

# SHAMBHUNATH INSTITUTE OF PHARMACY

3<sup>rd</sup> Sessional Examination 2019-2020

D. Pharm. 1<sup>st</sup> year

Subject- Human Anatomy and physiology

Time: - 90 minutes.

Roll no. -

Max. Marks: 20

Subject code: 214110

**Note:** Attempt any **four** questions.

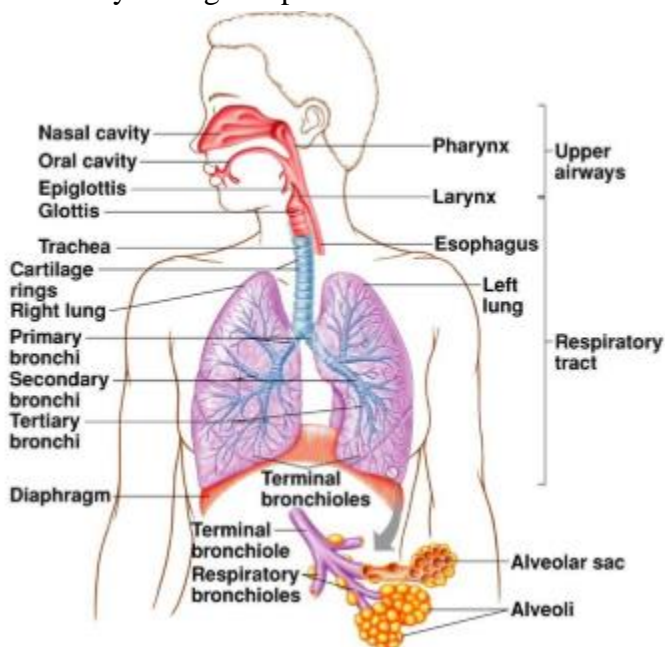
(4x5=20)

1. Discuss any **Two** of the followings-
  - a) Physiology of Respiration.
  - b) Diagram of Nephron and write the functions of Loop of Henle.
  - c) Physiology of Urine formation.
2. Give the diagram of Reflex Arc and properties of Reflex Action.
3. Discuss any **Two** of the followings-
  - a) Urine tract infection.
  - b) Renal failure.
  - c) Functions of stomach and small intestine.
4. Discuss the Anatomy and Physiology of Autonomic Nervous System.
5. Discuss the followings-
  - a) Classification of CNS.
  - b) Male reproductive system.

## SOLUTIONS

1. Discuss any **Two** of the followings-

- a) **Physiology of Respiration-** Respiration is defined as the exchange of gases between body tissues and the external environment. Supply of oxygen to the tissues and excretion of carbon dioxide occur only through respiration.

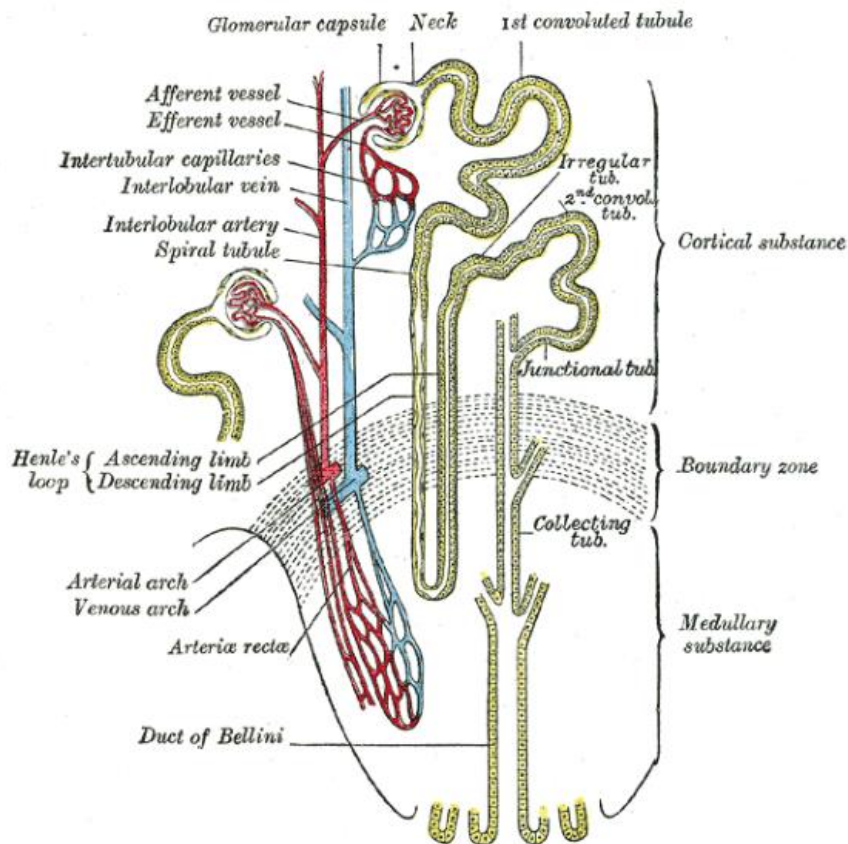


The Respiratory system consists of the following structures:

- 1) Nasal cavity
- 2) Pharynx
- 3) Larynx
- 4) Trachea
- 5) Bronchi
- 6) Alveoli
- 7) Lungs

Lungs are the principal organ of respiration. They are two in number lying one on each side of the chest cavity. The two lungs are separated in the middle by heart and other structures of mediastinum.

**b) Diagram of Nephron and write the functions of Loop of Henle-**



In the kidney, the **loop of Henle** or **Henle's loop**, **Henle loop**,<sup>[1]</sup> **nephron loop**<sup>[2]</sup> or its Latin counterpart **ansa nephroni**) is the portion of a nephron that leads from the proximal convoluted tubule to the distal convoluted tubule. Named after its discoverer, the German anatomist Friedrich Gustav Jakob Henle, the loop of Henle's main function is to create a concentration gradient in the medulla of the kidney.

By means of a countercurrent multiplier system, which uses electrolyte pumps, the loop of Henle creates an area of high urea concentration deep in the medulla, near the papillary duct in the collecting duct system. Water present in the filtrate in the papillary duct flows through aquaporin channels out of the duct, moving passively down its concentration gradient. This process reabsorbs water and creates a concentrated urine for excretion.

- c) **Physiology of Urine formation-** The kidneys filter unwanted substances from the blood and produce **urine** to excrete them. There are three main steps of **urine formation**: glomerular filtration, reabsorption, and secretion. These processes ensure that only waste and excess water are removed from the body.

#### **Glomerular Filtration-**

Glomerular filtration occurs as blood passes into the glomerulus producing a plasma-like filtrate (minus proteins) that gets captured by the Bowman's (glomerular) capsule and funneled into the renal tubule. This filtrate produced then becomes highly modified along its route through the nephron by the following processes, finally producing urine at the end of the collecting duct.

#### **Tubular Reabsorption-**

As the filtrate travels along the length of the nephron, the cells lining the tubule selectively, and often actively, take substances from the filtrate and move them out of the tubule into the blood. Recall that the glomerulus is simply a filter and anything suspended in the plasma that can fit through the holes in the filtration membrane can end up in the filtrate. This includes very physiologically important molecules such as water, sodium, chloride, and bicarbonate (along with many others) as well as molecules that the digestive system used a lot of energy to absorb, such as glucose and amino acids. These molecules would be lost in the urine if not reclaimed by the tubule cells. These cells are so efficient that they can reclaim all of the glucose and amino acids and up to 99% of the water and important ions lost due to glomerular filtration. The filtrate that is not reabsorbed becomes urine at the base of the collecting duct.

#### **Tubular Secretion-**

Tubular secretion occurs mostly in the PCT and DCT where unfiltered substances are moved from the peritubular capillary into the lumen of the tubule. Secretion usually removes substances from the blood that are too large to be filtered (ex: antibiotics, toxins) or those that are in excess in the blood (ex: H<sup>+</sup>, K<sup>+</sup>). These substances secreted into the tubule are destined to leave the body as components of urine.

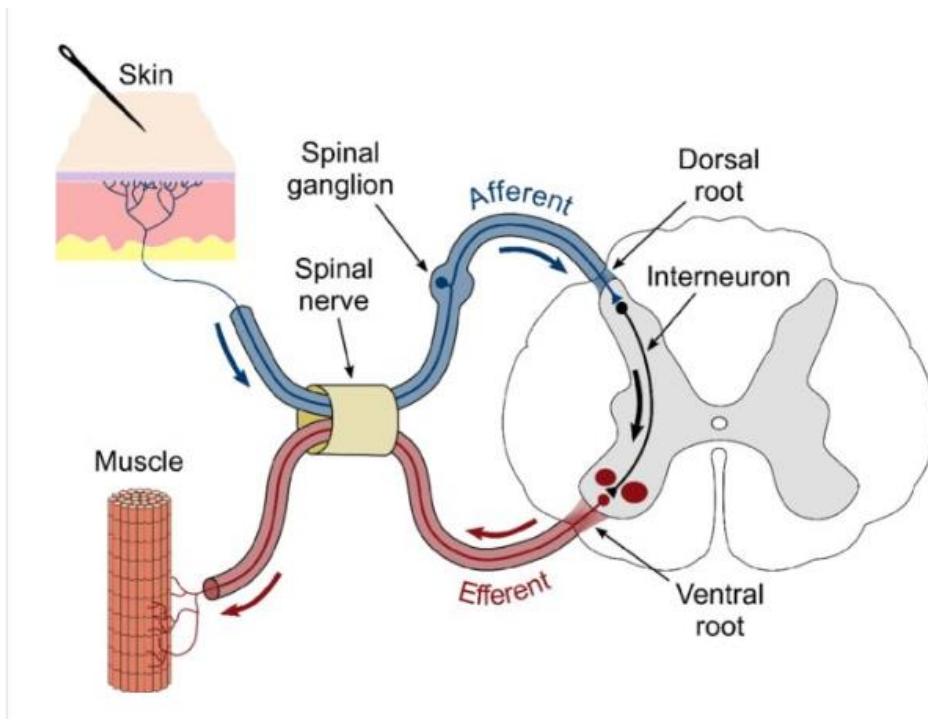
## **2. Give the diagram of Reflex Arc and properties of Reflex Action.**

A **reflex arc** is a neural pathway that controls a reflex. In vertebrates, most sensory neurons do not pass directly into the brain, but synapse in the spinal cord. This allows for faster reflex actions to occur by activating spinal motor neurons without the delay of routing signals through the brain. The brain will receive the sensory input while the reflex is being carried out and the analysis of the signal takes place after the reflex action.

There are two types: autonomic reflex arc (affecting inner organs) and somatic reflex arc (affecting muscles). Autonomic reflexes sometimes involve the spinal cord and some somatic reflexes are mediated more by the brain than the spinal cord.<sup>[1]</sup>

During a somatic reflex, nerve signals travel along the following pathway:

1. *Somatic receptors* in the skin, muscles and tendons
2. *Afferent nerve fibers* carry signals from the somatic receptors to the posterior horn of the spinal cord or to the brainstem
3. An *integrating center*, the point at which the neurons that compose the gray matter of the spinal cord or brainstem synapse
4. *Efferent nerve fibers* carry motor nerve signals from the anterior horn to the muscles
5. *Effector* muscle innervated by the efferent nerve fiber carries out the response.



A reflex arc, then, is the pathway followed by nerves which (a.) carry sensory information from the receptor to the spinal cord, and then (b.) carry the response generated by the spinal cord to effector organs during a reflex action. The pathway taken by the nerve impulse to accomplish a reflex action is called the reflex arc.

**3. Discuss any Two of the followings-**  
**a) Urine tract infection-**

A **urinary tract infection** (UTI) is an **infection** from microbes. These are organisms that are too small to be seen without a microscope. Most UTIs are caused by bacteria, but some are caused by fungi and in rare cases by viruses.

Symptoms of a UTI depend on what part of the urinary tract is infected.

Lower tract UTIs affect the urethra and bladder. Symptoms of a lower tract UTI include:

- burning with urination
- increased frequency of urination without passing much urine
- increased urgency of urination
- bloody urine
- cloudy urine
- urine that looks like cola or tea
- urine that has a strong odor
- pelvic pain in women
- rectal pain in men

Upper tract UTIs affect the kidneys. These can be potentially life threatening if bacteria move from the infected kidney into the blood. This condition, called **urosepsis**, can cause dangerously low blood pressure, shock, and death.

Symptoms of an upper tract UTI include:

- pain and tenderness in the upper back and sides
- chills
- fever
- nausea
- vomiting

**b) Renal failure-** Kidney (renal) failure is when kidneys don't work as well as they should. The term "kidney failure" covers a lot of problems. These problems can result in kidney failure: Your kidney doesn't get enough blood to filter. Kidney failure occurs when your kidneys lose the ability to sufficiently filter waste from your blood. Many factors can interfere with your kidney health and function, such as:

- toxic exposure to environmental pollutants or certain medications
- certain acute and chronic diseases
- severe dehydration
- kidney trauma

**Symptoms of kidney failure-**

Usually someone with kidney failure will have a few symptoms of the disease. Sometimes no symptoms are present. Possible symptoms include:

- a reduced amount of urine
- swelling of your legs, ankles, and feet from retention of fluids caused by the failure of the kidneys to eliminate water waste
- unexplained shortness of breath
- excessive drowsiness or fatigue
- persistent nausea
- confusion
- pain or pressure in your chest
- seizures
- coma

**c) Functions of stomach and small intestine-** The Digestive system comprises of gastrointestinal tract with various glands attached to it. The tract starts from the mouth and ends at the anus. It is subdivided in to:

- 1) Mouth
- 2) Pharynx
- 3) Esophagus
- 4) Stomach
- 5) Small Intestine
- 6) Large Intestine
- 7) Rectum
- 8) Anal Canal
- 9) Anus

The stomach secretes acid and enzymes that digest food. Ridges of muscle tissue called rugae line the stomach. The stomach muscles contract periodically, churning food to enhance digestion. The

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The small intestine or small bowel is an organ in the gastrointestinal tract where most of the end absorption of nutrients and minerals from food takes place. It lies between the stomach and large intestine, and receives bile and pancreatic juice through the pancreatic duct to aid in digestion.

**4. Discuss the Anatomy and Physiology of Autonomic Nervous System-**

**Anatomy and Physiology of Autonomic Nervous System-** The autonomic nervous system (ANS) is the part of the nervous system that regulates involuntary functions. Examples are the heartbeat, the digestive functions of the intestines, control of respiration, and secretion by glands.

Sympathetic nervous system - Preganglionic fibres originate from cell bodies in the grey matter of the lateral horn of the spinal cord between the first thoracic segment down to the second or third lumbar segment (T1 to L2/3). The so-called ‘thoraco-lumbar’ outflow.<sup>2</sup> These preganglionic fibres synapse with the post-ganglionic neurones in the ganglia of the sympathetic chain (Fig. 1). The ganglia form the sympathetic chain arranged as two paravertebral chains. The post-ganglionic fibres leave the ganglia and join the spinal nerves or visceral nerves to innervate the target organs.

The paravertebral sympathetic chain is divided into four parts.

A cervical part: consists of three ganglia (superior, middle, and inferior) supplying the head, neck, and thorax. The inferior cervical ganglion fuses with the first thoracic ganglion to form the stellate ganglion.

A thoracic part: consists of series of ganglia from each thoracic segment. T1–T5 branches supply the aortic, cardiac, and pulmonary plexus.

Lumbar part: situated in front of the lumbar vertebral column as the prevertebral ganglia. Branches from the lumbar part form the coeliac plexus.

Pelvic part: lies in front of the sacrum and consists of the sacral ganglia

Parasympathetic nervous system-

Preganglionic fibres arise from the CNS from both the cranial (from brain stem) and sacral nerves called ‘craniosacral’ outflow. Cranial parasympathetic fibres arise from brainstem motor nuclei of the 3rd, 7th, 9th, and 10th cranial nerves. Sacral outflow arises from the second, third, and fourth sacral segments of the spinal cord. Fibres emerge from ventral rami of nerves S2–4 and form the pelvic splanchnic nerves.

**The physiology of the ANS**

Neurotransmitters and receptors are integral to the automatic functioning of the ANS. Receptors mediate actions of the neurotransmitters involved in the ANS by activation of a second messenger, or by a change in ion channel permeability.

**5. Discuss the followings-**

a) Classification of CNS-

CNS	Brain	Prosencephalon	Telencephalon	Rhinencephalon, Amygdala, Hippocampus, Neocortex, Basal ganglia, Lateral ventricles
			Diencephalon	Epithalamus, Thalamus, Hypothalamus, Subthalamus, Pituitary gland, Pineal gland, Third ventricle

		Mesencephalon	Tectum, Cerebral peduncle, Pretectum, Mesencephalic duct	
	Brain stem	Rhombencephalon	Metencephalon	Pons, Cerebellum
			Myelencephalon	Medulla oblongata
Spinal cord				

b) Male reproductive system- Reproductive system is the system which involved in the production of further new members of the same species and this process of production of new offspring is known as reproduction.

**Male Reproductive System-**

The organ of male reproductive system can be classified into:

- 1) External genital organ: Penis containing the urethra
- 2) Internal genital organ: Testes

Vas deferens  
Seminal vesicles  
Prostate gland

