

# VISWASS SCHOOL & COLLEGE OF NURSING

## GNM 1<sup>ST</sup> YEAR

### ANATOMY AND PHYSIOLOGY

#### UNIT-6

#### THE RESPIRATORY SYSTEM

#### SHORT QUESTIONS AND ANSWERS

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#### 1) Write down the Structure and Function of Nose and Nasal cavity.(5)

##### Structure and Function of nose & nasal cavity:

The nostrils are the opening into the nose and are the main route of air entry into the respiratory system.

- It provides an entrance for air in which air is filtered by hairs inside the nostrils.
- It has two portions : the external and internal.
  - External nares (choanae) - opening to exterior
  - Internal nares opening to pharynx
    - The external portion is supported by a framework of bone and cartilage covered with skin and lined with mucous membrane.
    - The internal portion is a large cavity in the skull, merging with the external nose anteriorly and communicating with the throat posteriorly.

Nasal cavity: It is a large space in the anterior aspect of the skull that lies interior to the nasal bone and superior to the nasal cavity. It is pyramidal in shape .

Anteriorly ,the nasal cavity merges with the external nose, posteriorly it communicate with the pharynx through two openings called the internal nares or conchae.

##### Structure forming nasal cavity:

**1.Roof:** Formed by cribriform plate of ethmoid , sphenoid ,frontal and nasal bones.

2.Floor: Formed by roof of mouth consists of hard palate in front and soft palate behind.

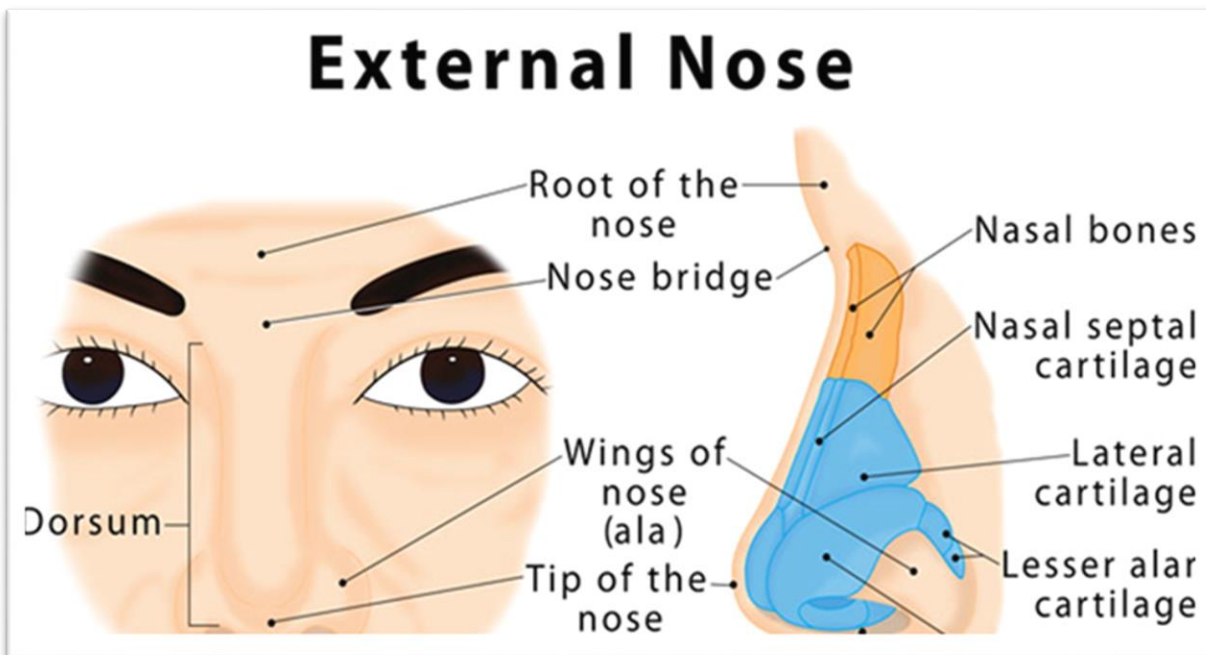
3.Medial wall: Formed by nasal septum.

4.Lateral wall : Formed by hyaline cartilage, ethmoid, maxilla, inferior conchae.

5.Posterior wall: Formed by the posterior wall of Pharynx.

### Functions of Nose:

- Breathing
- Air conditioning of inspired air
- Protection of lower airway
- Olfaction
- Nasal resistance
- Vocal resonance
- Nasal reflexes
- Ventilation and Drainage of PNS



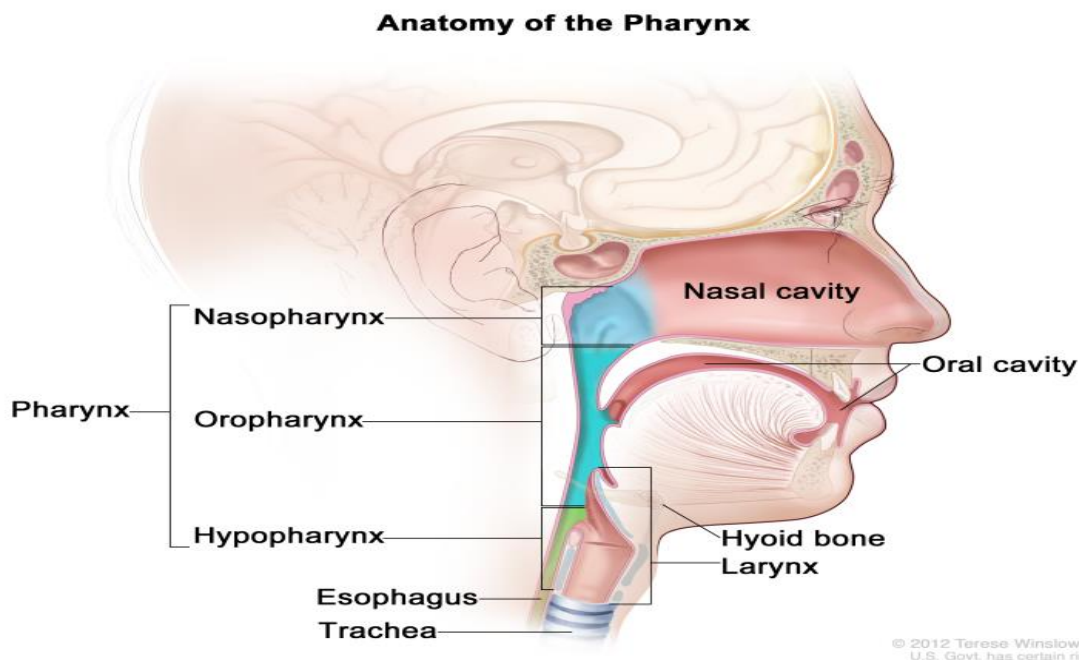
2) Write the Structure and Function of Pharynx.(5)

**Structure and function of pharynx**

- The **pharynx** is a funnel-shaped tube about 13 cm long that starts at the internal nares and extends to the level of the cricoid cartilage, the most inferior cartilage of the larynx.
- The pharynx lies just posterior to the nasal and oral cavities, superior to the larynx, and anterior to the cervical vertebrae.
- It is a common passageway for air and food.
- Its wall is composed of skeletal muscles and is lined with a mucous membrane.
- The muscles of the entire pharynx are arranged in two layers, an outer circular layer and an inner longitudinal layer.
- Relaxed skeletal muscles help keep the pharynx patent and contraction of the skeletal muscles assists in deglutition (swallowing).

#### Division of Pharynx

- ✓ Nasopharynx - uppermost portion
- ✓ Oropharynx - middle portion
- ✓ Laryngopharynx - lowermost portion



#### Nasopharynx

- The nasopharynx remains open all the time. On each lateral wall is the pharyngeal opening of the Eustachian (auditory) tube.
- The nasopharynx functions as an airway in the respiratory system.

- Also contained within the nasopharynx are the adenoids, or pharyngeal tonsils.

## Oropharynx

- The oropharynx is the middle portion of the pharynx, working with both the respiratory and digestive systems.
- It opens anteriorly in the mouth and extends from the soft palate to the hyoid. In each lateral wall is a palatine tonsil; also in this region are the sublingual tonsils, which are under the tongue.
- The oropharynx functions as an airway and as part of the alimentary canal

## Laryngopharynx

- The laryngopharynx is the posteriormost inferior region of the pharynx, reaching from the hyoid to the lower border of the cricoid cartilage; it's the place where the respiratory and digestive systems diverge.
- The rear of the laryngopharynx becomes the esophagus and continues into the digestive tract, while the front of the laryngopharynx merges with the entrance of the larynx.
- The epiglottis, a structure in the laryngeal skeleton, helps direct food toward the esophagus, preventing food and liquids (and coins) from entering the trachea.

## Pharyngeal Blood Supply

- Arterial Supply: Through external carotid artery branches, namely the ascending pharyngeal artery, lingual artery, facial artery and maxillary artery.
- Venous Drainage: Performed by the venous pharyngeal plexus that drains into the IJV (internal jugular vein).

## Functions of Pharynx

- The pharynx has a double function. It is a key part of both the digestive system and the respiratory system
- It allow the air that has been inhaled through the nasal cavity all the way down to the lungs, through the larynx and the windpipe.
- equalize the air pressure in the eardrum.
- When it comes to the digestive system, the pharynx helps the ingested food to go in

- It helps to stop air from entering the digestive system. pharynx helps the ingested food to go into the esophagus through the lumen.
- pharynx also plays an important role in speech, always in conjunction with other speech muscles and organs.

### 3) Structure and function of Larynx.(5)

#### Larynx:

- The Larynx, or Voice box, links the laryngopharynx and the trachea.
- It lies in front of the laryngopharynx and the 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> Cervical vertebrae.
- Until puberty there is little difference in the size of the larynx between the sexes.
- It grows larger in the male, which explains the prominence of the `Adam`s apple` and the generally deeper voice.

#### Structure associated with Larynx:

Superiorly-The hyoid bone and the root of the tongue.

Inferiorly-It is continuous with the Trachea.

Anteriorly-The muscles attached to the hyoid bone and the muscles of the neck.

Posteriorly-The laryngopharynx and 3<sup>rd</sup>-6<sup>th</sup> cervical vertebrae.

Laterally-The lobes of the thyroid gland.

#### Blood and Nerve Supply

- Blood is supplied to the larynx by the superior and inferior laryngeal arteries and drained by the thyroid veins, which join the internal jugular vein.
- Nerve supply is from the superior laryngeal and recurrent laryngeal nerves, which are branches of the vagus nerve.

#### Functions:

- ❖ Production of sound

Sound has the properties of pitch, volume and resonance.

- Pitch of the voice depends on the lengths and tightness of the cords. the tightness of the cords is controlled by the muscle to which they attach. Shorter cords produce higher-pitched sounds.
- Volume of the voice depends on the force with which the cord vibrate. The greater the force of expired air, the more strongly the cords vibrate and the louder the sound produce.
- Resonance, or tone, is dependent on the shape of the mouth, the position of the tongue and the lips, the facial muscles and the air in the paranasal sinuses.

❖ Speech

- This is produced when the sound produced by the vocal cords are amplified and manipulated by the tongue, cheeks and lips.

❖ Protection of the lower respiratory tract

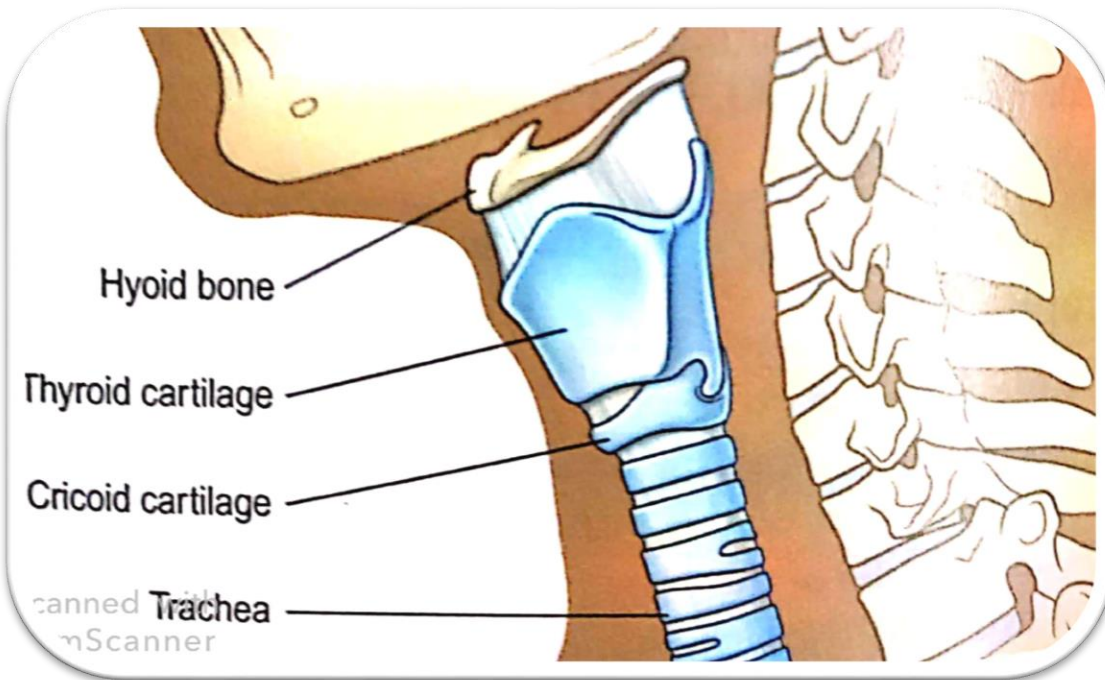
- During swallowing the larynx moves upwards , blocking the opening into it from the pharynx.
- In addition, the hinged epiglottis (a depression just behind the root of the tongue between the folds in the throat) closes over the larynx. This ensures that food passes into the oesophagus and not into the trachea.

❖ Passageway for air

- The larynx links the pharynx above with the trachea below.

❖ Humidifying, filtering and warming

- This process continue as inspired air travels through the larynx



**4) Write down the structure and function of Trachea.(5)**

**Trachea**

- The trachea, or windpipe, is a continuation of the larynx and extends downward as to about the level of the 5<sup>th</sup> thoracic vertebra, where it divides at the carina into the right and left primary bronchi.
- The carina is rich in sensory nerve endings, and inhaled particles, irritant gases or physical contact.
- The trachea is approximately 10-11 cm long and lies mainly in the median plane in front of the oesophagus.

Structures associated with the trachea:

Superiorly-The larynx

Inferiorly-The left and right primary Bronchi

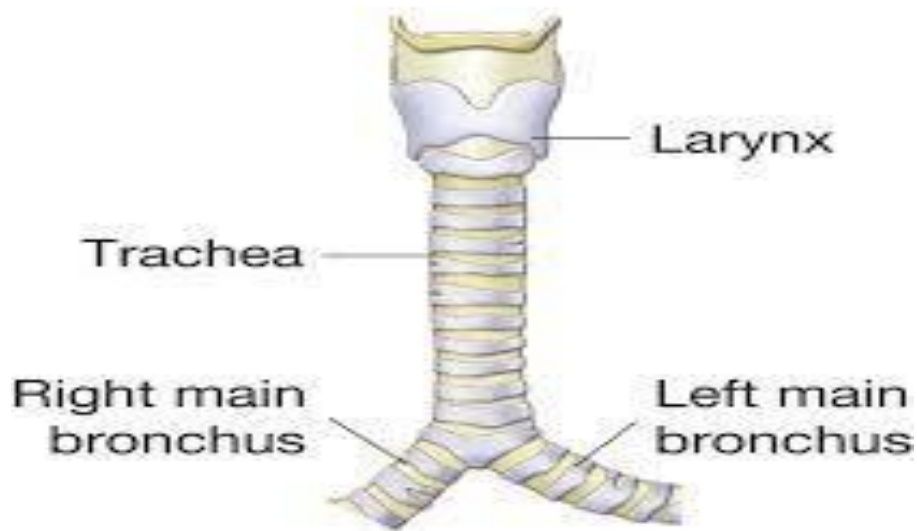
Anteriorly-Upper part, the isthmus of the thyroid gland; Lower part, the arch of the aorta and the sternum.

Posteriorly-The oesophagus, which separates the trachea from the vertebral column.

Laterally-The lungs and the lobes of the thyroid glands.

### Blood and nerve supply,lymph drainage

- Arterial blood supply is mainly by the inferior thyroid and bronchial arteries, and venous return is by the inferior thyroid veins into the brachiocephalic veins.
- Parasympathetic nerve supply is by the recurrent laryngeal nerves and other branches of the vagus nerves. sympathetic supply is by nerves from the sympathetic ganglia.
- Lymph from the respiratory passages drains through lymph node situated round the trachea and in the carina, the area where it divides into two bronchi.



### Function of trachea:

- ❖ Support & patency
  - Tracheal cartilages hold the trachea permanently open, but the soft tissue bands in between the cartilages allow flexibility so that the head and neck can move freely without obstructing or kinking the trachea.
  - The absence of cartilage posteriorly permits the oesophagus to expand comfortably during swallowing.
- ❖ Mucocilliary escalator



- This is the synchronous and regular beating of the cilia of the mucus membrane lining that wafts mucus with adherent particles upwards towards the larynx, where it is either swallowed or coughed up.
- ❖ Cough reflex
- Nerve endings in the larynx, trachea and bronchi are sensitive to irritation, which generates nerve impulses conducted by the vagus nerves to the respiratory centre in the brain stem.
- ❖ Warming, Humidifying and filtering
- This continues as in the nose, although air is normally saturated and at body temperature when it reaches the trachea.

### **5) List out the various abnormal respiration. (5 mark)**

#### Apnea

- Absence of breathing. (Ap-knee-a)
- No movement of muscles of respiration.
- No air flow into or out from the lungs.
- Gaseous exchange and cellular respiration is not affected.
- Apnea can be achieved - Voluntarily (Breath holding), Mechanically (Strangulation/Choking), from neurological trauma.
- A person can not sustain voluntary apnea for more than 1-2 min.

#### Dyspnea

- breathing difficulty
- Paroxysmal nocturnal dyspnea - attacks of severe shortness of breath that wakes a person from sleep, such that they have to sit up to catch their breath - common in patients with congestive heart failure.

#### Hyperventilation

- "Over" ventilation - ventilation in excess of the body's need for CO<sub>2</sub> elimination. Caused by rapid deep breathing.
- Characterized by rapid deep breathing.

- Other causes include:
  - Anxiety or pain
  - Excessive use of aspirin
  - Obstructive disorders-COPD, asthma, & pulmonary embolism
  - Infections-pneumonia
  - Congestive heart failure

### Hypoventilation

- Hypoventilation. Decreased rate (A) or depth (B), or some combination of both.
- "Under" ventilation - ventilation that is less than needed for CO<sub>2</sub> elimination, and inadequate to maintain normal PaCO<sub>2</sub>. Results in respiratory acidosis.

### Tachypnea

- Increased respiratory rate. > 20 b/min. Characterized by rapid shallow breathing.
- It is seen in conditions like Fever, Pneumonia, Respiratory insufficiency,

### Bradypnea

- Decreased respiratory rate. < 12 b/min. Characterized by slow, shallow breathing.
- The rate at condition bradypnea is diagnosed depend on the age:
  - 0-1 year- <30 breaths/min
  - 1-3 year - < 25 breaths/min
  - 3-12 year -< 20 breaths/min
  - 12 & above - <12 breaths/min
- It is seen in secondary condition like: Diabetic coma, Respiratory depression, Increase intra cranial pressure.

### Kussmaul breathing

- Rapid, gasping and very deep type of labored breathing.
- Commonly called as Air hunger.
- It is associated with severe metabolic acidosis, particularly diabetic ketoacidosis.

## Cheyne stokes breathing

- Also called as Periodic breathing.
- Characterized by alternative periods of tachypnea and apnea.
- Conditions seen are:
  - Stroke
  - Traumatic brain injury
  - Brain tumors
  - Heart failure
  - Toxic metabolic encephalopathy

## Biot`s breathing

- Also called as “cluster breathing” or “ataxic breathing”.
- It is periodic in nature and is characterized by unpredictable irregularities in breathing that alternates with periods of apnea.
- It is a group of quick, shallow inspiration followed by regular or irregular periods of apnea.
- Causes includes:
  - Lesion to brain stem
  - Cervical spine injury

## 6) Write short notes on paranasal sinuses.(5)

**Paranasal sinuses** are a group of four paired air-filled spaces that surround the nasal cavity.

### 1. Frontal Sinuses:

- These are the most **superior** in location, found under the forehead. The frontal sinuses are variable in size, but always triangular-shaped.

- They drain into the nasal cavity via the **frontonasal duct**, which opens out at the hiatus semilunaris on the lateral wall.

## 2.Sphenoid Sinuses:

- The sphenoid sinuses also lie relatively superiorly, at the level of the sphenoidal recess.
- They are found more **posteriorly**, and are related superiorly and laterally to the **cranial cavity**.
- The sphenoid sinuses drain out onto the roof of the nasal cavity.
- The relationships of this sinus are of clinical importance – the **pituitary gland** can be surgically accessed via passing through the nasal roof, into the sphenoid sinus and through the sphenoid bone.

## 3.Ethmoidal Sinuses:

There are three ethmoidal sinuses; anterior, middle and posterior. They empty into the nasal cavity at different places:

- Anterior – Hiatus semilunaris
- Middle – Ethmoid bulla
- Posterior – Superior meatus

## 4.Maxillary Sinuses:

- The largest of the sinuses. It is located laterally and slightly **inferiorly** to the nasal cavities.
- It drains into the nasal cavity at the **hiatus semilunaris**, underneath the **frontal sinus** opening.
- This is a potential pathway for spread of infection – fluid draining from the frontal sinus can enter the maxillary sinus.

## Functions

- They are centered on the nasal cavity and have various functions, including
- lightening the weight of the head,
- humidifying and heating inhaled air, increasing the resonance of speech,

- and serving as a crumple zone to protect vital structures in the event of facial trauma
- Communicate with the nasal cavity by ducts.

# Paranasal Sinuses

