

Q1. The primary site of exchange of gases in human lungs is:

- A. Bronchi
- B. Bronchioles
- C. Alveoli
- D. Trachea

Answer: C. Alveoli

Explanation: Alveoli are tiny, thin-walled, balloon-like structures surrounded by capillaries, where oxygen diffuses into blood and CO₂ diffuses out.

Q2. The volume of air remaining in the lungs after a normal expiration is known as:

- A. Residual volume
- B. Vital capacity
- C. Functional residual capacity
- D. Total lung capacity

Answer: C. Functional residual capacity

Explanation: Functional Residual Capacity = Expiratory Reserve Volume (ERV) + Residual Volume (RV); it prevents lung collapse after passive expiration.

Q3. Which of the following parameters will increase the affinity of hemoglobin for oxygen?

- A. Increased CO₂ concentration
- B. Increased temperature
- C. Decreased pH
- D. Decreased 2,3-BPG

Answer: D. Decreased 2,3-BPG

Explanation: Lower levels of 2,3-Bisphosphoglycerate shift the oxygen dissociation curve to the left, enhancing Hb's affinity for oxygen.

Q4. The majority of carbon dioxide is transported in the blood as:

- A. Dissolved CO₂ in plasma
- B. Carbamino-haemoglobin
- C. Bicarbonate ions
- D. Carbonic anhydrase

Answer: C. Bicarbonate ions

Explanation: Around 70% of CO₂ is transported as bicarbonate ions (HCO₃⁻), formed in RBCs and carried in plasma.

Q5. Which of the following is true about inspiration in humans?

- A. It is a passive process
- B. Diaphragm relaxes
- C. Thoracic volume decreases
- D. External intercostal muscles contract

Answer: D. External intercostal muscles contract

Explanation: During inspiration, external intercostal muscles and diaphragm contract, increasing thoracic volume and decreasing pressure.

Q6. Oxygen dissociation from hemoglobin is promoted by:

- A. High oxygen concentration
- B. Low carbon dioxide concentration
- C. Low temperature
- D. Low pH

Answer: D. Low pH

Explanation: In acidic conditions (low pH), hemoglobin releases oxygen more readily — called the Bohr effect.

Q7. Which of the following correctly represents the total lung capacity?

- A. TV + IRV + ERV
- B. VC + RV
- C. ERV + RV
- D. IRV + ERV + RV

Answer: B. VC + RV

Explanation: Total Lung Capacity (TLC) = Vital Capacity (VC) + Residual Volume (RV); it represents the total volume the lungs can hold.

Q8. Which of the following respiratory volumes cannot be measured by a spirometer?

- A. Inspiratory reserve volume
- B. Expiratory reserve volume
- C. Tidal volume
- D. Residual volume

Answer: D. Residual volume

Explanation: RV is the volume of air left in the lungs after forceful expiration and cannot be measured directly by spirometry.

Q9. Which of the following enzymes is present in red blood cells and catalyzes the conversion of CO_2 to bicarbonate?

- A. Pepsin
- B. Carbonic anhydrase
- C. Trypsin
- D. Amylase

Answer: B. Carbonic anhydrase

Explanation: Carbonic anhydrase rapidly catalyzes $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 \rightleftharpoons \text{H}^+ + \text{HCO}_3^-$ in RBCs, aiding in CO_2 transport.

Q10. At high altitudes, the oxygen dissociation curve shifts:

- A. To the left
- B. To the right
- C. Upward
- D. Downward

Answer: B. To the right

Explanation: At high altitudes, low oxygen levels and higher CO_2 /lactic acid cause a rightward shift, enhancing oxygen unloading to tissues.

Q11. Which of the following is not a characteristic of the alveoli?

- A. Large surface area
- B. Moist inner lining
- C. Thick epithelium
- D. Rich capillary network

Answer: C. Thick epithelium

Explanation: Alveoli have very thin (single-layered) squamous epithelium to allow efficient diffusion of gases. Thick walls would hinder gas exchange.

Q12. The respiratory rhythm in humans is primarily regulated by:

- A. Cerebral cortex
- B. Pneumotaxic centre
- C. Medullary respiratory centre
- D. Chemoreceptors

Answer: C. Medullary respiratory centre

Explanation: The medulla oblongata (specifically the medullary respiratory centre) is responsible for generating the basic rhythm of breathing.

Q13. Which of the following changes would cause a rightward shift in the oxygen dissociation curve?

- A. Low CO_2
- B. Low temperature
- C. Low pH
- D. High pH

Answer: C. Low pH

Explanation: A decrease in pH (acidic conditions) favors oxygen release (Bohr effect), shifting the curve to the right.

Q14. Match the following respiratory volumes with their approximate average values in a healthy adult male:

Column I

Column II

A. Tidal Volume 1. 1100 mL

B. Inspiratory Reserve Vol 2. 500 mL

C. Expiratory Reserve Vol 3. 2500–3000 mL

D. Residual Volume 4. 1100–1200 mL

Options:

A. A-2, B-3, C-1, D-4

B. A-3, B-2, C-1, D-4

C. A-1, B-4, C-2, D-3

D. A-2, B-1, C-4, D-3

Answer: A. A-2, B-3, C-1, D-4

Explanation:

Tidal Volume: 500 mL

Inspiratory Reserve Volume: 2500–3000 mL

Expiratory Reserve Volume: ~1100 mL

Residual Volume: ~1100–1200 mL

Q15. The Haldane effect describes:

- A. The dissociation of oxygen from oxyhemoglobin
- B. The promotion of CO₂ transport by deoxygenated hemoglobin
- C. The role of bicarbonate in buffering blood pH
- D. The effect of pH on hemoglobin affinity for oxygen

Answer: B. The promotion of CO₂ transport by deoxygenated hemoglobin

Explanation: According to the Haldane effect, deoxygenated hemoglobin binds more CO₂, facilitating CO₂ transport in venous blood.

Q16. Assertion (A): Vital capacity increases in trained athletes.

Reason (R): Regular exercise improves the strength of respiratory muscles.

- A. Both A and R are true, and R is the correct explanation of A
- B. Both A and R are true, but R is not the correct explanation of A
- C. A is true, R is false
- D. A is false, R is true

Answer: A. Both A and R are true, and R is the correct explanation of A

Explanation: Exercise improves diaphragm and intercostal muscle strength, increasing lung efficiency and vital capacity.

Q17. The exchange of gases between blood and tissues is primarily by:

- A. Osmosis

- B. Active transport
- C. Simple diffusion
- D. Facilitated diffusion

Answer: C. Simple diffusion

Explanation: The gas exchange occurs down their partial pressure gradients via simple diffusion, requiring no energy.

Q18. Which of the following statements is correct about carbon monoxide poisoning?

- A. CO binds to hemoglobin more weakly than oxygen
- B. CO is less toxic than CO₂
- C. CO competes with oxygen for binding to hemoglobin
- D. CO increases oxygen delivery to tissues

Answer: C. CO competes with oxygen for binding to hemoglobin

Explanation: Carbon monoxide binds to hemoglobin with 200–250 times more affinity than oxygen, reducing oxygen transport.

Q19. The partial pressure of oxygen in alveolar air is approximately:

- A. 40 mm Hg
- B. 45 mm Hg
- C. 104 mm Hg
- D. 120 mm Hg

Answer: C. 104 mm Hg

Explanation: In the alveoli, the partial pressure of oxygen is around 104 mm Hg, facilitating diffusion into blood.

Q20. Which of the following correctly explains why breathing rate increases during exercise?

- A. Decrease in CO_2 levels in blood
- B. Increase in pH of blood
- C. Increase in CO_2 and H^+ in blood
- D. Decrease in body temperature

Answer: C. Increase in CO_2 and H^+ in blood

Explanation: During exercise, CO_2 and lactic acid increase, lowering pH. This stimulates chemoreceptors, increasing breathing rate.

Q21. Which structure prevents food from entering the trachea during swallowing?

- A. Glottis
- B. Larynx
- C. Epiglottis
- D. Uvula

Answer: C. Epiglottis

Explanation: The epiglottis is a flap-like structure that covers the glottis during swallowing, preventing food from entering the windpipe.

Q22. The majority of CO_2 is transported in blood:

- A. Dissolved in plasma
- B. As carbamino-hemoglobin

- C. As bicarbonate ions
- D. As carbonic acid

Answer: C. As bicarbonate ions

Explanation: About 70% of CO_2 is transported as bicarbonate ions (HCO_3^-) in the plasma, following its conversion from carbonic acid.

Q23. Choose the correct statement regarding respiratory volumes:

- A. Residual Volume can be measured directly by spirometer
- B. Tidal Volume decreases during deep breathing
- C. Vital Capacity = IRV + TV + ERV
- D. Total Lung Capacity = IRV + TV + ERV

Answer: C. Vital Capacity = IRV + TV + ERV

Explanation: VC includes inspiratory reserve volume, tidal volume, and expiratory reserve volume. Residual volume cannot be measured by spirometry.

Q24. Match the following gases with their relative partial pressures in alveolar air (mm Hg):

Gas	Pressure
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- A. O_2 1. 40
- B. CO_2 2. 104
- C. N_2 3. 597
- D. H_2O vapor 4. 47

Options:

- A. A-2, B-1, C-3, D-4
- B. A-3, B-2, C-1, D-4
- C. A-1, B-2, C-4, D-3
- D. A-2, B-3, C-1, D-4

Answer: A. A-2, B-1, C-3, D-4

Explanation:

O₂: ~104 mm Hg

CO₂: ~40 mm Hg

N₂: ~597 mm Hg

Water vapor: ~47 mm Hg

Q25. The chloride shift in RBCs occurs to:

- A. Maintain osmotic balance
- B. Maintain electrochemical neutrality
- C. Transport oxygen more efficiently
- D. Prevent CO₂ accumulation in tissues

Answer: B. Maintain electrochemical neutrality

Explanation: The chloride shift (Hamburger phenomenon) maintains ionic balance when HCO₃⁻ exits RBCs, Cl⁻ enters.

Q26. Which statement is incorrect about hemoglobin?

- A. It binds oxygen at high pO_2
- B. It helps transport CO_2
- C. One molecule of Hb carries 8 oxygen atoms
- D. Hb has higher affinity for CO than O_2

Answer: B. It helps transport CO_2

Explanation: While Hb can carry some CO_2 (as carbamino-Hb), major CO_2 is transported as bicarbonate, so this is relatively incorrect in emphasis.

Q27. Assertion (A): A high altitude climber may experience hyperventilation.

Reason (R): Oxygen pressure decreases with altitude.

- A. Both A and R are true, and R is the correct explanation of A
- B. Both A and R are true, but R is not the correct explanation of A
- C. A is true, R is false
- D. A is false, R is true

Answer: A. Both A and R are true, and R is the correct explanation of A

Explanation: Low pO_2 at high altitudes causes the body to compensate by increasing the breathing rate (hyperventilation).

Q28. In which form is oxygen transported in blood?

- A. Only dissolved in plasma
- B. Mostly bound to plasma proteins

- C. Mostly bound to hemoglobin
- D. As bicarbonate

Answer: C. Mostly bound to hemoglobin

Explanation: About 97% of O_2 is carried by hemoglobin in the blood; only 3% is dissolved in plasma.

Q29. What happens to the affinity of hemoglobin for oxygen when CO_2 concentration increases?

- A. Increases
- B. Decreases
- C. Remains the same
- D. Initially increases then decreases

Answer: B. Decreases

Explanation: This is the Bohr effect – higher CO_2 (or lower pH) reduces hemoglobin's affinity for O_2 , promoting oxygen release to tissues.

Q30. During expiration, the diaphragm:

- A. Contracts and flattens
- B. Relaxes and becomes dome-shaped
- C. Contracts and becomes dome-shaped
- D. Relaxes and flattens

Answer: B. Relaxes and becomes dome-shaped

Explanation: During expiration, the diaphragm relaxes, resuming its dome shape, pushing air out of the lungs.

Q31. Which of the following factors shifts the oxygen dissociation curve to the right?

- A. Decreased CO₂ concentration
- B. Decreased temperature
- C. Increased pH
- D. Increased 2,3-BPG (bisphosphoglycerate)

Answer: D. Increased 2,3-BPG

Explanation: 2,3-BPG, low pH, high CO₂, and high temperature reduce Hb's affinity for O₂, causing a right shift, enhancing O₂ release to tissues.

Q32. A person with an obstructive lung disease is most likely to show:

- A. Increased vital capacity
- B. Decreased residual volume
- C. Increased total lung capacity
- D. Decreased expiratory reserve volume

Answer: D. Decreased expiratory reserve volume

Explanation: In obstructive lung diseases (e.g., asthma, emphysema), air trapping reduces the ability to exhale forcibly, lowering ERV.

Q33. The total surface area available for gas exchange in human lungs is approximately:

- A. 50 m²
- B. 70 m²
- C. 10 m²

D. 30 m²

Answer: B. 70 m²

Explanation: Human lungs offer a very large surface area (~70 m²) for efficient gas exchange through millions of alveoli.

Q34. Which is correctly matched?

- A. Apneustic center – inhibits inspiration
- B. Pneumotaxic center – promotes inspiration
- C. Chemosensitive area – sensitive to O₂ only
- D. Medullary rhythm center – generates respiratory rhythm

Answer: D. Medullary rhythm center – generates respiratory rhythm

Explanation: The medullary respiratory center in the brainstem initiates and maintains breathing rhythm. Pneumotaxic center limits inspiration.

Q35. Which chemical is responsible for triggering respiration primarily?

- A. O₂
- B. CO₂
- C. CO
- D. N₂

Answer: B. CO₂

Explanation: Respiration is primarily regulated by CO₂ levels (and H⁺ ions) detected by chemosensitive areas in the medulla.

Q36. Arrange the following steps of respiration in correct sequence:

P. Diffusion of gases

Q. Breathing

R. Transport of gases

S. Utilization of oxygen by cells

A. $Q \rightarrow R \rightarrow P \rightarrow S$

B. $Q \rightarrow P \rightarrow R \rightarrow S$

C. $P \rightarrow Q \rightarrow R \rightarrow S$

D. $R \rightarrow Q \rightarrow P \rightarrow S$

Answer: B. $Q \rightarrow P \rightarrow R \rightarrow S$

Explanation:

1. Breathing (inspiration/expiration)

2. Gas diffusion (lungs \leftrightarrow blood)

3. Transport via blood

4. Cellular respiration using O_2

Q37. Correct statement regarding alveoli:

- A. Each lung has 10,000 alveoli
- B. They have thick squamous epithelial lining
- C. They are richly supplied with blood vessels
- D. Their surface is dry to prevent infection

Answer: C. They are richly supplied with blood vessels

Explanation: Alveoli are thin-walled and highly vascular, maximizing gas exchange.

Q38. During exercise, which change is likely in a healthy person?

- A. Decreased CO₂ production
- B. Rightward shift of O₂ dissociation curve
- C. Decreased oxygen demand
- D. Reduced tidal volume

Answer: B. Rightward shift of O₂ dissociation curve

Explanation: During exercise, more CO₂ is produced, temperature increases, and pH drops – all leading to a rightward shift in the O₂-Hb curve.

Q39. Match the lung volume/capacity with its approximate value (in mL):

- | A. Tidal Volume (TV) | 1. 4800
- | B. Inspiratory Reserve Vol. | 2. 500
- | C. Residual Volume (RV) | 3. 1200
- | D. Vital Capacity (VC) | 4. 3000

Options:

- A. A-2, B-4, C-3, D-1
- B. A-1, B-4, C-2, D-3
- C. A-2, B-3, C-4, D-1
- D. A-3, B-2, C-1, D-4

Answer: A. A-2, B-4, C-3, D-1

Explanation:

Tidal Volume = 500 mL

IRV = 3000 mL

RV = 1200 mL

VC = 4800 mL

Q40. Carbon monoxide causes death because:

- A. It stimulates the brain's respiratory center
- B. It inhibits glycolysis
- C. It forms a stable complex with hemoglobin
- D. It breaks alveolar walls

Answer: C. It forms a stable complex with hemoglobin

Explanation: CO forms carboxyhemoglobin, which binds ~200x more tightly than O₂, blocking oxygen transport.

Q41. In which condition will the affinity of Hb for O₂ be highest?

- A. High temperature, low pH
- B. High CO₂ concentration
- C. Low temperature, high pH
- D. Exercise

Answer: C. Low temperature, high pH

Explanation: These are favorable conditions for O₂ binding, shifting the curve to the left (greater affinity).

Q42. Which of the following does not occur during inspiration?

- A. Diaphragm contracts
- B. Volume of thoracic cavity increases
- C. Intrapulmonary pressure rises
- D. Air enters lungs

Answer: C. Intrapulmonary pressure rises

Explanation: During inspiration, intrapulmonary pressure decreases, drawing air into the lungs.

Q43. The pneumotaxic center in the brain is located in:

- A. Cerebellum
- B. Medulla
- C. Pons
- D. Hypothalamus

Answer: C. Pons

Explanation: The pneumotaxic center, located in the pons, regulates the duration of inspiration and helps maintain respiratory rhythm.

Q44. Which one is not a part of respiratory volumes measurable using a spirometer?

- A. Tidal Volume
- B. Vital Capacity
- C. Inspiratory Reserve Volume
- D. Residual Volume

Answer: D. Residual Volume

Explanation: Residual Volume (RV) remains in the lungs after forced expiration and cannot be measured by a spirometer.

Q45. Which statement is false?

- A. Lungs are located in thoracic cavity
- B. Alveoli are the main site of gaseous exchange
- C. CO_2 is more soluble in blood than O_2
- D. Hb binds CO_2 more strongly than CO

Answer: D. Hb binds CO_2 more strongly than CO

Explanation: Hb binds CO much more strongly than either O_2 or CO_2 , making it highly toxic.