Breathing and Exchange of Gases

Case Study Based Questions

Read the following passages and answer the questions that follow:

1. A 60-year-old man presented to the emergency department complaining of persistent right-sided chest pain and cough. The chest pain was pleuritic in nature and had been present for the last month. The associated cough was productive of yellow sputum without hemoptysis. He had unintentionally lost approximately 30 pounds over the last 6 months and had nightly sweats. He had denied fevers, chills, myalgias or vomiting. He also denied sick contacts or a recent travel history. He recalled childhood exposures to persons afflicted with tuberculosis. The patient smoked one pack of cigarettes daily for the past 50 years and denied recreational drug use. He reported ingesting twelve beers daily and had had delirium tremens, remote right-sided rib fractures and a wrist fracture as a result of alcohol consumption. He had worked in the steel mills but had discontinued a few years previously. He collected coins and cleaned them with mercury.

(A) What factors hold true to the below statements?

(a) No respiratory volume could be traced after the death of a patient.

(b) Some respiratory volume could be traced after the death of a patient.

(c) Entire respiratory volume could be traced after the death of a patient.

(d) Respiratory volume does not matter after the death.

(B) Whether a child died after a normal birth or died before birth can be confirmed by measuring:

(a) The weight of the child

(b) The dead space air

(c) The tidal volume of air
(d) Residual volume of air

(C) The volume of ventilated air that does not participate in gas exchange are known as:

(a) The residual volume
(b) The dead space
(c) The inspiratory reserve volume
(d) The tidal volume

(D) Breathing is also known as:

(a) Ventilation
(b) Respiration
(c) Both (a) and (b)
(d) Vernation

(E) After a person's pulse and breathing stop, how much later does all cellular metabolism stop?

(a) 4-10 min
(b) 4-10 sec
(c) 72 sec
(d) 1 min

Ans. (A) (b) Some respiratory volume could be traced after the death of a patient.

Explanation: The residual respiratory volume (RV) remains inside the body even after forceful expiration. Lungs' alveoli retain this small amount of air within them and hence it can be traced as a residue of one survival.

(B) (d) Residual volume of air

Explanation: Measuring a child's residual air volume enables doctors to determine if they are dealing with a stillborn or healthy newborn. The first cry of a newborn opens the respiratory route, which causes a certain amount of air to be stored in his lungs. Residual volume is the name given to this amount of air. To confirm that a child died following a natural birth, the child's lungs are cut and put in water after death. Due to buoyancy, the lungs float in water since they are filled with air. If the lungs sink in water due to the lack of air in then, indicates that the child died before birth.

(C) (b) The dead space

Explanation: The amount of air that is inhaled but does not participate in gas exchange

is referred to as "dead space" because it either stays in the conducting airways or reaches alveoli that are either poor or not perfused. It indicates that not all of the air in each breath is accessible for the exchange of carbon dioxide and oxygen. Animals inhale and exhale air through their lungs, squandering the portion of the inhalation that remains in the conducting airways, where there can be no gas exchange.

(D) (a) Ventilation

Explanation: The act of breathing, also known as ventilation, involves moving air into and out of the lungs in order to facilitate gas exchange with the body's internal environment, primarily to expel carbon dioxide and draw in oxygen.

(E) (a) 4-10 min

Explanation:

the Depending on surrounding temperature, cell metabolism probably continues for four to ten minutes after a person dies. During this time, oxygenated blood is not moving around, which prevents the usual exchange of oxygen and carbon dioxide. As a result, carbon dioxide produced during cell respiration- which consumes oxygen to create cellular energy and produces carbon dioxide as a byproduct- does not leave the cell. This causes the cell's pH to decrease, creating an acidic intracellular environment. The lysosome, which houses enzymes for breaking down anything from proteins to lipids and nucleic acids, is one of the internal membranes that are damaged by this acidic environment. These enzymes are unleashed and start to break down the cell from the inside after the membranes have ruptured. The rate of autolytic spreads throughout the body and eventually destroys all the cells of the body.

2. Allergic reactions can cause symptoms in your nose, lungs, throat, sinuses, ears, lining of the stomach or on the skin. Allergies can trigger the symptoms of asthma, making it more difficult to breathe. An environmental allergy can affect your airway in two distinct ways, potentially resulting in shortness of breath. Allergic rhinitis, also known as hay fever, affects your nose and sinuses. It can lead to sneezing, congestion, an itchy nose, and itchy eyes. If you are especially congested, you may find it difficult to breathe through the nose. Allergic asthma primarily affects airways in the lungs and can develop among people who have been diagnosed with asthma. It can cause coughing, wheezing, tightness in the chest, and shortness of breath or rapid breathing. In the case of allergic

asthma, these symptoms can develop simultaneously.

A person had difficulty breathing when he/she came across certain factors like changes in weather, pollens, dust, etc.
(A) Do these symptoms necessarily mean that the patient is suffering from a certain respiratory disease or disorder?
(B) Name the factors which might be responsible for difficulty in breathing.
(C) What medications are involved for patients suffering from treating breathlessness due to allergies?

Ans. (A) No, these can also be common symptoms of diseases like cold and cough and these symptoms do not depict that the person necessarily has a certain respiratory disease or disorder.
(B) The factors may include dust allergies, mildew, or pollen allergies, stress and worry, clogged airways due to a stiff nose or throat phlegm, and decreased oxygen consumption due to high altitude heights.
(C) Antihistamine is prescribed for avoiding immunogenic responses due to allergen triggers. Use of bronchodilator drugs and inhalers for relief.

3. Breathing is a physical phenomenon where oxygen from the atmosphere is exchanged with the carbon dioxide produced by the cells. Various organisms have different mechanisms for breathing depending upon their needs and habitat. For example, lower invertebrates like sponges exchange gases by simple diffusion while earthworms use cuticles and insects have a network of tubes to transport atmospheric air within the body. Special vascularised structures called gills are used by aquatic arthropods and molluscs whereas vascularised bags called lungs are used by terrestrial forms for the exchange of gases. Fishes use gills while birds and mammals have lungs and amphibians use their moist skin to exchange gases.
(A) Assertion (A): Breathing is different from respiration.

Reason (R): Breathing is physical and respiration is biochemical.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

(B) Why is the mechanism of breathing different for different organisms?
(a) To meet their needs.
(b) To help them adapt to their environment.
(c) To suit their mode of life.
(d) All of the above

(C) What special name is given to the vascularised bags of terrestrial animals and vascularised structures of aquatic arthropods and molluscs?
(a) Gills and lungs respectively
(b) Lungs and trachea respectively
(c) Lungs and gills respectively
(d) Gills and trachea respectively

(D) How do lower invertebrates like sponges exchange gases?
(a) Diffusion
(b) Osmosis
(c) Breathing
(d) Cuticle exchange

(E) Assertion (A): The larynx is called the sound box.
Reason (R): The larynx is a cartilag- inous box that helps in sound production.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Ans. (A) (a) Both A and R are true and R is the correct explanation of A
Explanation: Breathing is a physical process. It occurs through nose, lungs, etc. While respiration is a biochemical process that takes place in cells and cell organelles.
(B) (d) All of the above
Explanation: Mechanism of breathing varies among different groups of animals depending mainly on their habitats and level of organisation.

(C) (c) Lungs and gills respectively Special

Explanation: vascularised structures called gills (branchial respiration) are used by most of the aquatic arthropods and molluscs whereas vascularised bags called lungs (pulmonary respiration) are used by the terrestrial forms for the exchange of gases.

(D) (a) Diffusion

Explanation: Lower invertebrates like sponges, coelenterates, flatworms, etc., exchange O_2 with CO_2 by simple diffusion over their entire body surface.

(E) (a) Both A and R are true and R is the correct explanation of A.

Explanation: The vocal cords are responsible for sound production. As the larynx houses the vocal cords it is called a voice box.