Delhi Public School Guwahati
"Under the aegis of the Delhi Public School Society, Delhi"

Class XI Session 2022 – 23 Subject: - BIOLOGY

Chapter: - 17 – Breathing and Exchange of gases

Competency based questions

I Source based Questions

Tidal Volume (TV): Volume of air inspired or expired during a normal respiration. It is approx. 500 mL., i.e., a healthy man can inspire or expire approximately 6000 to 8000 mL of air per minute. Inspiratory Reserve Volume (IRV): Additional volume of air, a person can inspire by a forcible inspiration. This averages 2500 mL to 3000 mL.

Expiratory Reserve Volume (ERV): Additional volume of air, a person can expire by a forcible expiration. This averages 1000 mL to 1100 mL.

Residual Volume (RV): Volume of air remaining in the lungs even after a forcible expiration. This averages 1100 mL to 1200 mL. By adding up a few respiratory volumes described above, one can derive various pulmonary capacities, which can be used in clinical diagnosis.

Inspiratory Capacity (IC): Total volume of air a person can inspire after a normal expiration. This includes tidal volume and inspiratory reserve volume (TV+IRV).

Expiratory Capacity (EC): Total volume of air a person can expire after a normal inspiration. This includes tidal volume and expiratory reserve volume (TV+ERV).

Functional Residual Capacity (FRC): Volume of air that will remain in the lungs after a normal expiration. This includes ERV+RV.

Vital Capacity (VC): The maximum volume of air a person can breathe in after a forced expiration. This includes ERV, TV and IRV or the maximum volume of air a person can breathe out after a forced inspiration.

Total Lung Capacity (TLC): Total volume of air accommodated in the lungs at the end of a forced inspiration. This includes RV, ERV, TV and IRV or vital capacity + residual volume.

1. Total lung capacity is equal _____
   a. Vital capacity + Residual volume
   b. Vital capacity + Functional Residual capacity
   c. Functional residual capacity + Tidal Volume
   d. Inspiratory capacity + Vital Capacity
2. Identify the correct formula
   a. Total Lung capacity = Vital capacity + Inspiratory Capacity
   b. Expiratory capacity = Tidal Volume + Residual Volume
   c. Total Lung Capacity = Vital capacity + tidal Volume
   d. Expiratory Capacity = Tidal Volume + Expiratory Reserve volume
3. Write the formula to calculate Inspiratory capacity.
4. Define Vital capacity
5. Give the formula to calculate volume of air remaining in the lungs under normal physiological conditions after normal breathing.

II. Case based questions

Breathing involves two stages : inspiration during which atmospheric air is drawn in and expiration by which the alveolar air is released out. The movement of air into and out of the lungs is carried out by creating a pressure gradient between the lungs and the atmosphere. Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is less than the atmospheric pressure, i.e., there is a negative pressure in the lungs with respect to atmospheric pressure. Similarly, expiration takes place when the intra-pulmonary pressure is higher than the atmospheric pressure. The diaphragm and a specialised set of muscles – external and internal intercostals between the ribs, help in generation of such gradients. Inspiration is initiated by the contraction of diaphragm which increases the volume of thoracic chamber in the antero-posterior axis. The contraction of external inter-costal muscles lifts up the ribs and the sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis. The overall increase in the thoracic volume causes a similar increase in pulmonary volume. An increase in pulmonary volume decreases the intra-pulmonary pressure to less than the atmospheric pressure which forces the air from outside to move into the lungs, i.e., inspiration. Relaxation of the diaphragm and the inter-costal muscles returns the diaphragm and sternum to their normal positions and reduce the thoracic volume and thereby the pulmonary volume. This leads to an increase in intra-pulmonary pressure to slightly above the atmospheric pressure causing the expulsion of air from the lungs, i.e., expiration (Figure 17.2b). We have the ability to increase the strength of inspiration and expiration with the help of additional muscles in the abdomen. On an average, a healthy human breathes 12-16 times/minute. The volume of air involved in breathing movements can be estimated by using a spirometer which helps in clinical assessment of pulmonary functions.

1. Identify the correct statement
   Statement 1 – In inspiration atmospheric air is drawn in.
   Statement 2 – In expiration the alveolar air is released out.
   Statement 3 – In inspiration atmospheric air is drawn out.
   Statement 4 – In expiration the alveolar air is released in.
   a. Both statement 1 & 2 are correct
   b. Both statement 2&3 are correct
   c. Both statement 3 &4 are correct
   d. Both statement 1 & 2 are incorrect
2. Inspiration can occur if the pressure within the lungs is _____
   a. Positive with respect to atmospheric pressure.
   b. Negative with respect to atmospheric pressure.
   c. Positive with respect to intra- pulmonary pressure.
   d. Negative with respect to intra- pulmonary pressure.
3. What is the precondition for expiration to take place?
4. State the mechanism associated with inspiration.
5. Give the use of spirometer.

III. Multiple Choice questions

1. Assertion: The movement of air into and out of the lungs is carried out by creating a pressure gradient between the lungs and the atmosphere.
   Reason: The diaphragm and a specialised set of muscles – external and internal intercostals between the ribs help in the generation of such gradients.

a. Both assertion and reason are true, and the reason is the correct explanation of assertion
b. Both assertion and reason are true, but reason is not the correct explanation of the assertion

c. Assertion is true but reason is false
d. Both assertion and reason are false.

2. Assertion: A sigmoid curve is obtained when % saturation of haemoglobin with O2 is plotted against PO2
   Reason: Saturation is affected by factors like PCO2, H+ concentration .
   a. Both assertion and reason are true, and the reason is the correct explanation of assertion
   b. Both assertion and reason are true, but reason is not the correct explanation of the assertion
   c. Assertion is true but reason is false
   d. Both assertion and reason are false
3. Amount of oxygen supplied by 100 ml of arterial blood while passing through the tissue is _.
4. Pneumotaxic centre which can moderate the function of the respiratory rhythmic centre is present in _____.
5. The enzyme essential for transport of CO_2as bicarbonate in blood is _____.