Pharma Unit

Human Anatomy and Physiology (HAP)

Top 10 Most Repeated Questions with Answers

According to New Syllabus ER 2020-21

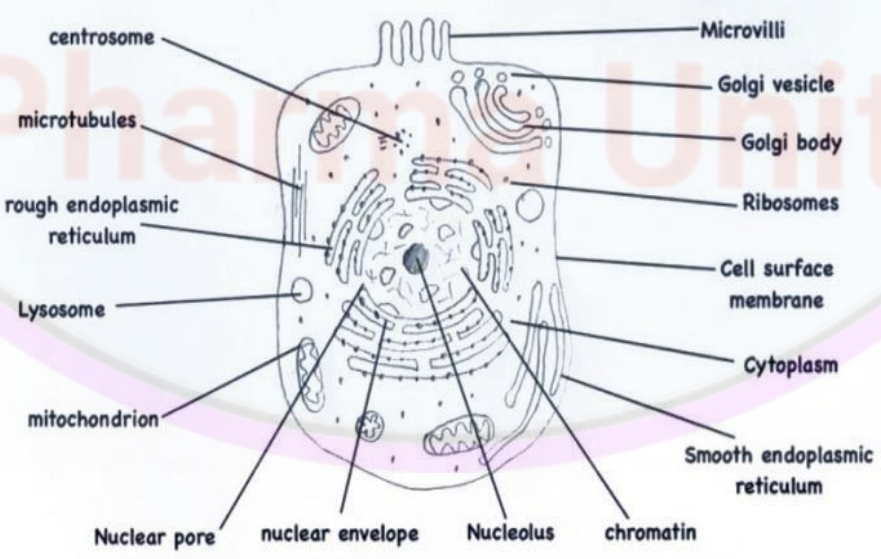
1st Year D. Pharmacy

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

Ans.

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

Components of cells



Cell Membrane: The cell membrane is the outermost layer of the cell. It separates the inside of the cell from its environment. It is made up of a double layer of lipids and proteins. The lipids form a barrier that prevents certain molecules from entering or leaving the cell, while the proteins help the cell to communicate with its environment.

Cytoplasm: The cytoplasm is a jelly-like substance that fills the cell. It contains lots of tiny structures called organelles. The organelles are like tiny machines that help the cell to do its job.

Nucleus: The nucleus is like the control center of the cell. It contains the cell's genetic material, which controls how the cell grows, develops, and functions. The genetic material is made up of DNA (deoxyribonucleic acid), which contains all the instructions for building and maintaining the cell.

Mitochondria: Mitochondria are organelles that produce energy for the cell. They are the powerhouse of the cell. They break down glucose (a type of sugar) to produce ATP (adenosine triphosphate), which is the main energy source for the cell.

Ribosomes: They are small organelles that make proteins. They read the genetic instructions in the DNA and use them to assemble proteins from amino acids.

Endoplasmic reticulum (ER): Endoplasmic reticulum (ER) is a network of tubes and membranes that help to transport proteins and lipids within the cell. There are two types of ER: rough ER, which has ribosomes attached to its surface and helps to make proteins, and smooth ER, which does not have ribosomes and is involved in lipid synthesis.

Golgi apparatus: Golgi apparatus is an organelle that modifies and packages proteins for export out of the cell. It works closely with the ER to ensure that the proteins are properly folded and processed before they are sent out of the cell.

Lysosomes: Lysosomes are organelles that contain digestive enzymes. They help to break down and recycle cellular waste, such as damaged organelles or old proteins.

2) Write about composition and function of blood?

Ans.

Definition: Blood is a fluid connective tissue that circulates throughout the body via the circulatory system. It is composed of a fluid called plasma, along with various cellular and non-cellular components.

Composition:

The main components of blood are:

a) Plasma: This is the liquid portion of blood, which makes up around 55% of its total volume. It is mostly made up of water, along with various proteins, electrolytes, and other molecules.
b) Red blood cells (RBCs): These are the most numerous cells in the blood, and they are responsible for carrying oxygen from the lungs to the body's tissues. Makes up around 41% of its total volume RBCs contain a protein called hemoglobin, which binds to oxygen and helps transport it throughout the body.
c) White blood cells (WBCs): These are immune cells that help protect the body against infections and foreign invaders. Makes up around 4% of its total volume There are several different types of WBCs, each with its own unique function.
d) Platelets: These are small, disc-shaped cells that help with blood clotting. They are important for stopping bleeding and repairing damaged blood vessels.

Function:

a. Transport: Blood carries oxygen, nutrients, and other essential molecules throughout the body. It also helps remove waste products like carbon dioxide and urea.
b. Regulation: Blood helps regulate the body's pH balance, temperature, and fluid balance.
c. Protection: White blood cells and platelets help protect the body against infections and injuries.

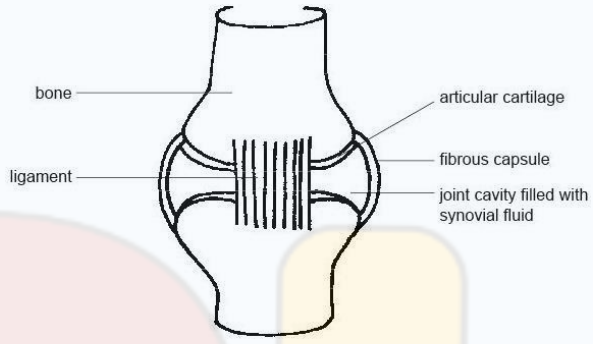
3) Discuss in detail about joints?

Ans.

Definition: A joint means a point where two or more bones are connected. Joints are important because they allow us to move our body in different ways.

Classification of Joints

a) Fibrous joints: These are joints where the bones are held together by strong connective tissue, like in the skull. These joints do not allow for any movement.
b) Cartilaginous joints: These joints are connected by cartilage, which is a firm, rubbery substance. For example, connection between the ribs and the sternum. These joints allow for some movement, but not as much as other types of joints.
c) Synovial joints: These are the most common type of joint in our body. They are surrounded by a capsule of connective tissue and contain synovial fluid, which helps to lubricate the joint and reduce friction. There are six types of synovial joints - Hinge joint, Ball-and-socket joint, Pivot joint, Saddle joint, Condyloid joint, Gliding joint.

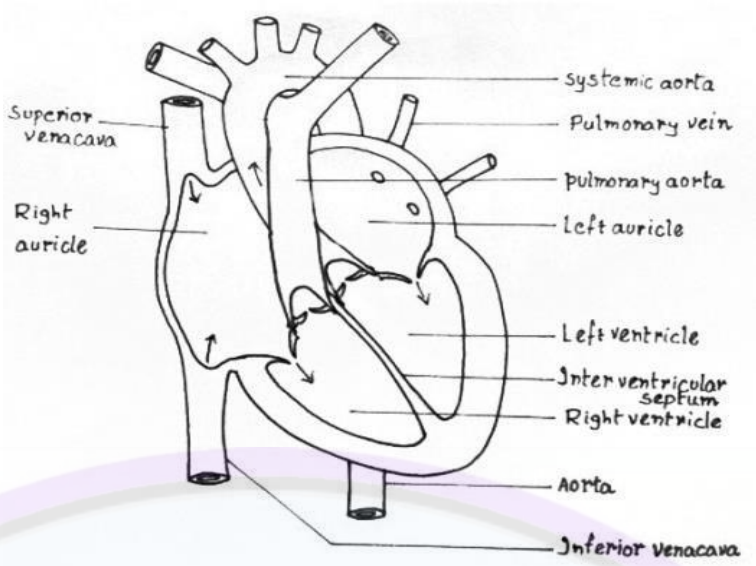


Function of Joints

1. Facilitate movement: Joints connect bones together and allow them to move in different directions, which is important for a wide range of activities like walking, running, jumping, and playing sports. Without joints, we would be unable to move our body and perform these activities.
2. Provide stability and support: Joints also provide stability and support to our body, which is important for maintaining posture and balance. Some joints, like the hip and shoulder, are designed to bear weight and provide support to the rest of the body.
3. Absorb shock: Certain joints, like those in the knee and ankle, are designed to absorb shock and protect our body from injuries during high-impact activities like running and jumping.
4. Allow for flexibility: Joints are also designed to allow for flexibility and range of motion. Some joints, like those in the neck and spine, are designed to allow for a wide range of movement, while others, like those in the fingers and toes, allow for more precise and delicate movements.
5. Protect vital organs: Some joints, like those in the rib cage, protect vital organs like the heart and lungs from external injuries and trauma.

4) Explain anatomy of heart with diagram?

Ans.



The heart is a muscular organ that is responsible for pumping blood throughout the body.

It is divided into four chambers: the right atrium, the left atrium, the right ventricle, and the left ventricle.

The right atrium receives blood that is low in oxygen and high in carbon dioxide from the body through the veins. This blood is then pumped into the right ventricle, which then pumps it to the lungs where it picks up oxygen and releases carbon dioxide.

The left atrium receives oxygen-rich blood from the lungs through the pulmonary veins. This blood is then pumped into the left ventricle, which then pumps it out to the rest of the body through the arteries.

The heart has its own electrical system, which controls the timing and rhythm of its contractions. The sinoatrial (SA) node, located in the right atrium, acts as the heart's natural pacemaker. It sends out electrical signals that cause the heart muscles to contract and pump blood.

The atrioventricular (AV) node, located between the atria and ventricles, helps coordinate the timing of the contractions between the two. These electrical signals cause the heart to beat in a coordinated way, allowing it to efficiently pump blood throughout the body.

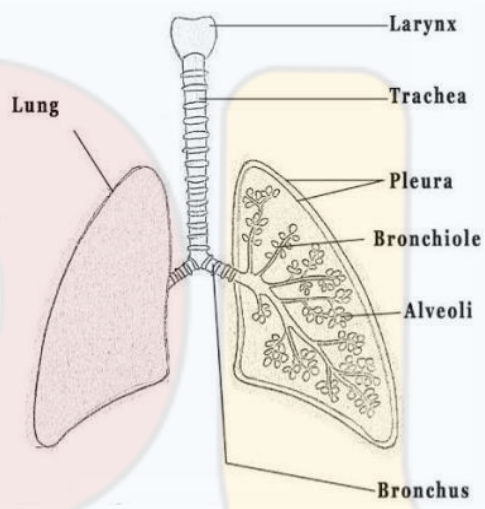
In addition, the heart has blood vessels called arteries and veins that help circulate the blood. Arteries carry oxygen-rich blood away from the heart, while veins bring oxygen-poor blood back to the heart.

5) Explain anatomy and Physiology of respiration?

Ans.

Anatomy of Respiration

a. The respiratory system consists of several components that work together to facilitate the exchange of oxygen and carbon dioxide. Air enters the body through the nose or mouth. The nose filters, warms, and humidifies the air, while the mouth serves as an alternate pathway for airflow. From here, air travels through the pharynx, a shared passageway for air and food.
b. The air then passes into the trachea, a tube supported by cartilage rings that keeps it open and prevents collapse during breathing. The trachea divides into two bronchi, each leading to a lung. These bronchi further branch into smaller tubes called bronchioles, which ultimately end in tiny air sacs known as alveoli.
c. The alveoli are the site of gas exchange. They are surrounded by a dense network of capillaries, which are part of the circulatory system. Oxygen from the air in the alveoli diffuses into the capillaries and binds to haemoglobin in red blood cells for transport throughout the body. Simultaneously, carbon dioxide, a waste product from cellular metabolism, diffuses from the capillaries into the alveoli to be exhaled. This close relationship between the alveoli and capillaries ensures efficient gas exchange.



Physiology of Respiration

a. The process of respiration consists of two main phases: inhalation and exhalation. During inhalation, the diaphragm, a dome-shaped muscle located below the lungs, contracts and moves downward. This action increases the volume of the chest cavity. At the same time, the intercostal muscles between the ribs contract, expanding the rib cage. The increased chest cavity volume creates negative pressure, drawing air into the lungs.
b. Exhalation occurs when the diaphragm and intercostal muscles relax. This reduces the volume of the chest cavity, creating positive pressure that forces air out of the lungs. At rest, exhalation is typically passive, but during activities like exercise, it can become active, involving additional muscles to expel air forcefully.
c. Gas exchange occurs in the alveoli through diffusion. Oxygen moves from an area of higher concentration in the alveoli to a lower concentration in the blood, where it binds to haemoglobin for transport to the tissues. Conversely, carbon dioxide diffuses from the blood, where it is in higher concentration, into the alveoli to be exhaled.
d. The control of respiration is managed by the medulla oblongata in the brainstem, which adjusts the breathing rate and depth based on carbon dioxide levels and blood pH. This ensures that oxygen delivery and carbon dioxide removal are balanced to meet the body's needs. Additionally, carbon dioxide is transported back to the lungs in three forms: as bicarbonate ions (the majority), bound to haemoglobin, or dissolved in plasma.

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

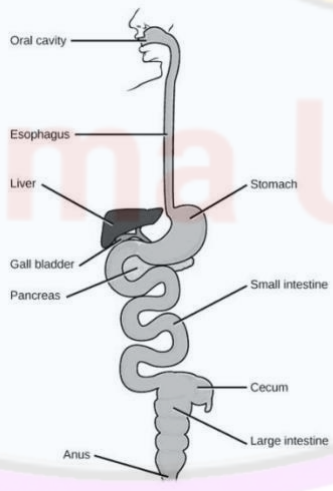
Ans.

Definition: The gastrointestinal tract, also known as the digestive system, is a long tube that runs from the mouth to anus. It's responsible for breaking down the food we eat into nutrients our body can use.

Anatomy of the GIT

The GIT is made up of several organs, including the mouth, oesophagus, stomach, small intestine, large intestine (also called the colon), rectum, and anus. Each of these organs has a specific work in the digestive process.

a) Mouth: When we eat food, we chew it in mouth, which starts the digestive process. Our teeth break the food down into smaller pieces, and saliva starts to break down the carbohydrates in the food.
b) Pharynx: The pharynx is enclosed in the neck and functions as part of both the digestive system and the respiratory system. It protects the food from entering the trachea and lungs.
c) Oesophagus: The food then travels down to oesophagus, which is a muscular tube that connects mouth to stomach. In this the action of swallowing becomes involuntary and is controlled by the oesophagus.
d) Stomach: The stomach is a J-shaped bag-like organ that stores the food temporarily. In stomach the food mixes with stomach acid and digestive enzymes. This helps break the food down even further. Stomach muscles then push the food into your small intestine.
e) Small intestine: It is where most of the nutrients from the food are absorbed into the bloodstream. The walls of the small intestine are lined with tiny finger-like projections called villi, which increase the surface area of the small intestine and allow for more efficient absorption of nutrients. Food is mixed with enzymes from the liver and the pancreas in the small intestine
f) Large intestine: After the small intestine, the food passes into the large intestine. The large intestine absorbs water and electrolytes from the leftover food waste and forms it into solid stool. This stool is then stored in the rectum until it's ready to be eliminated through the anus.



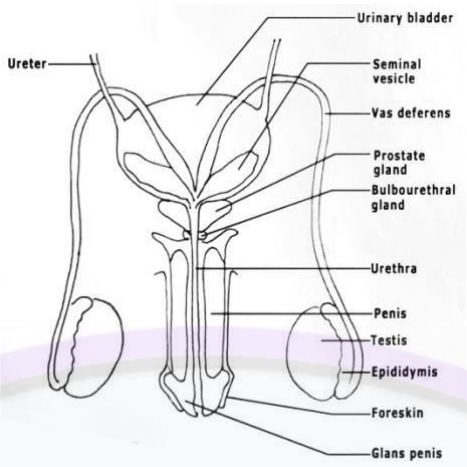
Physiology of the GIT

a) Digestion is a complex process that involves several different types of enzymes and hormones. Enzymes are proteins that help break down food molecules, while hormones are chemical messengers that help regulate various aspects of digestion.
b) When we eat food, body releases several digestive enzymes and hormones to help break down the food and absorb the nutrients. For example, the hormone gastrin is released in response to food in the stomach, and it helps stimulate the production of stomach acid and digestive enzymes.
c) Another important hormone is insulin, which is released by the pancreas in response to carbohydrates in the food. Insulin helps to regulate blood sugar levels by moving glucose from the bloodstream into cells.

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

Ans.

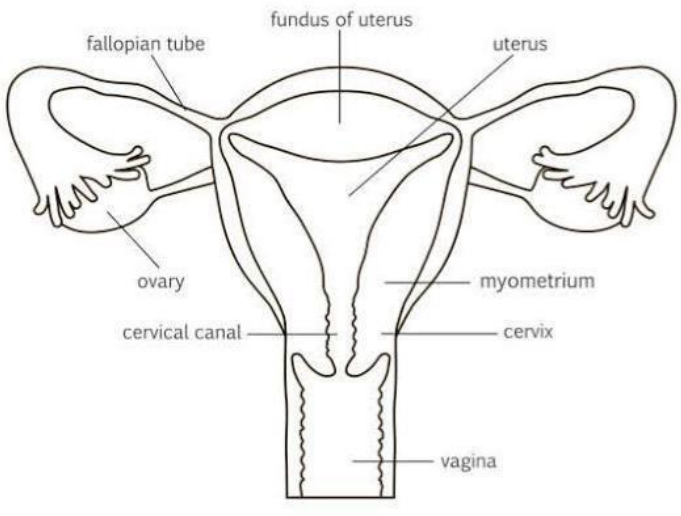
Male Reproductive system: The male reproductive system is responsible for producing and delivering sperm, which are necessary for fertilizing a female egg and initiating pregnancy.



a) Testes: The testes, also known as testicles, are the two oval-shaped glands that produce sperm and the hormone testosterone. The testes are located in the scrotum, a sac of skin that hangs outside the body to keep the testes cooler than the body temperature, which is necessary for sperm production.
b) Scrotum: The scrotum is the loose sac-like skin bag which hangs below the penis. This part of the male reproductive system holds the testes or testicles, along with many blood vessels and nerves.
c) Urethra: It is a tube which carries urine starting from the bladder to travel outside the body. Considering males, the additional purpose of ejaculating semen at the time of orgasm is managed by urethra
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 make up 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, which fill with blood during sexual arousal, causing the penis to become erect.

Female Reproductive system:

The female reproductive system is responsible for producing and delivering eggs, as well as providing a suitable environment for fertilization and pregnancy.



a) Ovaries: The ovaries are two almond-shaped glands located on either side of the uterus. They produce and release eggs, as well as 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 a 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 foetus. 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, and it also dilates during childbirth to allow the baby to pass through.
e) Vagina: This is tube like region which gets open in the outer region of the female body through vulva. This is the region through which the sperms move towards the egg for fertilisation. This is also called as the birth canal through which the child comes out.

8) Write Physiology of urine formation?

Ans.

1. **Filtration:** The first step in urine formation is glomerular filtration, which occurs in the renal corpuscle, composed of the glomerulus (a network of capillaries) and the Bowman's capsule. As blood flows through the glomerulus, the pressure forces water and small solutes like glucose, amino acids, electrolytes, and urea to pass through the filtration membrane into the Bowman's capsule, forming a fluid called filtrate. Larger molecules, such as proteins and blood cells, remain in the bloodstream as they are too large to pass through the filtration barrier. This step separates waste products and small useful molecules from the blood.

2. **Reabsorption:** After filtration, the filtrate enters the renal tubules, where the process of tubular reabsorption occurs. The kidneys selectively reclaim substances that are valuable for the body, such as glucose, amino acids, electrolytes (e.g., sodium and potassium), and water. These substances are absorbed back into the bloodstream via the walls of the proximal convoluted tubule, loop of Henle, distal convoluted tubule, and collecting duct. The extent of reabsorption depends on the body's current needs. For example, more water is reabsorbed if the body is dehydrated. This process ensures that the body retains necessary nutrients and maintains fluid and electrolyte balance.

3. **Secretion:** The next step is tubular secretion, which involves the active transport of additional waste products and excess substances from the blood into the renal tubules. This process occurs primarily in the distal convoluted tubule and collecting duct. Substances such as hydrogen ions (to regulate blood pH), potassium ions, ammonia, creatinine, drugs, and toxins that were not initially filtered in the glomerulus are secreted into the tubular fluid. Secretion helps the kidneys eliminate wastes and maintain proper chemical balance in the blood.

4. **Concentration of Urine:** The final step in urine formation is the concentration of urine, which occurs in the collecting ducts under the influence of the hormone antidiuretic hormone (ADH). In this step, water is reabsorbed from the filtrate back into the bloodstream, depending on the body's hydration level. When the body is dehydrated, ADH levels increase, causing more water to be reabsorbed, resulting in concentrated urine. Conversely, when the body is well-hydrated, less water is reabsorbed, producing dilute urine. The loop of Henle plays a critical role in establishing a concentration gradient in the kidney's medulla, which facilitates water reabsorption and helps concentrate the urine.

9) 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.

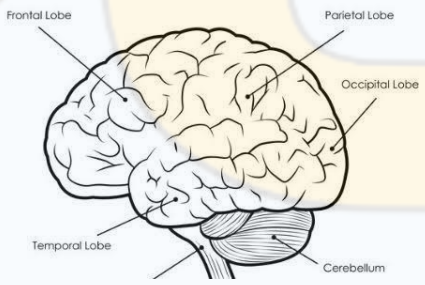
10) Write in detail about anatomy and physiology of human brain with a well labelled diagram?

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:

1. **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.
2. **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.
3. **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.
4. **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.

Extra Question:

1) Define Anatomy and physiology and write scope of Anatomy and physiology
2) Define tissue and classify tissue with their function?
3) Explain axial and appendicular skeleton?
4) Explain disorder of joints?
5) Define and classify nervous system?
6) Write anatomy and physiology of eye, ear, skin, tongue, nose?
7) Write anatomy and physiology of urinary system?
8) Explain spermatogenesis and oogenesis?

All The Best For Your Exam

Very Imp Note:

- Please Read All the chapters very carefully before Human Anatomy and Physiology Exam.
- These questions are only for the reference purpose.