

Question Bank Respiratory System

1. Name the following :

- (i) The condition in which the oxygen supply to the respiratory system is cut off.
- (ii) The membrane enveloping the lungs.
- (iii) The part of the tidal air that effectively takes part in the gaseous exchange in the lungs.
- (iv) Sum total of tidal volume, inspiratory reserve volume and expiratory reserve volume.
- (v) A muscular sheet of tissue extending across the body cavity between thorax and abdomen.

Ans. (i) Asphyxiation (ii) Pleura (iii) Alveolar air
(iv) Vital capacity of lung (v) Diaphragm.

2. Fill in the blanks :

- (i) _____ of the lungs is the volume of air that can be taken in and expelled by maximum inspiration and expiration. (vital capacity / total lung capacity / tidal volume)
- (ii) The respiratory centre is located in the _____. (cerebrum / cerebellum / medulla oblongata)
- (iii) Nasal passage is lined by _____. (flagella/ciliated epithelium/cilia)
- (iv) Exchange of air takes place between capillaries and _____. (alveoli / bronchi / trachea)
- (v) Respiration is a _____ process. (physical / chemical / biochemical)

Ans. (i) Vital capacity (ii) Medulla oblongata
(iii) Ciliated epithelium (iv) Alveoli (v) Biochemical.

3. Mention, if the following statements are true or false. If false, rewrite the sentence by changing only the words printed in bold face.

- (i) Total alveolar surface in adult man is **100 m²**.
- (ii) Oxygen combines with the **globin** part of haemoglobin.
- (iii) Cartilaginous rings around the trachea prevent its collapse.
- (iv) **Tidal volume** is the volume of air breathed in or out with maximum effort.
- (v) **Residual volume** is the volume of air left in the lungs after the deepest expiration.

Ans. (i) True (ii) False (Haemo) (iii) True
(iv) False (Vital capacity) (v) True

4. Which are the three activities involved in the internal respiration?

Ans. (i) Oxygen uptake by tissue cells.
(ii) Oxidation of food material with the help of oxidising enzymes inside tissues.
(iii) Elimination of CO₂ from the tissues.

5. What are the steps involved in pulmonary respiration?

Ans. (i) Pulmonary respiration requires breathing movements which includes inspiration and expiration.
(ii) Inspired air is exchanged over the surface of alveoli where O₂ is taken in and CO₂ given out.
(iii) The oxygen taken in is transported to the tissues and carbon-dioxide laden air is expired out.

6. What is the requirement of highly efficient surface for gas exchange?

Ans. Efficient respiratory surface should have large surface area. It should be thin, easily permeable and should be highly vascular.

7. What are the functions of
- (i) Ribs
 - (ii) Diaphragm
 - (iii) Epiglottis
 - (iv) Vocal cords
 - (v) Ciliated epithelium lining the respiratory tract
 - (vi) Mitochondria

Ans. (i) Ribs :

- (a) Form a protective bony cage around the organs in the thoracic cavity.
- (b) They aid in the process of inspiration and expiration.

(ii) Diaphragm :

- (a) A sheet of muscular tissue separating the thorax and abdomen.
- (b) The contraction and relaxation of diaphragm causes the change in thoracic cavity volume which results in breathing in and breathing out movements.

(iii) Epiglottis :

- (a) A muscular flap which guards the opening of the windpipe. At the time of swallowing food, the epiglottis closes the tracheal opening, thereby preventing the food from entering the windpipe.
- (b) Foodpipe is partially closed by epiglottis when not in use. Choking and coughing are reflex actions which tend to remove foreign particles that may have accidentally entered the trachea.

(iv) Vocal cords : Air expelled between the vocal cords vibrates them, producing sound. By adjusting the distance between the two cords and their tension by the means of attached muscles, a range of sounds is produced.

(v) Ciliated epithelium lining the respiratory tract : During life time cilia are constantly in motion driving any fluid (mucus) that is on them and also any particles that may have come in with the air towards the mouth.

(vi) **Mitochondria** : Releases of energy from food in the form of ATP acting as seat of cellular respiration and storing energy.

8. Differentiate between the following pairs on the basis of the aspect given in the brackets.

(i) Catabolism and anabolism

(ii) Pleural fluid and pericardial fluid

(iii) Aerobic and anaerobic respiration (end products of the process)

(iv) Respiration and photosynthesis (gas released)

(v) Aerobic and anaerobic respiration (end products)

Ans. (i) **Catabolism** : Biochemical reactions involved in the breakdown of complex protoplasmic molecules to simpler ones are collectively called catabolism.

Anabolism : Biochemical reactions involved in the synthesis of complex protoplasmic molecules from simple ones are collectively called anabolism.

(ii) Pleural fluid lubricates the lung, while pericardial fluid lubricates the heart.

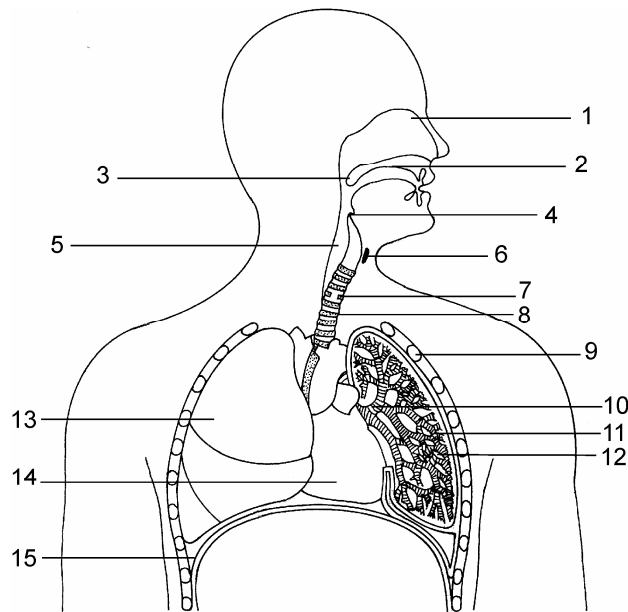
(iii) Aerobic respiration involves complete breakdown of glucose in presence of air, liberating large amount of energy (38 ATP). Anaerobic respiration involves incomplete breakdown of glucose in absence of air, liberating only 2 molecules of ATP.

(iv) CO₂ is released in respiration. O₂ (oxygen) is released in photosynthesis.

(v) Aerobic respiration – end products are carbon dioxide, water, energy (38 ATP).

Anaerobic respiration – end products are lactic acid, energy (2 ATP).

9. The figure below shows a ventral view of human thorax.

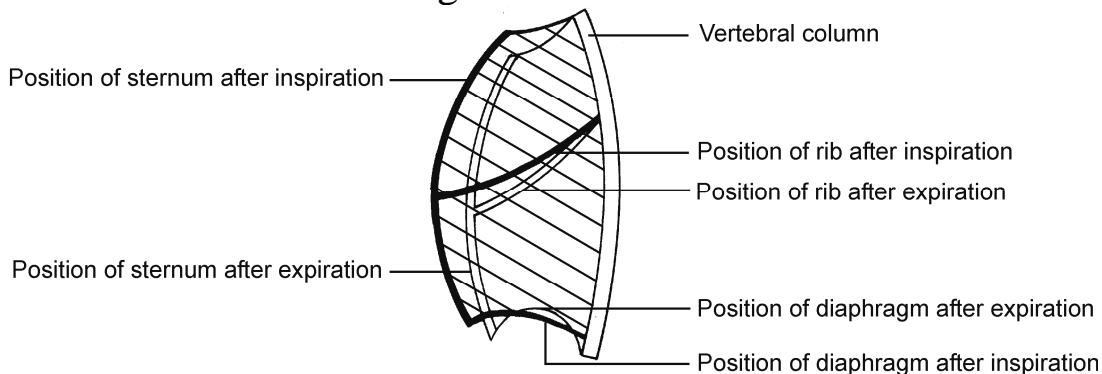


- (i) Label 1-15
- (ii) What are the devices for the protection of lungs?
- (iii) What is the importance of structure 12?
- (iv) Why is the trachea lined with C-shaped rings of cartilage?
- (v) With the help of ray diagram, name all parts in a sequence, through which atmospheric air reaches the last part of our lungs.

- Ans.** (i) 1-Nasal cavity; 2-Hard palate; 3-Soft palate; 4-Epiglottis; 5-Oesophagus; 6-Larynx; 7-Cartilaginous rings; 8-Trachea; 9-Cut end of ribs; 10-Bronchus; 11-Bronchiole; 12-Alveolus; 13-Right lung; 14-Diaphragm; 15-Pleural membrane.
- (ii) Lungs are protected by a rib cage and the pleura forms a protective membrane over the lungs.
 - (iii) Alveoli offers a good respiratory surface for gaseous exchange.

- (iv) Trachea is protected against closure by a series of closely packed C-shaped rings of cartilage. These cartilaginous rings support the wall of trachea on the dorsal side to prevent them from collapsing. The trachea remains open permanently and allows easy passage of air.
- (v) Nasal cavity → Nasopharynx → Larynx → Trachea → Bronchi and Bronchioles → Alveolar ducts → Alveolar air sacs → Pulmonary alveoli.

10. Given below is the relative position of ribs, diaphragm and sternum after breathing in and out.



- (i) Differentiate between inspiration and expiration with reference to intercostal muscles and diaphragm.
- (ii) What is the composition of the inspired air? How is it different from the expired air?
- (iii) How will you prove that water is released during breathing?
- (iv) “When we hold our breath, the exchange of gases does not stop for some time.”
Explain this statement.

Ans. (i)

Inspiration	Expiration
<p>(a) Intercostal muscles These muscles contract, raising the lower portion of the sternum forward and the lower ribs upwards and outwards increasing the volume of thoracic cavity.</p>	<p>The muscles relax and the sternum is pulled in and ribs are depressed under their own weight, thus the volume of thoracic cavity is reduced.</p>
<p>(b) Diaphragm It contracts and flattens, thus increasing the volume of the thoracic cavity.</p>	<p>Along with intercostal muscles, the diaphragm relaxes and returns to its arched position, thus decreasing the volume of the thoracic cavity.</p>

(ii)

Component	Inspired Air	Expired Air
Oxygen	20.14%	16.3%
Carbon dioxide	0.3%	4.0%
Nitrogen	79.03%	79.7%
Water vapour	Low	High

(iii) Gently breathe upon a cold surface, such as a piece of glass or slate; the water droplets appearing on the surface prove the presence of moisture in expired air.

(iv) This is due to the presence of residual volume of air in lungs.

11. What is the function of Adam's apple?

Ans. (i) Adam's apple also called the voice box, consists of two ligamentous folds called vocal cords. Vibrations of these cords produce sounds.

(ii) It also functions as a passage for air.

12. Give reasons why one should not talk while eating.

Ans. If we talk while eating, the food may enter into the larynx along with air, which could block the air breathing channels.

13. Design an experiment to demonstrate that expired air contains more carbon dioxide than inspired air.

Ans. Aim : To prove that expired air contains more carbon dioxide than inspired air.

Apparatus : A T-tube with clips, two flasks containing lime water, delivery tubes.

Procedure : The apparatus is set up as shown.

Clip X open, Clip Y closed

Breathe in (inhale) through the tube at the centre.

Clip X closed, Clip Y open

Breathe out (exhale) through the tube at the centre. Repeat the above procedure about 10-15 times.

Observation : Lime water in flask B turns milky faster than the lime water in flask A.

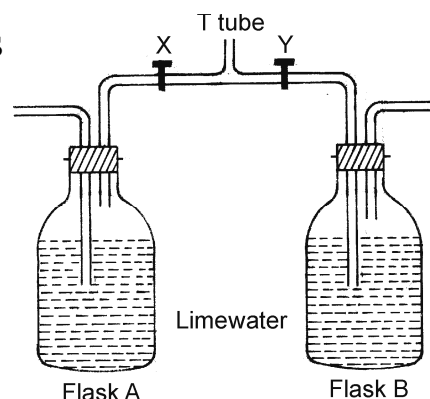
Inference : When clip X is open and clip Y closed, atmospheric air is drawn to the flask A.

When clip X is closed and clip Y is opened, exhaled air is forced into flask B.

The result of the experiment shows that expired air contains more carbon dioxide than inspired air.

14. Breathing through nose is said to be healthier than through the mouth.

Ans. Breathing through nose allows the air to undergo filtration in the nasal chambers, cleaning by trapping minute dust and other particles in mucus and cilia push them outwards, sterilization with the help of chemicals present in mucus, moistening through water vapour coming from mucus and changing the temperature while passing over lining of nasal cavity. It is, therefore, said that breathing through nose is healthier than through the mouth.



15. What is the effect of altitude on breathing?

Ans. At high altitudes, the reduced atmospheric pressure makes it difficult to load the haemoglobin with oxygen. In an attempt to obtain sufficient oxygen, a mountaineer takes very deep breaths. This also forces more carbon dioxide out of the body and the level of carbon dioxide in blood therefore falls. The inspiratory centre is no longer stimulated and breathing becomes increasingly laboured, causing great fatigue.

16. Give similarities and differences between plant respiration and animal respiration.

Ans.

Plant Respiration	Animal Respiration
Similarities	
1. Cellular respiration produces energy which is stored as ATP.	Cellular respiration produces energy which is stored as ATP.
2. The process occurs partly in cytoplasm and partly in mitochondria.	The process occurs partly in cytoplasm and partly in mitochondria.
3. By-products are CO ₂ and water.	By-products are CO ₂ and water.
Dissimilarities	
1. No external ventilation (breathing) movements.	External ventilation (breathing) movements except in small animals like amoeba or hydra.
2. No special gas transport system (usually direct diffusion from air spaces, or from cell to cell).	The blood system transports oxygen.
3. Anaerobic respiration forms ethyl alcohol and CO ₂ .	Anaerobic respiration forms lactic acid only and no CO ₂ .
4. Green plants produce little detectable heat.	Animals produce considerable detectable heat.
5. Green plants have additional oxygen source from photosynthesis.	Aerobic animals have only one oxygen source, the air.
6. Respiration rate is low.	Respiration rate is high.

17. Alveoli offer a good respiratory surface for gaseous exchange.
Comment.

Ans. The alveoli offer a good respiratory surface for gaseous exchange :

- (a) The alveoli have thin walls, made of single layer epithelium which is readily permeable to gases.
- (b) Elastic structure and smooth muscle fibres make the alveoli easily distensible and capable of accommodating large air volumes.
- (c) Each alveolus is covered with a thick net of capillaries derived from the pulmonary artery.
- (d) The lining of the alveoli is covered with a film of moisture. Oxygen dissolves in the moisture and diffuses through the epithelium and capillary walls into the blood where it combines with the haemoglobin.
- (e) Both lungs contain 300 to 400 million microscopic alveoli which in a normal adult have a diameter of 0.2 mm. Owing to the large number of alveoli, the lungs have an enormous respiratory surface (almost 100 m^2 during inspiration in an average adult).

18. Choose the right answer out of the four choices given in each case. The (alveoli/bronchioles/tracheoles/bronchi) are the ultimate end parts of the respiratory system in humans.

Ans. Alveoli.

19. With regard to the respiratory system and the process of respiration in man, answer the following questions :

- (i) Name the two muscles that help in respiration.
- (ii) Briefly describe how the above mentioned muscles help in the inspiration of air.
- (iii) Give the overall chemical equation to represent the process of respiration in man.
- (iv) What is meant by : (a) Residual air? (b) Dead air space?

Ans. (i) (a) External Intercostal, (b) Internal Intercostal Muscles.

(ii) The process of respiration is completed in two steps — Inspiration and expiration. It is supported by external and internal intercostal muscles.

During inspiration, the volume of the thoracic cavity increases with the combined movement of sternum, ribs and diaphragm by the contraction of external intercostal muscles. The volume of thoracic cavity increases all around and abdominal muscles relax. The pressure of the air inside the lungs decreases in comparison to the atmospheric pressure and the fresh air rushes into the lungs. During expiration, the volume of the thoracic cavity decreases because of the relaxation of the internal intercostal muscles and downward movement of ribs and sternum. The diaphragm moves upward and abdominal muscles contract. The air pressure inside the lungs is more than the pressure of atmospheric air outside, so the air is expelled out.

(iii) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 36 \text{ ATP}$.

(iv) (a) Residual air : This is the amount of air left in the alveoli of lungs even after forceful expiration. It is about 1500 ml, which always remains in lungs.

(b) Dead air space : It is the volume of air found in the respiratory tract where no diffusion of gases can occur. It is around 150 ml.

20. Given below are certain functional activities of specific structures in the body of living organisms. Name the structure responsible for the same.

(i) Prevents food from entering the trachea during swallowing.

(ii) Transfers impulses from inner ear to brain.

(iii) Initiates cell division in animal cells.

(iv) Helps to change the focal length of the eye lens.

(v) Transports oxygen to the cells of the human body.

(vi) Helps to increase the volume of the chest cavity lengthwise.

- Ans.** (i) Epiglottis. (ii) Auditory nerve
(iii) Centrosome with centriole
(iv) Suspensory ligament along with ciliary muscles.
(v) Red blood cells (vi) Diaphragm

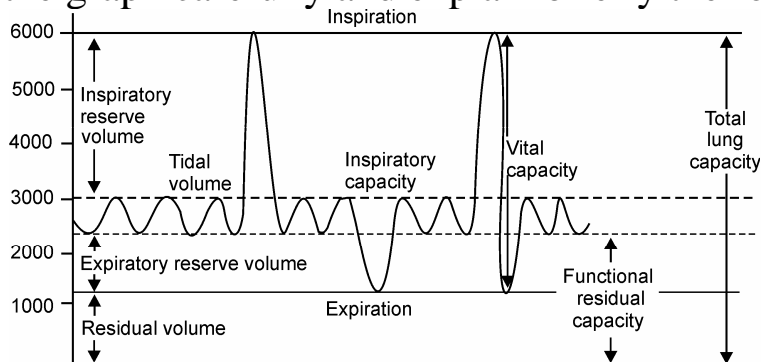
21. Match the items in column I with the ones most appropriate in column II. Rewrite the matching pairs.

Column I	Column II
(i) Alveoli	Where aerobic respiration takes place
(ii) Bronchioles	Lined with hair
(iii) Nasal chamber	Diffusion of gases
(iv) Pharynx	Small air tubes
	A common passage for food and air.

- Ans.** (i) Alveoli – diffusion of gases.
(ii) Bronchioles – small air tubes.
(iii) Nasal chamber – lined with hair
(iv) Pharynx – a common passage for food and air.

22. The volume of air in the lungs and the rate at which it is exchanged during inspiration and expiration is measured with a spirometer. The following diagram shows the spirogram of lung volumes and capacities.

Study the graph carefully and explain briefly the following :



- (i) Tidal volume (TV).
(ii) Inspiratory reserve volume (IRV).
(iii) Expiratory reserve volume (ERV).
(iv) Vital capacity (VC).
(v) Residual volume (RV).

- Ans. (i)** Air breathed in and out in a normal quiet breathing (500 cm^3).
- (ii)** Air that can be drawn in forcibly over and above the tidal air (3000 cm^3).
- (iii)** Air that can be expelled out forcibly after an ordinary respiration (1000 cm^3).
- (iv)** The volume of air that can be taken in and expelled out by maximum inspiration and expiration (vital capacity = 4500 cm^3).
- (v)** The leftover air in the lungs even after forcibly breathing out (1200 cm^3).