Breathing and Exchange of Gases

1. Select the sequence of steps in Respiration. **(2023)**
   (A) Diffusion of gases O_2 and CO_2 across alveolar membrane.
   (B) Diffusion of O_2 and CO_2 between blood and tissues.
   (C) Transport of gases by the blood
   (D) Pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out.
   (E) Utilisation of O_2 by the cells for catabolic reactions are resultant release of CO_2
   Choose the correct answer from the options given below:
   (a) (D), (A), (C), (B), (E)
   (b) (C), (B), (A), (E), (D)
   (c) (B), (C), (E), (D), (A)
   (d) (A), (C), (B), (E), (D)
2. Vital capacity of lung is ____. **(2023)**
   (a) IRV+ ERV+ TV+ RV
   (b) IRV+ ERV+ TV + RV
   (c) IRV+ ERV+ TV
   (d) IRV + ERV
3. Identify the region of human brain which has pneumotaxic centre that alters respiratory rate by reducing the duration of inspiration. **(2022)**
   (a) Cerebrum
   (b) Medulla
   (c) Pons
   (d) Thalamus
4. Which of the following statements are correct with respect to vital capacity? **(2022)**
   (A) It includes ERV, TV AND IRV
   (B) Total volume of air a person can inspire after a normal expiration.
   (C) The maximum volume of air a person can breathe in after forced expiration.
   (D) It includes ERV, RV and IRV
   (E) The maximum volume of air a person can breath out after a forced inspiration.
   Choose the most appropriate answer from the options given below:
   (a) (A) and (C)
   (b) (B), (D) and (E)
   (c) (A), (C), and (D)
   (d) (A) and (C) and (E)
5. Under normal physiological conditions in human being every 100 ml of oxygenated blood can deliver _____ ML. of O_2 to the tissues. **(2022)**
   (a) 2 ml
   (b) 5 ml
   (c) 4 ml
   (d) 10 ml
6. Which of the following is not the function of conducting part of respiratory system? **(2022)**
   (a) It clears inhaled air form foreign particles
   (b) Inhaled air is humidified
   (c) Temperature of inhaled air is brought to body temperature
   (c) Provides surface for diffusion of O_2 and CO_2
7. The partial pressures (in mm Hg) of oxygen (O_2) and carbon dioxide (CO_2) at alveoli (the site of diffusion) are **(2021)**
   (a) $pO_2 = 40\ and\ pCO_2 = 45$
   (b) pO_2 = 95 and pCO_2 = 40
   (c) pO_2 = 159 and pCO_2 = 0.3
   (d) pO_2 = 104 and pCO_2 = 40
8. Select the favourable conditions required for the formation of oxyhaemoglobin at the alveoli. **(2021)**
   (a) Low) pO_2, high pCO_2, more H+, higher temperature
   (b) High) pO_2, high pCO_2, less H+, higher temperature
   (c) Low) pO_2, low pCO_2, more H+, higher temperature
   (d) High) pO_2, low pCO_2, less H+, lower temperature
9. Identify the wrong statement with reference to transport of oxygen **(2020)**
   (a) Partial pressure of CO_2 can interfere with O_2 binding with haemoglobin
   (b) Higher H+ concentration in alveoli favours the formation of oxyhaemoglobin
   (c) Low pO_2 in alveoli favours the formation of oxyhaemoglobin
   (d) Binding of oxygen with haemoglobin is mainly related to partial pressure of O_2

10. Select the correct events that occur during inspiration **(2020)**
    1. Contraction of diaphragm
    2. Contraction of external inter-costal muscles
    3. Pulmonary volume decreases
    4. Intra pulmonary pressure increases
    (a) 3 and 4
    (b) 1, 2 and 4
    (c) Only 4
    (d) 1 and 2
11. Match the following columns and select the correct option **(2020 Covid Re-NEET)**

Column - I		**Column - II**	
1.	Pneumotaxic Centre	(i)	Alveoli
2.	0_2 dissociation curve	(ii)	Pons region of brain
3.	Carbonic anhydrase	(iii)	Haemoglobin
4.	Primary site of exchange of gases	(iv)	RBC

1 2 3 4
(a) (ii) (iii) (iv) (i)
(b) (iii) (ii) (iv) (i)
(c) (iv) (i) (iii) (ii)
(d) (i) (iii) (ii) (iv)

12. Total Lung Capacity (TLC) is the total volume of air accomodated in the lungs at the end of a forced inspiration. This includes **(2020 Covid Re-NEET)**
    (a) RV, ERV, IC and EC
    (b) RV, ERV, VC and FRC
    (c) RV, ERV, TV, and IRV
    (d) RV, IC, EC, and ERV
13. Due to increasing air-borne allergens and pollutants, many people in urban areas are suffering from respiratory disorder causing wheezing due to **(2019)**
    (a) Benign growth on mucous lining of nasal cavity
    (b) Inflammation of bronchi and bronchioles
    (c) Proliferation of fibrous tissues and damage of the alveolar walls
    (d) Reduction in the secretion of surfactants by pneumocytes
14. Tidal Volume and Expiratory Reserve Volume of an athlete is 500 mL and 1000 mL respectively. What will be his Expiratory Capacity if the Residual Volume is 1200 mL? **(2019)**
    (a) 1500 mL
    (b) 1700 mL
    (c) 2200 mL
    (d) 2700 mL
15. Which of the following option is correctly represent the lung conditions in asthma and emphysema respectively? **(2018)**
    (a) Inflammation of bronchioles; Decreased respiratory surface
    (b) Increased number of bronchioles; Increased respiratory surface
    (c) Increased respiratory surface; Inflammation of bronchioles
    (d) Decreased respiratory surface; Inflammation of bronchioles
16. Match the items given Column I with those in Column II and select the correct option given below **(2018)**

Column I		Column II	
(a)	Tidal volume	(i)	2500-3000 mL
(b)	Inspiratory Reserve volume	(ii)	1100-1200 mL
(c)	Expiratory Reserve volume	(iii)	500-550 mL
(d)	Residual volume	(iv)	1000-1100 mL

    (a) A-(iii) B-(ii) C-(i) D-(iv)
    (b) A-(iii) B-(i) C-(iv) D-(ii)
    (c) A-(i) B-(iv) C-(ii) D-(iii)
    (d) A-(iv) B-(iii) C-(ii) D-(i)
17. Which of the following is an occupational respiratory disorder? **(2018)**
    (a) Anthracis
    (b) Silicosis
    (c) Botulism
    (d) Emphysema
18. Lungs are made up of air-filled sacs, the alveoli. They do not collapse even after forceful expiration because of **(2017)**
    (a) Residual Volume
    (b) Inspiratory Reserve Volume
    (c) Tidal Volume
    (d) Expiratory Reserve Volume
19. Which of the following cannot be measured by spirometry? **(2017)**
    (a) Vital capacity
    (b) Tidal volume

(c) Inspiratory reserve volume
(d) Residual volume

20. Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because **(2016-II)**
(a) There is a positive intrapleural pressure
(b) Pressure in the lungs is higher than the atmospheric pressure
(c) There is a negative pressure in the lungs
(d) There is a negative intrapleural pressure pulling at the lung walls

21. Partial pressure of oxygen in the alveoli of the lungs is **(2016-II)**
(a) Less than that in the blood
(b) Less than that of carbon dioxide
(c) Equal to that in the blood
(d) More than that in the blood

22. Reduction in pH of blood will **(2016-I)**
(a) Reduce the rate of heart beat
(b) Reduce the blood supply to the brain
(c) Decrease the affinity of hemoglobin with oxygen
(d) Release bicarbonate ions by the liver

23. When you hold your breath which of the following gas changes in blood would first lead to the urge to breathe? **(2015 Re)**
(a) Rising CO_2 concentration
(b) Rising CO_2 and falling O_2 concentration
(c) Falling O_2 concentration
(d) Falling CO_2 concentration

24. Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs **(2014)**
(a) As carbamino-haemoglobin
(b) As bicarbonate ions
(c) In the form of dissolved gas molecules
(d) By binding to R.B.C

Answer Key

S1. Ans. (a)

S2. Ans. (c)

S3. Ans. (c)

S4. Ans. (d)

S5. Ans. (b)

S6. Ans. (d)

S7. Ans. (d)

S8. Ans. (d)

S9. Ans. (b)

S10. Ans. (d)

S11. Ans. (a)

S12. Ans. (c)

S13. Ans. (b)

S14. Ans. (a)

S15. Ans. (a)

S16. Ans. (b)

S17. Ans. (b)

S18. Ans. (a)

S19. Ans. (d)

S20. Ans. (d)

S21. Ans. (d)

S22. Ans. (c)

S23. Ans. (a)

S24. Ans. (b)

Solutions

S1. Ans.(a)

Therefore, the sequence is (D), (A), (C), (B), (E).

S2. Ans.(c)

The vital capacity (VC) of the lung is the maximum amount of air a person can expel form the lungs after a maximum inhalation. It is equal to the sum of inspiratory reserve volume (IRV), tidal volume (TV), and expiratory reserve volume (ERV).

S3. Ans.(c)

Option(c) is the correct answer Pneumotaxic centre is present in the pons region of the brain that can moderate the functions of the respiratory rhythm centre.

S4. Ans.(d)

Option (d) is the correct answer because statements (a), (c) and (e) are correct.

Viral capacity includes ERV, TV, and IRV

Vital capacity is the maximum volume of air a person can breathe in after a forced expiration or the maximum volume of air a person can breathe out after a forced inspiration.

S5. Ans.(b)

Option (b) is the correct answer because every 100 ml of oxygenated blood can deliver around 5 ml 0_2 to the tissues under normal physiological conditions.

S6. Ans.(d)

Option (d) is correct because the parts starting with the external nostrils upto the terminal bronchioles constitute the conducting part; whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system.

S7. Ans.(d)

$p0_2$ = 104 mm Hg; $pC0_2$ = 40 mmHg

S8. Ans.(d)

Favourable conditions required for the formation of oxyhaemoglobin at the alveoli is:. High $p0_2$. Low

$pC0_2$. Less H^+. Lower temperature

S9. Ans.(b)

In tissues, higher H^+concentration favours the dissociation of oxygen from oxyhaemoglobin. In the alveoli, high $p0_2$, low $pC0_2$, lesser H^+concentration and lower temperature are the factors favourable for the formation of oxyhaemoglobin.

S10. Ans.(d)

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. A similar rise in pulmonary volume is caused by the overall increase in thoracic volume. An increase in pulmonary volume decreases the intra-pulmonary pressure.

S11. Ans.(a)

Pneumotaxic centre can moderate the functions of the respiratory rhythm centre. It is present in the pons region of brain. Alveoli is the primary site for gaseous exchange. Nearly 70 per cent of carbon dioxide is transported by RBC as bicarbonate (HCO_3–) with the help of the enzyme carbonic anhydrase.

A sigmoid curve is obtained when percentage saturation of haemoglobin with 0_2 is plotted against the $P0_2$. This curve is called the Oxygen dissociation curve.

S12. Ans.(c)

Total Lung Capacity: 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.

S13. Ans.(b)

Asthma is a difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles.

It can be due to increasing air-borne allergens and pollutants. Asthma is an allergic condition. Many people in urban areas are suffering from this respiratory disorder.

S14. Ans.(a)

Tidal Volume = 500 ml

Expiratory Reserve Volume = 1000 ml

Expiratory Capacity = TV + ERV = 500 + 1000 = 1500 ml

S15. Ans.(a)

Asthma is a chronic lung disease that inflames and narrows the airways. It is the result of chronic inflammation of conducting zone of airways, especially the bronchi and bronchioles.

Emphysema is a chronic disorder in which alveolar walls are damaged due to which respiratory surface is decreased.

S16. Ans.(b)

Tidal volume – Normal volume of air displaced between normal inhalation and exhalation. It is about 500 ml.

Inspiratory reserve volume – Maximal amount of additional air that can be drawn into lungs by determined effort; it is 2500-3000 ml. Expiratory reserve volume – Forceful expiration after normal inspiration; It is volume is 1000-1100 ml. Residual volume – volume remaining in lungs after forceful expiration, measures 1100-1200 ml.

S17. Ans.(b)

Silicosis is caused by inhalation of dust containing silica. Defense mechanism of the body can not fully cope with the sitution. Long exposure can give rise to inflammation leading to serious lung damage. It is a form of occupational lung disease. Workers in such industries should wear protective masks.

S18. Ans.(a)

Residual volume (RV) : Volume of air remaining in lungs even after a forcible expiration. It is about 1100-1200 ml.

S19. Ans.(d)

Spirometer is used in the estimation of the volume of air involved in breathing movements. Vital capacity, tidal volume, inspiratory reserve and expiratory reserve can all be measured with a spirometer. Residual volume can not be measured by the spirometer because it is impossible to breath out completely.

S20. Ans.(d)

Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because there is a negative intrapleural pressure pulling at the lung walls.

S21. Ans.(d)

The partial pressure of oxygen in the alveoli (104mmHg) of the lungs is more than that in the blood. (95mmHg)

Respi-rator-y Gas	Atmo-spheric Air	Alveoli	Blood (Deoxy-genated)	Blood (Oxy-genated)	Tis-sues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

S22. Ans.(c)

Reduction in pH of blood will decrease the affinity of haemoglobin with oxygen.

S23. Ans.(a)

A chemosensitive area is situated adjacent to the rhythm centre which is highly sensitive to CO_2 and H^+ ions. Increase in these substances can activate this centre which in turn can signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated. The role of oxygen in the regulation of respiratory rhythm is quite insignificant.

S24. Ans.(b)

Bicarbonate = 70 percent of CO_2

RBCs = 20-25 percent of CO_2

Plasma = 7 percent of CO_2