

BOARD SOLVED QUESTION
WITH ANSWER

Year : 2023

Subject : Human Anatomy & Physiology

Subject Code : ER20-14T

Subject In-Charge : Arun Aniket Das



DO NOT WRITE ANYTHING ON YOUR QUESTION PAPER EXCEPT YOUR ROLL NUMBER.
QUESTION PAPER CONTAINING ANYTHING WOULD BE TREATED AS MALPRACTICE.
ANSWER THE QUESTIONS SERIALY AND CONTINUOUSLY

Full Mark -80

Subject: HUMAN ANATOMY & PHYSIOLOGY (Theory)

Time -3

1. Answer any six out of seven
- Define endocrine gland. Briefly discuss about the hormone secreted from the pituitary gland.
 - Describe the parts of Respiratory system & discuss the mechanism of respiration.
 - Define joint. Give the classification of joint with suitable example.
 - Classify tissue. Write a note on muscular tissue.
 - Describe about Physiology of Vision.
 - Describe the process of Urine formation.
 - Give a note on Cerebrum.
2. Answer any ten questions:
- Write a note on Parturition.
 - Describe Meninges & Ventricles of brain.
 - Describe about ECG & Cardiac output.
 - Briefly describe human tooth with suitable diagram.
 - Write a note on physiology of pain.
 - Write a short note on physiology of smell.
 - Write a note on RBC.
 - Discuss about different parts of tongue.
 - Differentiate between smooth and skeletal muscle.
 - Write down functions of antidiuretic hormone (ADH).
 - Write down the importance of blood group.
3. Define the following terms. (Within 20 words) (20x1)
- | | | | |
|---------------------|---------------|---------------------|--------------------------|
| a) Tidal volume. | b) TSH. | c) Angina pectoris. | d) Pulmonary circulation |
| e) Pinocytosis | f) Pacemaker | g) Acrosome | h) Facilitated diffusion |
| i) Active transport | j) Synapse | k) Vas deference | l) Endoplasmic reticular |
| m) Osteomalacia | n) Ptyalin | o) Lysosome | p) Sickle cell anemia |
| q) Golgi bodies | r) Centrosome | s) Pepsin | t) Tympanic membrane |

11) Define endocrine gland. Briefly discuss about the hormone secreted from the pituitary gland?

Ans) The pituitary gland, often referred to as 'master gland'.

It is a small, pea-sized gland, located at the base of the brain. Just below the hypothalamus.

The gland consist of two main parts i.e

1) Anterior pituitary (Adenohypophysis)

2) Posterior pituitary (Neurohypophysis)

This gland responsible for secreting different hormones.

Secretion and Function of the Pituitary Hormone.

Anterior Pituitary

1. Growth Hormone (GH)

• Function - Stimulate growth of bones and tissues, increase metabolism by increasing fat breakdown.

2. Thyroid Stimulating Hormone (TSH)

• Function - Stimulate the thyroid gland to produce thyroid hormone (T₃ and T₄). And regulate metabolism, immune response.

3. Adrenocorticotropic Hormone (ACTH)

• Function - Stimulate the adrenal cortex to produce glucocorticoids (mainly cortisol)

4. Follicle-Stimulating Hormone (FSH)

In female of - stimulate the growth of ovarian follicles.

In ♂ → stimulate spermatogenesis (sperm production)

5. Luteinizing Hormone (L.H)

Function - In ♂ → Triggers ovulation and stimulates the production of estrogen and progesterone.

In ♂ → stimulates the production of testosterone

Posterior Pituitary.

1. Antidiuretic Hormone (ADH) or Vasopressin.

Function! - Regulate water balance in the body by increasing water reabsorption in the kidney, and maintain blood pressure.

2. Oxytocin :-

Function :-

- Stimulate uterine contraction during child birth
- Promote milk ejection during breast feeding.
- Plays a role in social bonding and trust.

b) Describe the parts of respiratory system of Mammals
the mechanism of respiration?

*
→

Respiratory system is essential for gas exchanges
providing O_2 to the blood and removing CO_2 .
→ Its structure and function are crucial for maintaining
homeostasis and supporting cellular respiration.

Parts of Respiratory system:-

* Nasal cavity

→ Nose is the part of upper respiratory system tract
which is directly contact with outer environment.

→ Front part of nose form two Nostrils which is
internally connected with nasal cavity.

→ In side of nose form special type of cell which
called Goblet cell - this cells produce mucus.

* Pharynx

→ Pharynx is also upper respiratory tract. It take
 O_2 from the nose and send to the lungs.

→ Its normal length is 12 to 14 cm

→ It is divided in to 3 parts i.e

1) Nasal Pharynx

2) Oral Pharynx

3) Laryngeal Pharynx.

Larynx:

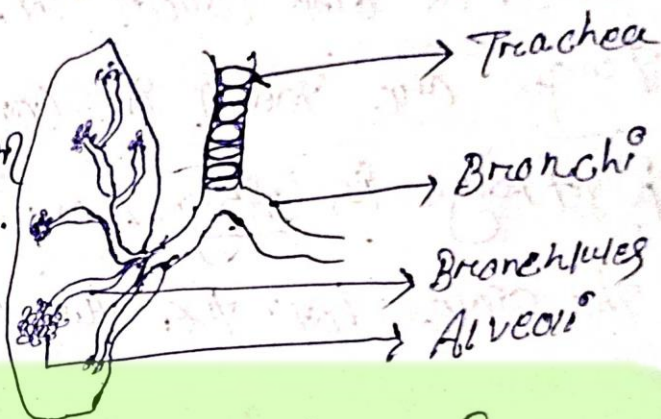
- Larynx is also called voice box. ~~It~~ It produces sound.
- Its main function is that it keeps out food from air way.
- Upper part of larynx present epiglottis.

Trachea:

- Upper part of trachea attached to larynx and lower part with lungs.

- Trachea is made up many 'C' shaped cartilage.

- Its normal length is 12cm



Bronchi:

- when trachea enters into lungs then it divides small branch which called Bronchi.

- 3 bronchi present in right lungs

- 2 bronchi present in left lungs.

Alveoli:

- Alveoli is a grape like structure. It is site of gas exchange.

- It tiny air sacs in your lungs that fine up the O₂ your breath in and keep your body going.

Lungs

→ Your lungs make up a large part of your respiratory system.

^{be} → you have two lungs, one on each side of your chest, which is also called the thorax.

→ Lungs are found in cone shaped, and weight of right lung is 25 gm and left lung is 57 gm.

→ The space betⁿ the two lungs is called mediastinum.

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c) Define joint. Give the classification of joint with example.

Ans:- Definition of joint

→ A joint (also called an articulation) is a connection between two or more bones in the body. Joints allow for movement and flexibility, while also providing structural support.

→ Depending on their structure and function, joints can be classified into different types.

* Classification of joints :-

→ Joints can be classified into two main ways :

① structurally

② functionally

① structurally :- This classification is based on the type of tissue that holds the bones together.

→ These are three main types.

① Fibrous joints :-

→ Characteristics :- Bones are connected by dense connective tissue with little or no movement.

Eg: • suture :- In the skull (e.g. between the frontal and parietal bones).

• syndesmoses :- (e.g. between the tibia and fibula).

• Gomphoses :- (e.g. teeth fixed into the sockets of the jaw).

b) cartilaginous joints:

→ Description: The bones are connected by cartilage, and there is limited movement.

e.g. • synchondrosis: (e.g. - The joint between the first rib and the sternum).

• symphysis: (e.g. The pubic symphysis or intervertebral discs).

c) synovial joints: - These are the most movable joints, characterized by a synovial cavity filled with synovial fluid, and the bones are connected by ligaments.
→ they allow free movement.

Example: -

→ Hinge joint (e.g. - elbow, knee)

→ Ball-and-socket joint (e.g. - shoulder, hip)

→ Pivot joint (e.g. - atlantoaxial joint, allowing head rotation)

→ Saddle joint (e.g. - Carpometacarpal joint of the thumb).

→ Condylloid joint (e.g. - wrist joint)

→ Gliding joint (e.g. - joints between the carpal bones in the wrist).

d) classify tissue write a note on muscular tissue

Ans → Tissues are groups of cells that work together to perform a specific function. In the human body, tissues are classified into four main types.

① Epithelial tissue

② Connective tissue

③ Muscular tissue

④ Nervous tissue

① Epithelial tissue :-

Function :- Epithelial tissue covers body surface, lines internal cavities and organs, and forms glands. It plays roles in protection, absorption, secretion, and sensation.

Eg :- skin epithelium, lining of the digestive tract, respiratory tract, and glands like sweat glands.

② connective tissue :-

Function :- connective tissue supports, binds, and protects supports, binds, and protects other tissues and organs. It also stores energy, helps in transport (blood), and provides structural support.

Eg :- Bone, cartilage, blood, adipose tissue (fat), and tendons.

③ Muscular tissue :-

Function :- muscular tissue is responsible for producing movement in the body by contraction. It is involved in both voluntary and involuntary movements.

Eg - skeletal muscle, cardiac muscle, and smooth muscle.

④ Nervous tissue :-

Function :- Nervous tissue transmits electrical signals to coordinate body activities. It controls responses to stimuli and integrates information.

Eg - Brain, spinal cord and nerves.

* Note on Muscular tissue :-

→ muscular tissue is specialized for contraction, enabling movement within the body. It consists of cells called muscle fibers that contract and relax. There are three types of muscular tissue.

① Skeletal muscle :-

• structure :- skeletal muscle fibers are long, cylindrical, and multinucleated. They have a striated appearance due to the regular arrangement of actin and myosin filaments.

• function :- skeletal muscles are under voluntary control and are responsible for movements such as walking, running, and lifting. They are attached to bones and play a major role in body movement and posture.

• Example :- Biceps, quadriceps, and diaphragm.

② Cardiac muscle :-

• structure :- cardiac muscle fibers are striated, but they are branched and usually have a single central nucleus. Cardiac muscle cells are connected by intercalated discs, which allow for synchronized contraction.

• function :- cardiac muscle is found in the heart and is responsible for pumping blood. It operates under involuntary control and has a unique ability to contract rhythmically without fatigue.

• Example :- Heart muscle.

③ Smooth muscle :-

• structure :- smooth muscle fibers are spindle-shaped, non-striated, and have a single nucleus. They are arranged in sheets or layers.

• function :- smooth muscle is involved in involuntary movements and controls the movement of internal organs. It is found in the walls of blood vessels, the digestive tract, the bladder, and other hollow organs.

• Example :- muscles of the intestines, blood vessel walls, and the bladder.

e) Describe about physiology of vision.

→ The physiology of vision involves the complex process by which light is captured by the eyes, converted into electrical signals, and interpreted by the brain to form images. This process can be broken down into several key steps:

1) Light Entry and Refraction:

- cornea: Light first enters the eye through the transparent cornea, which helps focus the the clear, dome-shaped outer layer. The cornea bends the incoming light to help focus it.

- Aqueous humor: After passing through the cornea, the light travels through the aqueous humor, a clear fluid that fills the space between the cornea and lens.

- pupil: The light then passes through the pupil, the adjustable hole in the center of the iris, which controls the amount of light entering the eye.

- Lens: The lens fine-tunes the focus by further bending the light. The lens can change shape to focus on objects at various distances.

*) Image projection onto retina:

- vitreous humor: After passing through the lens, light travels through the vitreous humor, a gel-like substance filling the eye.

- retina: The light is finally projected onto the retina, the light-sensitive tissue lining the back of the eye. The retina contains two types

① Rods: These are sensitive to low light and help in vision under dim conditions but cannot detect color.

② Cones: These work best in bright light and are responsible for color vision and sharp detail.

* Signal Transmission to the Brain :-

• optic nerve :- The electrical signals from the retina are sent through the optic nerve. Each eye sends signals from the retina to the opposite side of the brain.

F) Describe the process of urine formation :-

^{Ans:-} → urine formation occurs in three main stages:

① filtration ② reabsorption ③ secretion.

→ These processes take place primarily in the kidneys, which filter blood and regulate waste and fluid balance.

① Filtration :- Blood enters the kidneys through the renal arteries and flows into the nephron, the functional unit of the kidney. The first part of the nephron, the glomerulus, is a network of capillaries surrounded by the Bowman's capsule. Here, blood pressure forces water, small molecules like glucose, amino acids, and electrolytes, and waste products such as urea out of the blood and into the Bowman's capsule, forming glomerular filtrate.

→ Larger molecules, like protein and blood cells, are too big to pass through and remain in the blood.

2) Reabsorption:- The filtrate moves through the renal tubule, which consists of the proximal convoluted tubule (PCT), the loop of Henle, and the distal convoluted tubule (DCT).

→ In these segments, essential substances like water, glucose and electrolytes are reabsorbed back into the blood through the surrounding capillaries occurs in the PCT, while the loop of Henle and DCT play key roles in regulating water and salt balance.

→ This process helps the body retain vital substances and maintain homeostasis.

3) secretion:- After reabsorption, some waste products and excess ions such as hydrogen ions, potassium and certain drugs are secreted from the blood into the filtrate in the distal convoluted tubule and the collecting duct.

→ This further helps regulate the body's pH, electrolytes balance and eliminate specific waste products.

→ The final product, now called urine flows into the renal pelvis, then the ureter, and is stored in the bladder before being excreted through the urethra.

Q) Give a note on Cerebrum :-

Ans:- The cerebrum is the largest part of the brain and is responsible for many vital functions such as sensory perception, voluntary movement, reasoning, problem-solving, and higher cognitive processes. → It is divided into two hemispheres, the left and right, each controlling functions on the opposite side of the body. The cerebrum is also divided into four lobes:

① Frontal lobe :- Associated with higher cognitive functions like decision-making, problem-solving, planning, and motor control.

② Parietal lobe :- Involved in processing sensory information, such as touch, temperature, and pain.

③ Temporal lobe :- Responsible for processing auditory information and memory.

④ Occipital lobe :- primarily responsible for vision and visual processing.

→ The outer layer of the cerebrum is called the cerebral cortex, which is made up of gray matter and plays a key role in information processing. Beneath the cortex is white matter, which helps transmit signals between different brain areas.

Please write a note on parturition

1) → parturition is the process of giving birth, in which the fetus is expelled from the mother's uterus. It is a complex physiological event that involves several stages and mechanism to ensure the safe delivery of the baby.

Stages of parturition :-

1) stage-1: Dilation of the cervix :-

→ This stage begins with the onset of labor and ends when the cervix is fully dilated (10 cm). It is characterized by regular uterine contractions that help to soften, thin, and open the cervix, allowing the baby to move into the birth canal.

2) stage 2: Expulsion of the fetus :-

→ once the cervix is fully dilated, the second stage begins. The baby is pushed through the birth canal by strong uterine contractions, aided by maternal pushing efforts. This stage ends when the baby is born.

3) stage 3: Delivery of the placenta :-

→ after the baby is delivered, the third stage involves the expulsion of the placenta, or afterbirth. uterine contractions help detach the placenta from the uterine wall and expel it through the birth canal.

b) describe meninges & ventricles of brain

Ans:- The meninges and ventricles are critical components of the brain's anatomy that help protect and support the central nervous system.

Meninges :-

The meninges are three layers of protective tissue that surround the brain and spinal cord, providing cushioning and helping to regulate the flow of cerebrospinal fluid (CSF). The three layers, from outermost to innermost, are:

① Dura mater :- This is the thick, ~~to~~ tough, outermost layer. It consists of two sub-layers, one attached to the skull and the other forming a covering around the brain and spinal cord.

② Arachnoid mater :- The middle layer, which is a delicate, web-like structure. Between the arachnoid and the pia mater lies the subarachnoid space, which is filled with cerebrospinal fluid (CSF) that cushions the brain.

③ Pia mater :- The innermost layer, this thin membrane closely adheres to the surface of the brain and spinal cord, following their contours. It is rich in blood vessels, providing nutrients and oxygen to the neural tissue.

* Ventricles :- The ventricles are a system of interconnected cavities within the brain, filled with cerebrospinal fluid (CSF). which helps to cushion the brain, remove waste products, and circulate nutrients. The major ventricles include.

1) Lateral ventricles: These are the largest ventricles and are located in the cerebral hemispheres. They are connected to the third ventricle through the interventricular foramen.

2) Third ventricle :- This is a narrow, midline cavity located between the two halves of the diencephalon. It is connected to the fourth ventricle by the cerebral aqueduct.

3) Fourth ventricle :- Situated between the brainstem and the cerebellum, this ventricle narrows as it extends into the spinal cord as the central canal.

c) Describe about ECG & Cardiac output?

Ans:- ECG (Electrocardiogram):

→ An ECG is a medical test used to measure the electrical activity of the heart. It records the electrical impulses as they travel through the heart, helping to assess the heart's rhythm, the size and position of the heart muscle.

→ An ECG produces a graphical representation of the heart's electrical activity, typically showing several key waves.

1) P wave :- Represents atrial depolarization.

2) QRS complex :- Represents ventricular depolarization.

3) T wave :- Represents ventricular repolarization.

*1) cardiac output (CO):-

cardiac output is the volume of blood the heart pumps per minutes. It is a key indicator of heart function and overall circulatory efficiency.

cardiac output is determined by two main factors:

1) Heart Rate (HR): The number of heartbeats per minute

2) stroke volume (SV): The amount of blood pumped by the heart with each beat.

The formula for cardiac output is:

$$CO = HR \times SV$$

Normal cardiac output: A healthy adult typically has a cardiac output of about 4 to 8 liters per minute at rest.

d) Briefly describe human tooth with suitable diagram?

Ans: → A human tooth is a hard, calcified structure located in the mouth, primarily designed for breaking down food during chewing. Each tooth has different parts and is classified into various types based on their function. Here's a brief description of a tooth's structure.

*1) parts of a human tooth:-

1) Crown: The visible part of the tooth above the gum line, covered by enamel.

2) Enamel: The hardest substance in the human body. It covers the crown and protects the tooth from decay.

3) Dentin: A layer beneath the enamel that forms the bulk of the tooth. It's not as hard as enamel but is still quite strong.

4) pulp: The innermost part of the tooth containing nerves and blood vessels. It provides nutrients to the tooth and is responsible for sensation.

5) Cementum: A calcified substance covering the root of the tooth, helping anchor it to the jawbone.

6) Root: The part of the tooth embedded in the jawbone holding the tooth in place.

7) Gum line: The area where the tooth meets the gums.

• Types of teeth:-

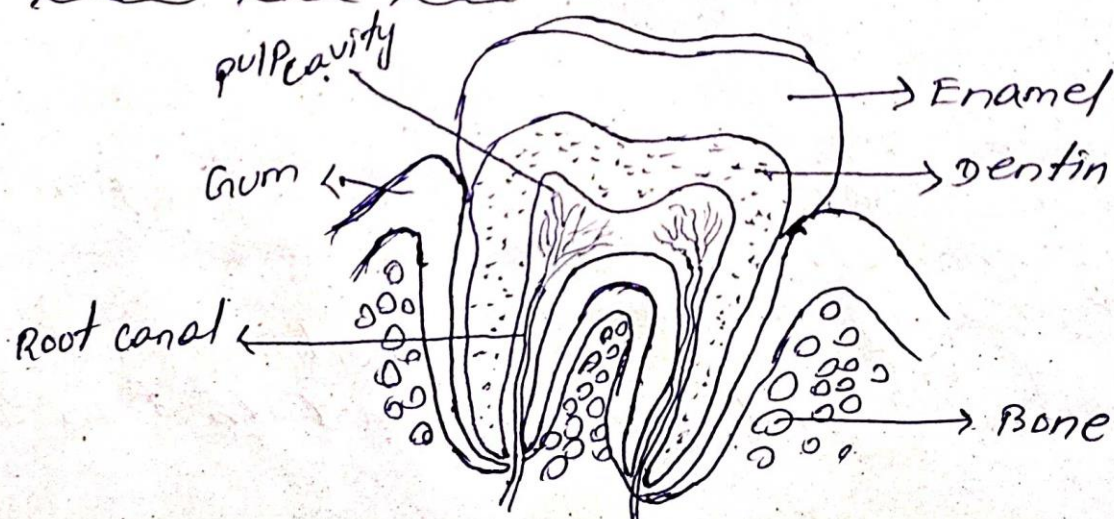
• Incisors:- sharp, flat teeth at the front, used for cutting food.

• Canines:- pointed teeth used for tearing food.

• Premolars: flat-topped teeth used for crushing and grinding food.

• Molars: larger, flatter teeth at the back used for grinding and chewing food.

8) Diagram of a tooth:-



e) write a note on physiology of pain?

Ans:- physiology of pain:-

→ pain is a complex, multifactorial experience that involves both sensory and emotional components.
→ It is the body's way of signaling potential or actual tissue damage.

→ The physiology of pain can be broken down into four main processes.

① Transduction. ② Transmission. ③ Modulation, ④ Perception.

1) Transduction

→ Transduction is the first step in the pain process, where noxious stimuli are converted into electrical signals. Specialized sensory receptors called nociceptors (located in the skin, muscles, joints, and internal organs) detect harmful stimuli.

2) Transmission:-

once nociceptors are activated, the electrical signals are transmitted via peripheral nerve fibers to the spinal cord and brain.

3) Modulation:-

→ pain perception can be influenced by various factors, including psychological and physiological mechanisms. Modulation refers to the processes by which the body alters the intensity of pain signals.

4) Perception:-

pain perception occurs when the brain interprets the pain signals transmitted from the body.

* Types of pain :-

→ Acute pain :- typically short-term and associated with injury or illness.

→ chronic pain :- persists for weeks, months, or even longer, often without an obvious cause.

→ Nociceptive pain :- Resulting from actual tissue injury or inflammation.

→ Neuropathic pain :- Arises from damage to the nervous system itself, such as in diabetic neuropathy or post-stroke pain.

Q Write a short note on physiology of smell?

Ans :- The physiology of smell, when a molecule enters the nasal cavity and binds to olfactory receptors located on sensory nerve cells in the olfactory epithelium.

→ These receptor cells are specialized to detect different odorants. Once bound, the receptors trigger electrical signals that are transmitted via the olfactory nerve to the olfactory bulb at the base of the brain.

→ From the olfactory bulb, the signals are processed and sent to various brain regions, including the olfactory cortex, which interprets the smell.

The brain also integrates the sensory input with emotional and memory centers, making smell closely linked to memory and emotion.

Q) Write a note on RBC.?

Ans:- RBC stands for Red Blood cell. RBCs, also known as erythrocytes, are the cells responsible for delivering oxygen to the body's tissue.

Functions of RBCs:

1) Oxygen transport:- RBCs carry oxygen from the lungs to the body's tissues.

2) Carbon dioxide removal:- RBCs carry carbon dioxide from the tissues back to the lungs for exhalation.

3) pH regulation:- RBCs help maintain the body's acid-base balance.

* Structure of RBCs:

1) Disk-shaped cells with no nucleus.

2) Flexible membrane allows for changing shape.

3) Contain hemoglobin, a protein that binds oxygen.

* Normal RBC count:

→ Men: 4.32-5.72 million cells per microliter.

→ Women: 3.90-5.03 million cells per microliter.

* Abnormal RBC count:

→ Anemia (low RBC count)

→ polycythemia (high RBC count)

1) The tongue is a fascinating organ that plays a crucial role in our daily lives, particularly in eating, speaking and tasting. The tongue is divided into different parts. ie

↳ **Tip (Apex):** The tip of the tongue is the most flexible part, responsible for articulating sounds and pronouncing words.

↳ **Front (Anterior):** The front part of the tongue is involved in articulation and is also responsible for tasting food.

↳ **Back (Posterior):** The back part of tongue is primarily involved in swallowing and tasting bitter flavors.

↳ **Sides (Lateral):** The sides of tongue help move food around the mouth for chewing and also aid in articulation.

↳ **Root (Racix):** The root of the tongue is the base of the tongue containing small bumps called papillae which house taste buds.

↳ **Dorsum** → It is top surface of the tongue.

↳ **Ventral Surface** → The ventral surface is the underside of the tongue which faces the floor of the mouth.

(1) Smooth muscle

- Non-striated, smooth, and spindle-shaped cells
- Involuntary movements, like digestion, heart pressure regulation and breathing.
- Controlled by the ANS and hormones.
- ~~are~~ ^{located} in walls of hollow organs

Skeletal muscle

- Striated, multinucleated and long fibres.
- Voluntary movements, like walking, talking and writing.
- Controlled by the SNS and conscious thought.
- ^{attached} Attached to bones helping move the skeleton.

(2) ADH (Antidiuretic Hormone)

- ADH also known as vasopressin, plays crucial role in regulating water balance in the body.
- water reabsorption → ADH stimulates in kidneys to reabsorb water back into blood stream, reducing urine production ^{over} ^{activity}.
- It also helps to regulate the concentration of electrolyte (minerals) and water in the body, maintain osmotic balance.
- It also maintain the blood pressure by constricting blood vessels and increasing water reabsorption.

(3) Importance of blood group

- In case of medical emergency situations, knowing a person's blood group can help providing appropriate treatment.
- In case of organ transplants, blood group compatibility is essential for successful organ transplant.
- Blood group can help identify genetic relationships and ancestry.
- Blood groups can aid in criminal investigation and paternity testing.
- Knowing the blood group of the mother and father can help identify potential risks and take necessary precautions.

- 8)
- a) Tidal Volume - CVT → The amount of air that moves in and out of the lungs during each breath. P.S. Small
 - b) TSH - Thyroid-Stimulating hormone → It stimulates the thyroid gland and produce Thyroid hormone, i.e. (T₃ and T₄).
 - c) Angina pectoris - Also called chest pain or discomfort that occurs when a part of your heart doesn't get enough blood and oxygen.
 - d) Pulmonary circulation - System of blood vessels that carries oxygenated blood from the heart to the lungs.
 - e) Pinocytosis → It is a process by which the cell takes in the fluids along with dissolved small molecules.
 - f) Pacemaker → A small battery-powered device that regulate the heart's rhythm and rate by sending electrical pulses.
 - g) Acrosome → A cap like organelle on the head of a sperm cells that contain enzymes that help the sperm penetrate an egg.
 - h) Facilitated diffusion - It is a passive transport process that move molecules or ions across a cell membrane.
 - i) Active diffusion - Active transport requires energy to move substance against a concentration gradient.
 - j) Synapse - Specialized Junction between two neurons or between a neuron and another cell, where nerve impulses are transferred.
 - k) Vas deference - A thin tube that carries the sperm out of the testes.
 - l) Endoplasmic reticulum → A network of cell membrane through which proteins and other molecules move.
 - m) Osteomalacia → Osteomalacia is softening of the bones occurs leads to vitamin D-deficiency.
 - n) Ptyalin → It is enzyme found in human saliva breakdown starch into simple sugar.

Q) Lysosome - It is a animal cell organelle which break down intracellular materials.

P) Sickle cell anemia - It is an inherited blood disorder that causes hard hard cells.

Q) Storage bodies - It is a stack of small flat sacs formed by membranes inside the cell's cytoplasm.

R) Centrosome - It is a cell organelle that plays a key role in cell division.

S) Pepsin - It is a digestive enzyme which is found in stomach.

T) Glycocalyx membrane - Also called as eardrum. It is a semipermeable membrane that separates outer ear from inner ear.

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