

CHAPTER # 10
GASEOUS EXCHANGE

Q1. Differentiate between cellular respiration and aerobic respiration?

Ans: Difference between cellular respiration and aerobic respiration: Cellular respiration:

Cellular respiration is the process in which the C-H bonds in food are broken by oxidation reduction reactions and the energy is transformed into ATP.

Aerobic respiration;

In aerobic respiration, oxygen is used and there is complete oxidation of the food material, Carbon dioxide and water are also produced in this process

Aerobic respiration	Cellular respiration
<p>i. Cellular respiration is a series of the metabolic reactions occurs in cells in order to convert nutrients into small energy molecules called adenosine triphosphate (ATP).</p>	<p>i. Cellular respiration is the set of the metabolic reactions and processes that take place in the cells of organisms to convert biochemical energy from nutrients into adenosine triphosphate (ATP) and then release waste products.</p>
<p>ii. Aerobic respiration requires oxygen in order to generate energy molecule ATP. Whereas an anaerobic respiration synthesizes ATP by using the electron transport chain. With inorganic molecules other than oxygen.</p>	<p>ii. The reactions involved in respiration are catabolic reactions, which break large molecules into smaller ones releasing energy in the process as they break high energy bonds. Respiration is one of the key ways a cell gains useful energy to fuel cellular activity.</p>

Q2. Differentiate between breathing and cellular respiration.

Ans: Difference between breathing and cellular respiration:

Cellular respiration	Breathing
<p>i. Organism get the oxygen needed for cellular respiration from their environment and provide it to their cells. The carbon dioxide produced during cellular respiration is taken out of the cells and ultimately from the body. Taking in oxygen and giving out of carbon dioxide is terms as Gaseous exchange.</p>	<p>i. The term breathing is used for the process through which animals take air in their bodies to get oxygen from it and then give out the air for getting rid of carbon dioxide.</p>
<p>ii. Respiration involves the mechanical and bio-chemical processes</p>	<p>ii. Breathing is only the mechanical or physical process of exchange of gases</p>
<p>iii. Cellular respiration occurs in the cells in the following steps glycolysis (no O₂ needed). "prep step", Krebs cycle, chemiosmosis/ ETC (electron transport chain)</p>	<p>iii. Breathing is exhaling and inhaling. Breathing is what provides the O₂ needed for cellular respiration, and helps dispose of the waste products of cellular respiration and helps dispose of the waste product of cellular respiration CO₂.</p>

Q3. How do the different parts of the plant body exchange gases with the environment?

Ans: See Q#1 from Exercise (Understanding the Concept)

Q4. How do the different parts of humans body exchange gases with the environment?

OR

Explain respiratory system in humans.

Ans: Gaseous Change in Humans:

In human and other higher animals the exchange of gases is carried out by the respiratory system. We can divide the respiratory system in two parts

- i. The air passageway
- ii the lungs

i. The Air Passageway:

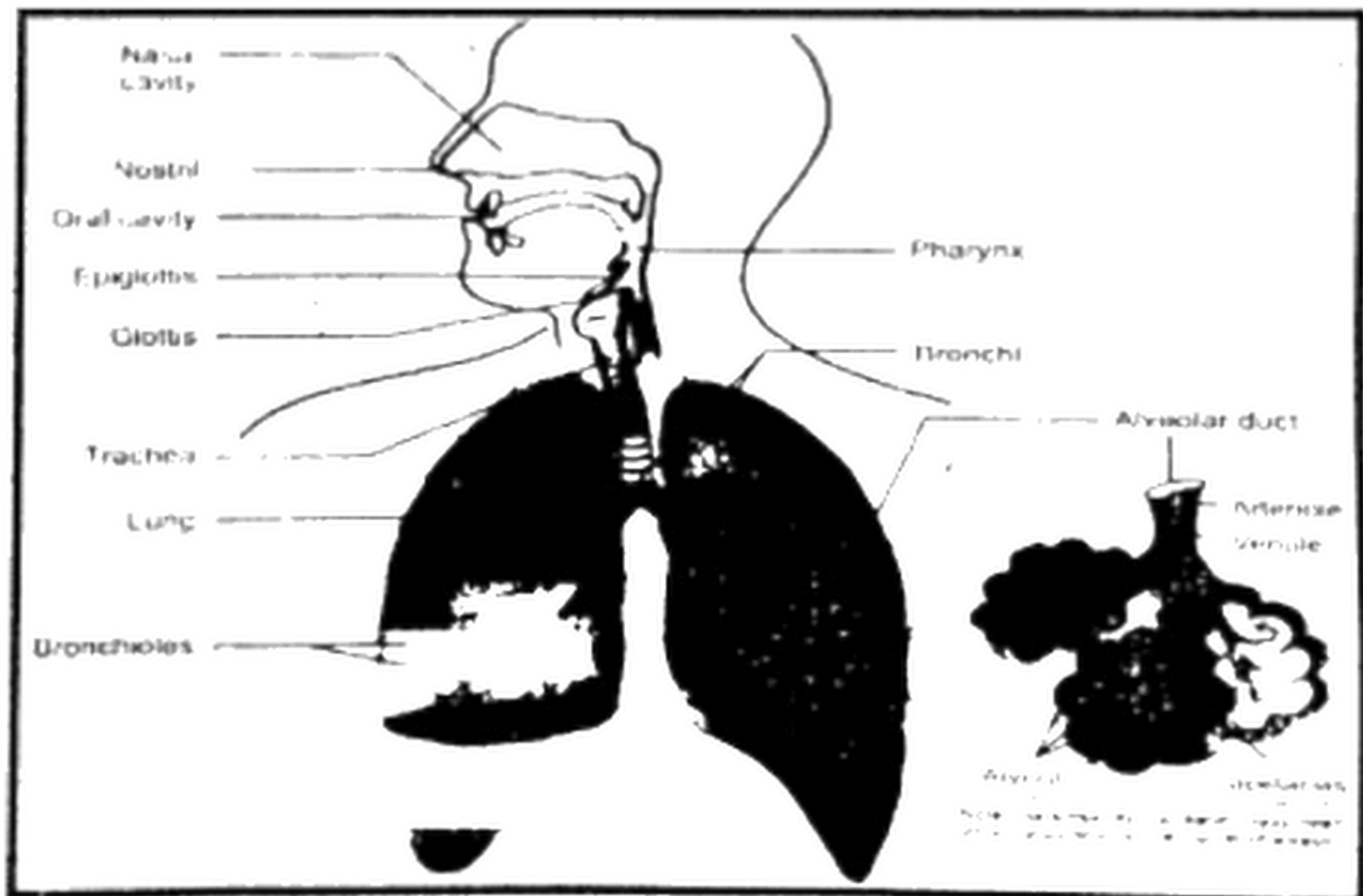
The air passageway consists of the parts through which the outside air comes in the lungs and after the exchange of gases it goes out.

Parts of the air passageway:

This passage of air consists of the following parts

Nasal cavity:

The nose encloses the nasal cavity. It opens to the outside through the openings called the nostrils. The nasal cavity is divided into two portions by a wall. Each portion is lined by fine hairs and mucous which filter the dust particles from the air. The mucous also moistens and warms the incoming air and keeps its temperature nearly equal to that of the body.



The air passangeway and the lungs

Pharynx:

The nasal cavity opens into the pharynx by means of two small openings called internal nostrils. Pharynx is a muscular passage and is common to both food and air. It extends to the opening of the esophagus and the larynx the air goes from the pharynx into the larynx.

Glottis:

Glottis is a narrow opening at the floor of pharynx which leads into larynx. The glottis is guarded by a flap of tissue called the epiglottis.

Larynx (voice box):

The larynx is a box, made of cartilage. It is present between pharynx and trachea. It is also called the voice box. Two pairs of fibrous bands called vocal cords are stretched across the larynx.

Function of vocal cords.

The vocal cords vibrate when the air passes through them. This vibration produces sounds.

Trachea (windpipe):

Larynx continues to the trachea, which is also called the windpipe. It is about 12 cm long tube which lies in front of the esophagus. There are C-shaped cartilaginous rings in the wall of trachea. The cartilages keep the trachea from collapsing even when there is no air in it.

Bronchi:

On entering the chest cavity, the trachea divides into two smaller tubes called bronchi (Singular: bronchus). The bronchi also have cartilaginous plates in their walls. Each bronchus enters into the lung of its side and then divides into smaller branches.

The bronchi continue dividing in the lungs until they make several fine tubes called bronchioles.

Alveolar ducts:

The bronchioles progressively lose the cartilages as they become narrower. The bronchioles end as fine tubules called the alveolar ducts.

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Alveoli:

Each alveolar duct opens into a cluster of pouches called alveoli. The ... form the respiratory surface in human body. Each alveolus is a sac-like structure lined by a single layer of epithelial cells. It is bound on the outside by a network of capillaries.

The pulmonary artery:

The pulmonary artery from the heart containing deoxygenated blood enters the lungs and branches into arterioles and then into capillaries which surround the alveoli. These then join together to form the venules which form pulmonary vein. The pulmonary vein carries the oxygenated blood back to the heart.

ii. The Lungs:

All the alveoli on one side constitute a lung. There is a pair of lungs in the thoracic cavity.

Intercostal muscles:

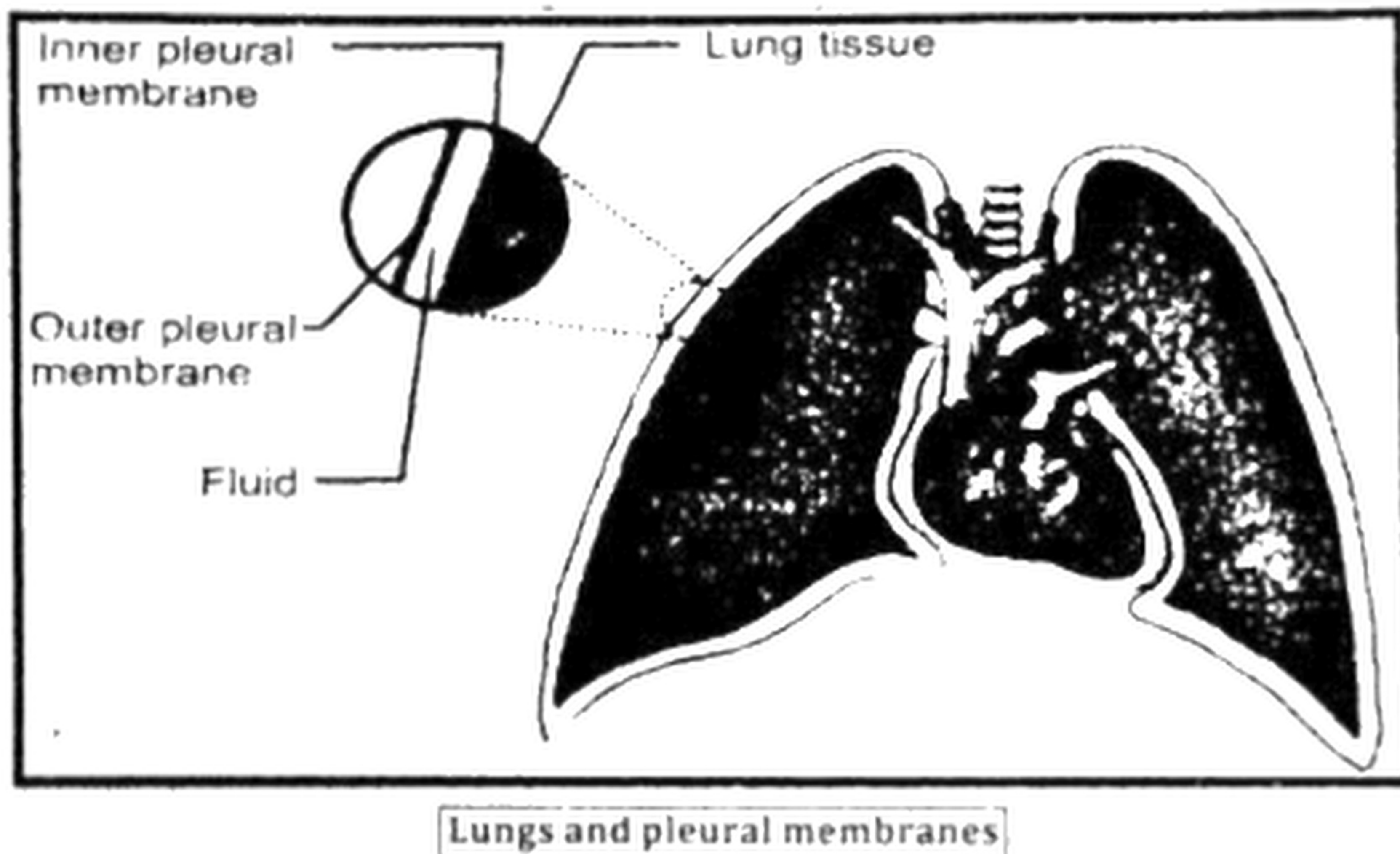
The chest wall is made up of 12 pairs of ribs and the rib muscles called Intercostal muscles.

Diaphragm:

A thick muscular structure, called diaphragm is the part below the lungs. The left lung is slightly smaller and has two lobes and the right lung is bigger with three lobes, they are spongy and elastic organs. The lungs also have blood vessels that are the branches of the pulmonary arteries and veins.

Function of membranes in the lungs:

Each lung is enclosed by two membranes called the outer pleural membrane and the inner pleural membrane. The membranes enclose a fluid which provides lubrication for the free expanding and contracting of the lungs.



Interesting Information

The vibrations in vocal cords and the movements of lips, cheeks, tongue, jaws produce specific sounds which result in speech. Speech is an ability that only humans are gifted with and this is one of the characteristics which has put human beings superior to all.

Interesting Information

The trachea and bronchi are also lined with ciliated and glandular cells. The glandular cells secrete mucus which moistens the air and also traps any fine particles of dust or bacteria that have escaped from nasal cavity. The cilia beat with an upward motion so that the foreign particles along the mucus are sent to the oral cavity from where it may be either swallowed or coughed out.

Q5. Write down the steps of inhalation and exhalation.

OR

Explain the mechanism of breathing?

Ans: See Q #2 from Exercise (Understanding the Concept)

Q6. Briefly describe human breathe rate per minute in different circumstances.

Ans: Human breathe rate during normal circumstances:

Humans breathe 16-20 times per minute in normal circumstances i.e. at rest. The rate of breathing is controlled by the respiratory center in the brain. The respiratory centre is sensitive to the concentration of carbon dioxide in the blood.

Human breathe rate during exercise:

When we do exercise or some hard job our muscle cells carry out cellular respiration at greater rate. It results in the production of more carbon dioxide which is released in the blood. This greater than normal concentration of carbon dioxide stimulates the respiratory centre of brain. The respiratory centre sends messages to the rib muscles and diaphragm to increase the rate of breathing so that the excess carbon dioxide present in pod can be removed out of body. During exercise or other hard physical works, the breathing rate may increase up to 30-40 times per minute.

Note:

The breathing movements are involuntary to a large extent. However, we can control the rate of breathing but not for a long time.

Q7. How will you compare between the inspired and expired air?

Ans: Comparison between the inspired and the expired air:

Feature	Inspired Air	Expired Air
Amount of oxygen	2.1%	16%
Amount of carbon dioxide	0.04%	4%
Amount of nitrogen	79%	79%
Amount of water vapours	Variable	Saturated
Amount of dust particles	Variable	Almost none
Temperature	Variable	Almost equal to body temperature

Q8. What part of the blood transports oxygen from lungs to the cells of the body?

Ans: Haemoglobin in Red Blood Cells.

Q9. What is the job of breathing system?

Ans. Job of breathing system:

Breathing system exchanges oxygen and carbon dioxide.

Q10. Name five types of respiratory disorder in your body?

Ans: Respiratory Disorders:

There are a number of respiratory disorders which affect people. The percentage of such disorders is particularly high in Pakistan. It is due to the more

concentration of air pollutants not only in the urban but also in the rural atmosphere. Some of the important respiratory disorders are described next.

1. Bronchitis
2. Emphysema
3. Pneumonia
4. Asthma
5. Lung Cancer

Q11. State the signs and symptoms, causes and treatments of bronchitis, emphysema and pneumonia.

OR

Explain respiratory disorders in human beings?

Ans: See Q # 3 from Exercise (Understanding the Concept)

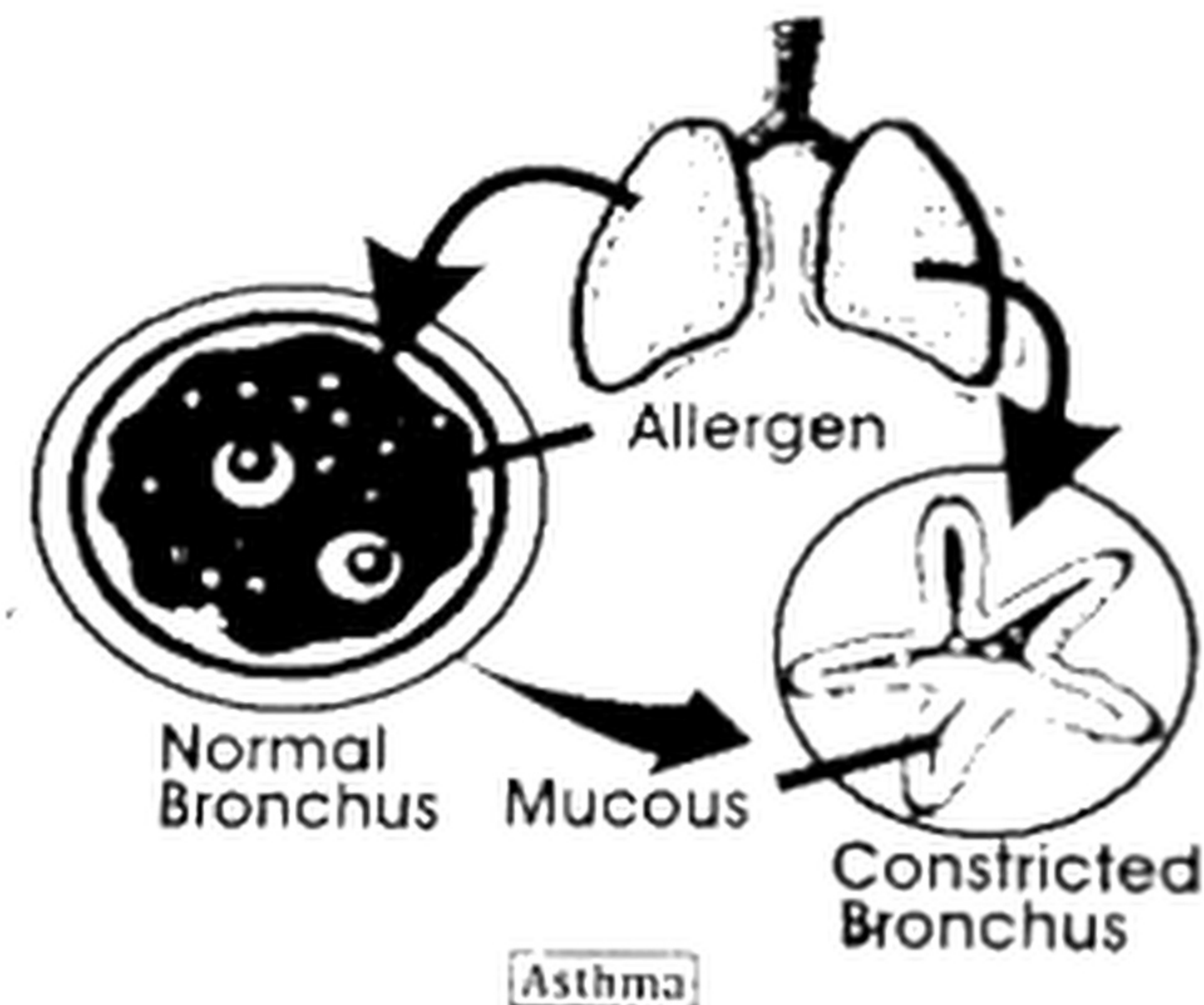
Interesting Information

Prior to the discovery of antibiotics, one-third of pneumonia patients died from the infection

Q12. State the signs and symptoms, causes and treatments of asthma?

Ans: Asthma:

Asthma is a form of allergy, in which there is inflammation of the bronchi, more mucous production and narrowing of the airways.



Causes of asthma:

In asthma patients, the bronchi and bronchioles become sensitive to different allergens (allergy causing factors) e.g. dust, smoke, perfumes, pollens etc. When exposed to any of such allergens the sensitive airways show immediate and excessive response of constriction. In this condition, the patient feels difficulty in breathing.

Sign and symptoms

The symptoms of asthma vary from person to person. The major symptoms include shortness of breath (especially with exertion or at night), wheezing (whistling sound when breathing out), cough and chest tightness.

Treatment and drugs:

The chemicals with ability to dilate the bronchi and bronchioles are used in the treatment of asthma. Such medicine is given in the form of inhalers.

Q13. State the signs and symptoms, causes and treatments of lung cancer?

Ans: Lung Cancer:

Lung cancer is a disease of uncontrolled cell divisions in the tissues of the lung. The cells continue to divide without any control and form tumours. The cellular growth may also invade adjacent tissues beyond the lungs.

Sign and symptoms:

The most common symptoms are shortness of breath, coughing (including coughing up blood) and weight loss.

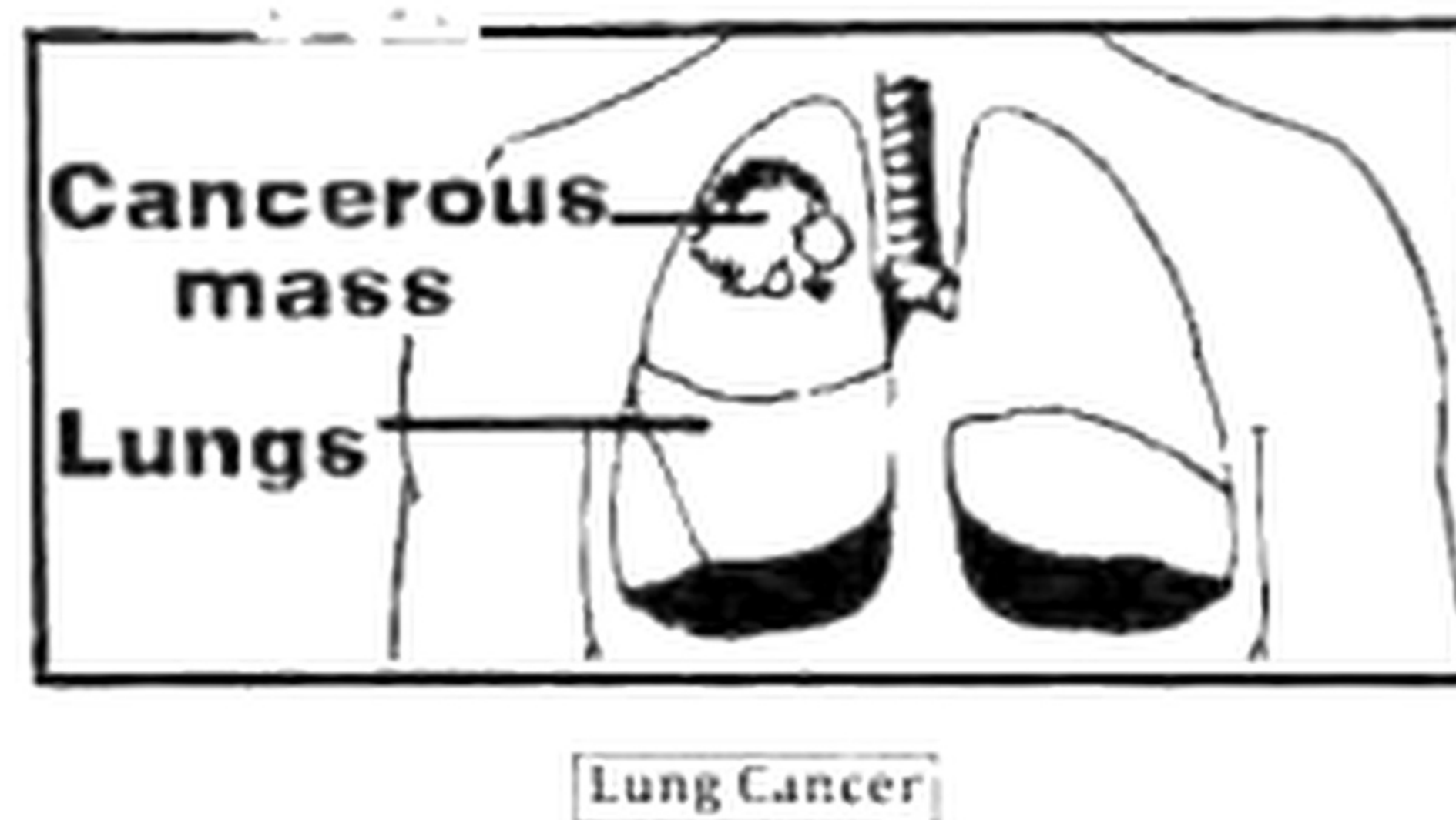
Causes of lung cancer:

The main causes of any cancer include carcinogens (such as those in cigarette smoke), ionizing radiation and viral infection. Smoking is the main cause of lung cancer. This risk of lung cancer is significantly lower in nonsmokers. Cigarette smoke contains over 50 known carcinogens.

Passive smoking (the inhalation of smoke from another's smoking) is also a cause of lung cancer. The smoke from the burning end of a cigarette is more dangerous than the smoke from the filter end.

Prevention of lung cancer:

Eliminating tobacco smoking is a primary goal in the prevention of lung cancer. The World Health Organization has called for governments to stop tobacco advertising to prevent young people from taking up smoking.

**Cancer related deaths**

Lung cancer is the most common cause of cancer-related death responsible for more than 1.3 million deaths worldwide annually.

If a person stops smoking, the chance to develop cancer decreases as damage to the lungs is repaired and contaminant particles are gradually removed.

Nicotine

Nicotine is a powerful poison, and was widely used as an insecticide in the past. When inhaled through tobacco smoking, it reaches our circulatory system and not only hardens the walls of the arteries but also damages the brain tissues.

Rates of smoking

According to the WHO, the rates of smoking have declined in the developed world in the developing world, however it is rising by 3.4% per year as of 2002 The World No Tobacco Day is celebrated on the 31st of May every year.

Q14. How does the tobacco smoke damage the respiratory system?

Ans: Damaging of respiratory system:

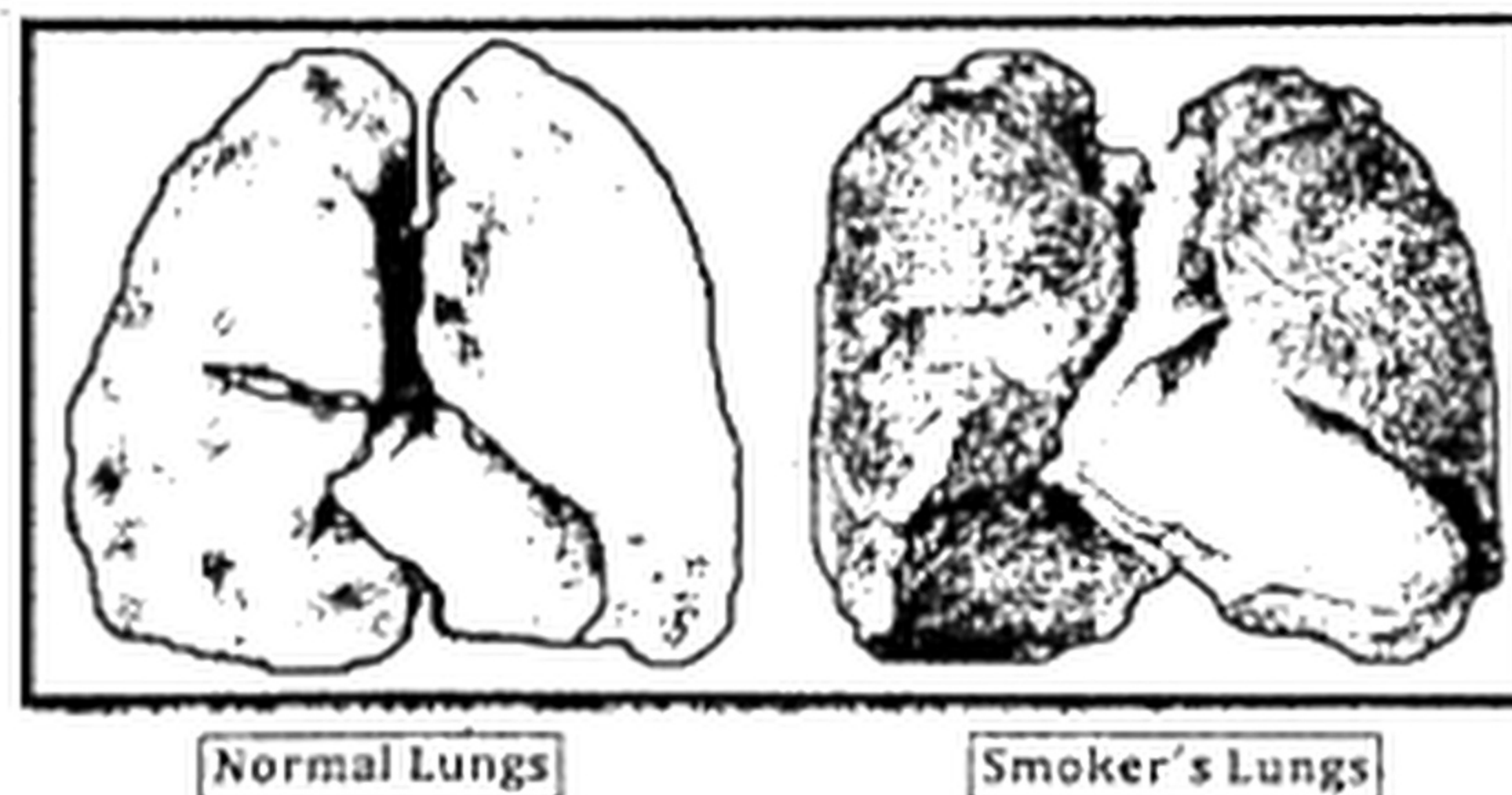
While nicotine has effects on blood flow, these effects are not as significant as the damage to the lung and irritation of the air passages to the lung. One such problem is "smoker's cough", caused by damage to the epithelia of the windpipe. Emphysema caused by the body's immune response to cigarette smoke causes a major loss in lung function and debilitating disease.

Q15. How would you associate the bad effects of smoking on human body systems?

Ans: Bad Effects of Smoking:

i. **Chemicals in smoke:**

Smoking is harmful due to the chemicals in cigarettes and smoke. Tobacco smoke contains over 4,000 different chemicals, out of which at least 50 are carcinogens and many are poisonous.



ii. Smoking lead to the cancers:

Smoking may also lead to the cancers in kidneys, oral cavity, larynx, breast, bladder and pancreas etc. Many chemicals in tobacco smoke damage the air passageway, which leads to emphysema and other respiratory disorders.

iii. Effect on circulatory system:

Smoking also has effects on the circulatory system. The carbon monoxide present in tobacco smoke lessens the oxygen-carrying capacity of hemoglobin.

Many other chemicals in smoke increase the production of blood platelets. When platelets are more than the normal numbers, they make the blood viscous and it can lead to arteriosclerosis.

iv. Infections in the lungs:

Smokers are at greater risk of developing infections, particularly in the lungs. For example, smoking increases the risk of tuberculosis by two to four times, and of pneumonia by four times

v. Weakening and staining of teeth:

Smoking is also responsible for weakening, and staining the teeth. Tooth loss is 2 to 3 times higher in smokers than in non-smokers

World No Tobacco Day

The World No Tobacco Day is celebrated on 31st of May every year

second-hand smoke (passive smoke)

Non-smokers who are exposed to second-hand smoke (passive smoke) at home or work increase their heart cancer risk by 20-30% and their lung disease risk by 25-30%.

Affects on social life

Smoking also affects the social life of a person. Smokers may face social un-acceptance because other people may not want to be exposed to other's smoke.

