released from the ovary, and if a sperm cell penetrates it, the secondary oocyte completes meiosis II, forming the mature ovum and a second polar body.
h) Unlike spermatogenesis, which produces four functional gametes, oogenesis produces only one functional ovum, because the polar bodies do not participate in fertilization and eventually degenerate.
i) Therefore, oogenesis is a prolonged, cyclical process that starts before birth, pauses for many years, and continues monthly after puberty until menopause.

All The Best For Your Exam

Notes:

1) Please Read All the Topics & All the Chapters of Human anatomy and physiology Very Carefully.
2) This Pdf Notes/Questions & Answers Are Only for Reference Purpose.