

BREATHING AND EXCHANGE OF GASES

INTRODUCTION

EXERCISE - I

1. Skin of man cannot act as respiratory organ because
 - a. It is dry
 - b. It is not thin
 - c. It is not permeable to and
 - d. All of these
2. In cockroach inspiration is brought about by
 - a. Contraction of tergo - sternal muscles
 - b. Relaxation of tergo-sternal muscles
 - c. Relaxation of abdominal muscles and it is a passive process
 - d. Both 2 & 3
3. In birds exchange of gases occurs
 - a. First in the lungs and then in air sacs
 - b. First in the air sacs and then in lungs
 - c. Simultaneously in lungs and air sacs
 - d. In the lungs only and not in air sacs
4. In frog, cutaneous respiration takes place
 - a. Only in water when pulmonary respiration does not take place
 - b. Only in water, but along with pulmonary respiration
 - c. Only on land
 - d. Always
5. Inspiration in frog is caused due to
 - a. Suction force caused by buccopharyngeal cavity
 - b. Force pump action of buccopharyngeal cavity
 - c. Elasticity of the lungs
 - d. Suction force provided by abdominal walls
6. In the birds exchange of gases takes place in
 - a. Alveoli
 - b. Parabronchi
 - c. Air sacs
 - d. All of these
7. The process of respiration is concerned with
 - a. In take of oxygen
 - b. Liberation of oxygen
 - c. Liberation of carbon dioxide
 - d. Liberation of energy

8. In which of these, skin serves as an accessory organ of respiration
a. Rabbit b. Frog c. Lizards d. Birds

Key:

1. c 2. d 3. d 4. c 5. a 6. b 7. d 8. b

EXERCISE - II

1. Which one of these statements is correct :
a. All the animals need O₂ for respiration
b. In all animals O₂ is transported by blood
c. All animals take O₂ from water or air through gills or lungs
d. All animals require a medium for cellular respiration

Key: 1. d

EXERCISE - III

In each of the following question a statement of **Assertion (A)**: is given followed by a corresponding statement of

Reason (R): just below it. Of the statements, mark the correct answer as

- a. If both assertion and reason are true and reason is the correct explanation of assertion
b. If both assertion and reason are true but reason is not the correct explanation of assertion
c. If assertion is true but reason is false
d. If both assertion and reason are false
e. If assertion is false but reason is true.

1. **Assertion (A)** : In cockroach inspiration is a passive process

Reason (R): Expansion of abdominal cavity allows the space of expansion of tracheal trunk, as a result air enters through spiracle.

- a. If both Assertion & Reason are true and the reason is the correct explanation of the assertion
b. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion.
c. If Assertion is true statement but Reason is false
d. If both Assertion and Reason are false statements.

2. **Assertion (A):** Oxidation of nutrients releases bond energy
Reason (R): Oxidation of nutrients is done by using molecular oxygen
3. **Assertion (A) :** Aerobic animals are not truly aerobic
Reason (R): They produce lactic acid anaerobically
4. **Assertion (A):** Aerobic respiration involves the exchange of respiratory gases twice
Reason (R): Exchange occurs from lung to heart and then heart to lung
5. **Assertion (A) :** Insects develops complex system of air tubes called trachea for respiratory purpose
Reason (R): Exchange through body surface is not possible in insects
6. **Assertion (A):** Most fish when out of water die of suffocation
Reason (R): Atmospheric air contains far less oxygen content than the dissolved oxygen in water
7. **Assertion (A):** Earthworms come out of their burrows on rainy days.
Reason (R): Rainwater fills their burrows, depriving them of O₂
8. **Assertion (A):** Respiration is most efficient in the insects.
Reason (R): In the insects, air is carried directly to the cells by tracheoles
9. **Assertion (A):** In cockroach, inspiration is a passive process while expiration is an active process.
Reason (R): Tracheas of cockroach form an extensive network and extends up to the body cells

Key:

1. b 2. a 3. a 4. b 5. b 6. B 7. a 8. a 9. b

EXERCISE - IV

1. Identify the correct representation of aerobic respiration reaction
 - a. $C_6H_{12}O_6 + 6H_2O + 6CO_2 \rightarrow O_2 + 6H_2O + 686 \text{ K. Cal Energy}$
 - b. $C_6H_{12}O_6 + 6H_2O + 6O_2 \rightarrow 6CO_2 + 12H_2O + 686 \text{ K. Cal Energy}$
 - c. $C_6H_{12}O_6 + 6H_2O + 6O_2 \rightarrow 6O_2 + 6H_2O + 686 \text{ K. Cal Energy}$
 - d. $C_6H_{12}O_6 + 6H_2O + 6O_2 \rightarrow 6CO_2 + 12H_2O + 986 \text{ K. Cal Energy}$

Key:

1. b

RESPIRATORY SYSTEM OF HUMAN

EXERCISE - I

1. In man which of the following structure is analogous to the spiracles of cockroach?
a. Alveoli b. Bronchioles c. Lungs d. Nostrils
2. Conchae are located in
a. Trachea b. Bronchioles c. Ventricle d. Nasal chambers
3. Glottis is opening in the floor of
a. Diaphragm b. Pharyngeal cavity c. Trachea d. None of these
4. Adams apple is another name for
a. Sound box in birds b. Sound box in man c. Epiglottis d. Thyroid cartilage
5. Ring like cartilage of larynx is known as
a. Thyroid cartilage b. Arytenoid cartilage
c. Cricoid cartilage d. Cartilage of Santorini
6. Which of the following prevents collapsing of trachea?
a. Muscles b. Diaphragm c. Ribs d. Cartilaginous rings
7. Trachea is lined with incomplete rings of
a. Fibrous cartilage b. Calcified cartilage c. Elastic cartilage d. Hyaline cartilage
8. The covering of the lung is called
a. Pericardium b. Perichondrium c. Pleural membrane d. Peritoneum
9. The terminal bronchiole is lined by
a. Simple squamous epithelium b. Ciliated columnar or cuboidal epithelium
c. Stratified epithelium d. Pseudostratified epithelium
10. In alveoli surfactant is produced by
a. Type I pneumocyte b. Type II pneumocyte c. Kupffer's cells d. Dust cells
11. In an adult the ratio of physiological and anatomical dead space is :
a. 2 : 1 b. 1 : 3 c. 3: 1 d. 1: 1
12. Common factor in the trachea of mammals and insects is
a. Ciliated inner lining b. Paired nature
c. Non-collapsible wall d. C-shaped rings

13. Which of the following is paired cartilage?
a. Cricoid b. Arytenoid c. Thyroid d. Epiglottis
14. Total surface area of human alveoli in lungs is
a. 1 m^2 b. 10 m^2 c. 100 m^2 d. 1000 m^2
15. Adam's apple in man represents
a. Arytenoid cartilage of larynx b. Thyroid cartilage of larynx
c. Cricoid cartilage of larynx d. Cartilage of Santorini
16. The phospholipid acting as surfactant i.e., reduces surface tension and keeps the lungs inflated and prevent alveolar collapsing is
a. Cephalin b. Lecithin c. Sphingomyelin d. Cerebroside
17. "Cartilages of santorini" are present on
a. Ventral and lateral walls of the larynx b. The tips of cricoid cartilage
c. The tips of arytenoid cartilages d. Posterior side of Trachea
18. Identify the largest cartilage from the following
a. Thyroid b. Cricoid c. Arytenoid d. Cartilages of santorini
19. In rabbit each alveolus is lined by
a. Simple cuboidal epithelium b. Simple squamous epithelium
c. Simple columnar epithelium d. Pseudostratified epithelium
20. Thyroid cartilage of larynx and C- shaped cartilage of trachea are incomplete on
a. ventral surface b. dorsal surface
c. dorso- ventral surface d. ventro – lateral surface
21. The part of the nasal chamber which act as natural air conditioner is
a. Olfactory part b. Vestibular part c. Respiratory part d. All the above
22. Epiglottis arises from this cartilage of larynx
a. Cricoid b. Arytenoid c. Thyroid d. All the above
23. The space between the two vocal cords is called
a. Glottis b. Rima glottides c. Epiglottis d. Turbinals
24. Which of the following is not a character of respiratory surface?
a. Thin, permeable to gases b. Extensive
c. Least vascular d. Moist

25. The tracheal cartilaginous rings in mammals are
- a. Complete rings
 - b. Incomplete ventrally
 - c. Incomplete dorsally
 - d. Incomplete laterally
26. In man lungs are made up of
- a. Two lobes in left and right both
 - b. Left by two lobes and right by three lobes
 - c. Right by two lobes and left by two lobes
 - d. Both are made up of three lobes
27. The parts of respiratory tract of rabbit whose walls are supported by incomplete cartilaginous rings are lined by
- a. Ciliated columnar epithelium
 - b. Simple squamous epithelium
 - c. Pseudo stratified ciliated epithelium
 - d. Stratified nonkeratinized squamous epithelium
28. Azygous lobes are
- a. Lobes of left lung of rabbit
 - b. Left side lobes of liver of rabbit
 - c. Right side lobes of liver of rabbit
 - d. Lobes of right lung of rabbit
29. Vocal cords of rabbit extend between
- a. Cricoid and arytenoids cartilages
 - b. Thyroid and arytenoid cartilages
 - c. Cricoid and thyroid cartilage
 - d. Thyroid and epiglottis
30. Larynx of rabbit anteriorly opens into
- a. Trachea by glottis
 - b. Laryngopharynx by gullet
 - c. Trachea by gullet
 - d. Laryngopharynx by glottis
31. The ring like structure present behind the thyroid cartilage is
- a. Arytenoid cartilage
 - b. Cartilage of Santorini
 - c. Epiglottis
 - d. Cricoid cartilage
32. Respiratory system derived from
- a. Endoderm
 - b. Mesoderm
 - c. Ectoderm
 - d. Both 1 & 2

33. The alveolar epithelium in the lungs is
- a. Nonciliated columnar
 - b. Nonciliated squamous
 - c. Ciliated columnar
 - d. Ciliated squamous

Key:

1. d 2. d 3. b 4. d 5. c 6. D 7. d 8. c 9. b 10. b
11. d 12. C 13. b 14. c 15. b 16. b 17. c 18. a 19. b 20. b
21. c 22. c 23. b 24. c 25. c 26. b 27. c 28. c 29. b 30. d
31. d 32. a 33. b

EXERCISE - II

1. Trachea of human beings possesses
 - a. Incomplete cartilaginous rings
 - b. Complete cartilaginous rings
 - c. Thick fibrous wall
 - d. Thick muscular wall
2. A major function of surfactant is to
 - a. Decrease alveolar surface tension
 - b. Increase alveolar surface tension
 - c. Increase the work of breathing
 - d. Increase the tendency of the lungs to collapse
3. The following statements are true about surfactant except
 - a. It is secreted by type II cells of alveolar epithelium
 - b. It reduces surface tension
 - c. It decreases the efficiency of lung
 - d. It ensures stability of the alveoli
4. Mammalian lungs have enormous number of minute alveoli (Air sacs). It is to allow
 - a. More space for increasing the volume of inspired air
 - b. More surface area for diffusion of gases
 - c. More spongy texture for keeping lungs in proper shape
 - d. More nerve supply to keep organs active when working

Key: 1. a 2. a 3. c 4. b

EXERCISE - III

In each of the following question a statement of **Assertion (A)** is given followed by a corresponding statement of

Reason (R) just below it. Of the statements, mark the correct answer as

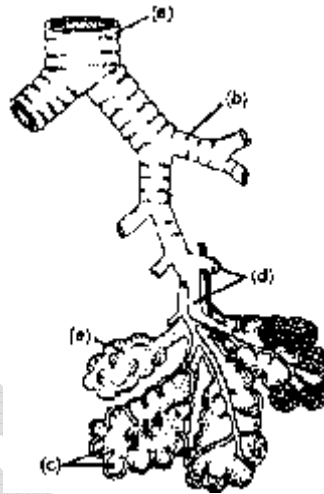
- If both assertion and reason are true and reason is the correct explanation of assertion
 - If both assertion and reason are true but reason is not the correct explanation of assertion
 - If assertion is true but reason is false
 - If both assertion and reason are false
 - If assertion is false but reason is true.
- Assertion (A):** Voice of women and children is high pitched whereas that of men is low pitched
Reason (R): Vocal cords of men are longer than of woman and children
 - Assertion (A):** Alveoli of lung of man are lined by lecithin phospholipid.
Reason (R): Lecithin lowers the surface tension and prevents collapsing of alveolar walls.
 - Assertion (A):** Each alveolus acts as a miniature lung.
Reason (R): Alveoli provide about 100 sq. m. surface area of respiration, which is about 50 times than that of skin.

Key: 1. a 2. a 3. a

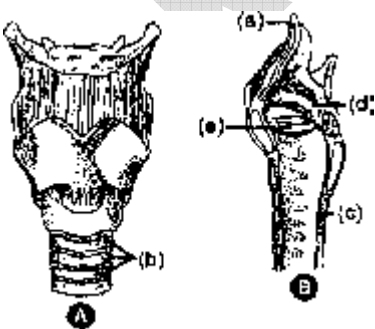
EXERCISE - IV

- Number of alveoli in the human lungs has been estimated to be approximately
a. 100 million b. 300 million c. 125 million d. 300 billion
- The total number of lobes present with the lungs of rabbit are
a. 3 + 2 b. 4 + 2 c. 4 + 3 d. 3 + 3
- The volume of air present in the 'conducting zone' of the respiratory passage i.e., from nose and mouth up to the terminal bronchioles is called
a. Anatomical dead space b. Physiological dead space
c. Total dead space d. All of these
- A swimmer breathing through a pipe has a respiration rate of 10/min a tidal volume of 550 ml and an effective anatomic dead space of 250 ml. What is his alveolar ventilation?
a. 2500 ml/min b. 3000 ml/min c. 3500 ml/min d. 4000 ml/min

5. What will happen if pleural fluid is absent from pleural space?
- a. Nothing will happen
 - b. Pleural membranes will stick to each other
 - c. Lungs will slip over pleura during breathing
 - d. Pleural membranes press against each other to form mediastinal septum
6. (i) Study the given figure of respiratory passage carefully. Parts are labeled as a, b, c, d and e. Label these parts.
- (ii) How many secondary bronchi are there in right and left human lung?
- (iii) What is the approximate length and width of human trachea (wind pipe)?
- (iv) What is the role of epiglottis?
- (v) In which body cavity the lungs are located?



7. Study the figure depicting human larynx carefully and answer the following questions :
- (i) Some parts are labeled (a), (b), (c), (d), (e). Name them
- (ii) Write one major function of each of these.



Key: 1. a 2. b 3. a 4. b 5. b

6. (i)

(a) Alveolar sac (b) Secondary bronchus

(c) Alveoli (air sacs) (d) Bronchioles

(e) Trachea

(ii) 3 & 2 respectively

(iii) 11cm long and 2.5cm wide

(iv) It closes the glottis, during swallowing to check the entry of food into wind pipe.

(v) Thoracic cavity

6. (i) (a) - Epiglottis,

(b) - Cartilaginous rings of trachea,

(c) - Trachea, (d) - Larynx,

(e) - Vocal cord

(ii) Functions of parts

(a) Epiglottis closes the glottis during swallowing to prevent the entry of food into wind pipe.

(b) Cartilaginous rings prevent the trachea from collapsing

(c) Trachea is a wind pipe for passage of air into

or out of the lungs.

(d) Larynx is called the voice box. It is instrumental in producing articulate human speech.

(e) Vocal cords help in producing sound.

MECHANISM OF BREATHING AND REGULATION

EXERCISE - I

1. Which of the following muscle contract during normal expiration?
 - a. Internal intercostal muscles
 - b. Diaphragm
 - c. Abdominal muscles
 - d. None of these
2. Chest movements are inconspicuous during
 - a. Normal breathing
 - b. Abdominal breathing
 - c. Thoracic breathing
 - d. Both 1 & 2
3. Ribs move outwards during respiration with
 - a. Intercostal muscles
 - b. Petrohyal muscles
 - c. Pharyngeal muscles
 - d. Phrenic muscles
4. The impulse for voluntary muscles for forced breathing starts in
 - a. Cerebellum
 - b. Medulla
 - c. Vagus nerve
 - d. Cerebrum
5. Respiratory control centre lies in
 - a. Pons
 - b. Medulla oblongata
 - c. Cerebrum
 - d. Both 1 & 2
6. Which of the following controls the switch off point of inspiration?
 - a. Apneustic centre
 - b. Pneumotaxic centre
 - c. Pons varoli
 - d. Cerebrum
7. Concentration of which of the following muscles is most important for causing forceful expiration :
 - a. Pharyngeal
 - b. Diaphragm
 - c. External intercostals
 - d. Internal intercostals
8. Breathing is controlled by
 - a. Lungs
 - b. Medulla
 - c. Hypothalamus
 - d. Intercostal muscles
9. The basis rhythm of respiration is generated in
 - a. Apneustic centre
 - b. Medulla oblongata
 - c. Pneumotaxic centre
 - d. Cerebrum
10. The most important function of diaphragm in mammals is
 - a. To aid in formation of oxyhaemoglobin
 - b. To aid in ventilation
 - c. To divide the body cavity into compartments
 - d. To aid in swallowing

11. Rate of breathing is directly affected by
 - a. Concentration of CO₂ in blood
 - b. Concentration of O₂ in blood
 - c. Concentration of O₂ in lung alveoli
 - d. Expansion of diaphragm
12. Herring Breuer reflex is related to
 - a. Pleural fluid between two pleural membranes
 - b. Chemoreceptors
 - c. Stretch receptors on the wall of bronchioles
 - d. Diaphragm
13. Respiratory mechanism is controlled by
 - a. Central nervous system
 - b. Sympathetic nervous system
 - c. Parasympathetic nervous system
 - d. Autonomic nervous system
14. At the time of inspiration, the diaphragm
 - a. Expands
 - b. Contracts
 - c. Relaxes
 - d. Does not undergo any change
15. When the internal intercostal muscles are contracted, the lungs are at
 - a. Expiratory reserve volume
 - b. Functional residual capacity (FRC)
 - c. Residual volume
 - d. Vital capacity
16. At high altitude, one will develop:
 - a. Respiratory alkalosis
 - b. Respiratory acidosis
 - c. Metabolic acidosis
 - d. Metabolic alkalosis
17. In breathing entering air becomes
 - a. Warm and filtered
 - b. Cold and then warm
 - c. Warm filtered and moistened
 - d. Cold, moistened.
18. Which one of the following structures is responsible for raising of throat?
 - a. Hyoglossus muscles
 - b. Sternohyoid muscles
 - c. Petrohyal muscles
 - d. Both 1 & 2
19. Muscles which help in respiration are
 - a. Sternum & petrohyal
 - b. Sternohyal & Petrohyal
 - c. Jugal & Tendons
 - d. Both 3 & 4

Key

1. d 2. d 3. a 4. d 5. d 6. B 7. d 8. b 9. b 10. b
11. a 12. C 13. a 14. b 15. c 16. a 17. c 18. C 19. b

EXERCISE - II

1. Rate and depth of respiration shall increase when
 - a. Oxygen concentration increases
 - b. concentration increases in alveolar air
 - c. Bicarbonate concentration increases
 - d. Bicarbonate concentration decreases
2. If the spinal cord is severed where it joins the brain stem, what would happen to breathing?
 - a. Inspiration occurs while expiration stops
 - b. Expiration occurs while inspiration stops
 - c. The length of inspiration increases abruptly
 - d. Both inspiration and expiration cease
3. If a man from sea coasts of Kerala goes to Mount Everest
 - a. His breathing rate and heart-beat will increase
 - b. His breathing rate and heart-beat will decrease
 - c. His breathing rate will increase, but heart beat will decrease
 - d. His breathing rate will decrease but heart beat will increase
4. Study the following about respiratory mechanism in rabbit.

I) Inspiration is an active process

II) Normal expiration is a passive process

III) Inspiration is an active process as it does not involve contraction of muscles

Correct combination:

- a. I and II b. II and III c. I and III d. I, II and III

5. Which one of the following is true during inspiration?
 - a. External inter costal muscles contract and radial muscles of the diaphragm also contract
 - b. External inter costal muscles relax and radial muscles of diaphragm also relax
 - c. External inter costal muscles contract and radial muscles of the diaphragm relax
 - d. External inter costal muscles relax and radial muscles of the diaphragm contracts

Key

1. b 2. d 3. b 4. a 5. a

EXERCISE - III

In each of the following question a statement of **Assertion (A)** is given followed by a corresponding statement of

Reason (R) just below it. Of the statements, mark the correct answer as

- If both assertion and reason are true and reason is the correct explanation of assertion
- If both assertion and reason are true but reason is not the correct explanation of assertion
- If assertion is true but reason is false
- If both assertion and reason are false
- If assertion is false but reason is true.

1. **Assertion (A):** Pneumotaxic centre control rate of respiration

Reason (R): Primarily it controls switch off point of inspiration

2. **Assertion (A):** Rate of breathing is

regulated by respiratory centers present in the medulla oblongata.

Reason (R): Changes in the CO₂ level of the arterial blood control the rate of breathing.

3. **Assertion (A):** Phrenic muscles of diaphragm are called principal expiratory muscles.

Reason (R): Contraction of these muscles decrease thoracic cavity to expel main part of foul air.

4. **Assertion (A):** Gaseous exchange continue in the lungs without interruption even during expiration

Reason (R): During expiration, volume of thorax increases and air is expelled out

5. **Assertion (A):** It is beneficial to respire through mouth than through the nasal openings

Reason (R): Air gets filtered when passed through the mouth

6. **Assertion (A):** Abdominal muscle is related to respiration in an animal

Reason (R): Relaxation of abdominal muscles draws in air

7. **Assertion (A):** Forceful expiration occurs through expiratory muscles

Reason (R): Expiratory muscles expires quickly

8. **Statement I (SI):** Forceful expiration is an active process

Statement II (SII): It involves the contraction of external intercostal muscles

- a. Both SI and SII are true and SII is the correct explanation of SI
- b. Both SI and SII are true and SII is not the correct explanation of SI
- c. SI is true and SII is false
- d. Both SI and SII is false

Key : 1. a 2. a 3. a 4. c 5. d 6. C 7. c 8. C

EXERCISE - IV

1. The, level in the expired air under normal condition is approximately
 - a. 46mm of Hg b. 100mm of Hg c. 32mm of Hg d. 116mm of Hg
2. Which of the following is not possible when pneumotaxic centre is sending a strong signal?
 - a. Rate of breathing increases b. Complete filling of lungs
 - c. Decreased duration of inspiration d. Decreased duration of expiration
3. Overstretching of the lungs is prevented due to
 - a. Bohr's effect b. Herring Breuer reflex
 - c. Conditionea reflex d. Haldane's effect
4. Hyperventilation leads to the stoppage of breathing for a brief period. This is due to
 - a. Increase in oxygen content
 - b. Decrease in blood carbon dioxide content
 - c. Increase in blood carbon dioxide content
 - d. Decrease in oxygen content

Key : 1. c 2. a 3. b 4. a

EXCHANGE OF GASES

EXERCISE - I

- Exchange of gases between alveolar air and alveolar capillaries occurs by
 - Osmosis
 - Active transport
 - Absorption
 - Diffusion
- The effect of CO_2 concentration on dissociation of oxyhaemoglobin was explained by
 - GS Carter
 - Yapp
 - William Hoar
 - Christian Bohr
- Oxygen hemoglobin dissociation curve will shift to right on decrease of
 - Acidity
 - Carbon dioxide concentration
 - Temperature
 - pH
- In the process of transport of CO_2 which phenomenon occurs between RBCs and plasma?
 - Osmosis
 - Adsorption
 - Chloride shift
 - Absorption
- Which of the following can be termed as opposite of Bohr's effect?
 - Haldane's effect
 - Hamburger's phenomenon
 - Hering - Breur reflex
 - None of these
- Which of the following gases makes the most stable combination with the haemoglobin of red blood cells?
 - CO_2
 - CO
 - O_2
 - N_2
- Site of gaseous exchange in lungs is :
 - Trachioles
 - Alveoli
 - Bronchioles
 - Pulmonary chambers
- In mammals, CO_2 is transported from tissues to respiratory surface by:
 - R. B. C. only
 - R. B. C. and W. B. C.
 - Plasma and R. B. C.
 - Plasma only
- The globin portion of the fetal hemoglobin-F is made of:
 - Two α -and two α -chains
 - Two α -and one β -chain
 - Two α -and two β -chains
 - One α -and one β -chain
- The difference in the number of iron atoms of hemoglobin and myoglobin is :
 - 2 iron atoms
 - 1 iron atom
 - 3 iron atoms
 - 4 iron atoms
- Oxygen carrying capacity of blood is
 - 40%
 - 100%
 - 20%
 - 98%
- Hemoglobin has highest affinity for which of the following gases?
 - Carbon monoxide
 - Carbon dioxide
 - Oxygen
 - Nitrogen

13. Blood carries CO₂ mainly in which form?
a. Hb. CO₂ b. Physical solution form
c. Carbonic acid d. NaHCO₃
14. Breakdown of oxyhemoglobin into oxygen and hemoglobin in the tissues will be increased if
a. Blood pH increases b. CO₂ in blood decreases
c. Blood pH decreases d. Free fatty acids decrease in blood
15. In human being partial pressure of CO₂ in expired and inspired air is
a. 0.3 mm Hg and 40 mm Hg b. 32 mm Hg and 0.3 mm Hg
c. 40 mm Hg and 46 mm Hg d. 40 mm Hg and 0.3 mm Hg
16. Oxygen dissociation curve of hemoglobin is
a. Sigmoid b. Hyperbolic c. Linear d. Hypobolic
17. During transport of CO₂, blood does not become acidic due to
a. Neutralization of H₂CO₃ by Na₂CO₃ b. Absorption by leucocytes
c. Blood buffers d. Non-accumulation
18. Partial pressure of oxygen in inspired and expired air is respectively
a. 158 mm of Hg and 116 mm of Hg b. 116 mm of Hg 158 mm of Hg
c. 46 mm of Hg and 40 mm of Hg d. 40 mm of Hg and 40 mm of Hg
19. Oxygen dissociation curve for myoglobin is
a. Parabolic b. Sigmoid c. Hyperbolic d. Linear
20. Sigmoid oxygen dissociation curve represents interrelationship between
a. PO₂ and PCO₂ b. PO₂ and pH of blood
c. PO₂ and oxyhaemoglobin formation d. PCO₂ and deoxyhaemoglobin formation
21. Respiratory rate increases twice/thrice with every 10°C rise in temperature. This is called
a. Haldane effect b. Hamburger phenomenon
c. Chloride shift d. Vant Hoff's law
22. Conc. of CO₂ is lowest in
a. Anatomical dead space after expiration b. The alveoli at the end of inspiration
c. In blood after inspiration d. Anatomical dead space after inspiration
23. In diffusion capacity of O₂ is 20 ml/min/Hg at rest; what will be diffusion capacity of CO₂
a. 20 b. 200 c. 400 d. 20,000
24. Shift to right of oxygen dissociation curve is seen in all except in
a. Increased concentration of 2, 3 DPG b. Hemophilia
c. Fever d. Decreased pH
25. Body tissue demand of O₂ at rest is:
a. 0.18 ml% b. 1-1.5 ml% c. 2-3 ml% d. 5 ml%
26. Most of the carbondioxide is carried to the lungs from the tissues in the form of
a. Carboxhaemoglobin b. Carbaminohaemoglobin
c. Carbonic acid d. Bicarbonate ions

27. One of the following can not enhance the unloading of oxygen from hemoglobin at the level of tissues
- a. Increase of CO₂ b. Increase of pH
- c. Decrease of pH d. Increase of temperature
28. Percentage of hemoglobin saturated in pulmonary vein is
- a. 40% b. 97% c. 45% d. 95%
29. Bohr Effect is related with
- a. Reduced oxygen level in hemoglobin b. Reduced carbon dioxide level in blood
- c. Reduced carbon level in lymph d. Oxidized phosphorus level in blood
30. Chloride shift helps in transporting
- a. O₂ b. CO c. CO₂ d. HCO₃+H⁺
31. Which of the following acts as buffer?
- a. Hydrogen b. Oxyhaemoglobin c. Carbondioxide d. Deoxyhemoglobin
32. The color of oxyhaemoglobin is
- a. dark red b. light red c. pale red d. bright red
33. Major amount of CO₂ is transported as
- a. Bicarbonate ions b. Carbondioxide
- c. Carbamino compound d. Carbonic anhydrase
34. The percentage saturation of hemoglobin near the tissue cells at rest will be
- a. 97% b. 50% c. 35% to 40% d. 75%
35. The combination of hemoglobin with O₂ in the blood can be promoted by
- a. Decreasing O₂ concentration b. Increasing O₂ concentration
- c. Increasing CO₂ concentration d. Decreasing CO₂ concentration

Key

1. d 2. d 3. d 4. c 5. a 6. B 7. b 8. c 9. a 10. c
11. d 12. A 13. d 14. c 15. b 16. a 17. c 18. A 19. c 20. c
21. d 22. d 23. c 24. B 25. d 26. d 27. b 28. b 29. a 30. c
31. d 32. d 33. a 34. c 35. b

EXERCISE - II

1. The combination of with hemoglobin can be increased mostly by
 - a. Increasing concentration in air
 - b. Decreasing concentration in blood
 - c. Increasing concentration in air
 - d. Decreasing concentration in blood
2. If level gets increased in the blood, it favours
 - a. Loading of in the blood
 - b. Unloading of in the blood
 - c. Decreased availability of oxygen to tissue
 - d. Both 1 & 3
8. What would happen if human blood becomes acidic?
 - a. O₂-carrying capacity of hemoglobin decreases
 - b. O₂-carrying capacity of hemoglobin increases
 - c. RBC count increases
 - d. RBC count decreases
4. Which statement correctly defines Bohr Effect?
 - a. Rise in P₅₀ with a decrease in CO₂ conc.
 - b. Rise in P₅₀ with an increase in CO₂ conc.
 - c. Rise in P₅₀ with an increase in pH and decrease in
 - d. Fall in with a decrease in pH
5. Structure through which oxygen must diffuse in passing from alveolar lumen to hemoglobin?
 - a. Surfactant containing liquid
 - b. Alveolar membrane, basement membrane
 - c. Capillary endothelium, plasma and RBC membrane
 - d. All of the above
6. Which of the following statement holds true for hemoglobin if the PCO₂ increases?
 - a. It must be exposed to a higher partial pressure of oxygen in order to become fully saturated
 - b. It will tend to release its oxygen at higher partial pressure of carbon dioxide.
 - c. It becomes less efficient at taking up oxygen and more efficient at releasing it.
 - d. All of these
7. Diffusion capacity is the volume of gas diffusing
 - a. Each second for pressure difference of 100 mm Hg
 - b. Each minute for pressure difference of 1 mm Hg
 - c. Each minute for pressure difference of 100 mm Hg
 - d. Each second for pressure difference of 1 mm Hg
8. One of the following statements is not correct
 - a. Reduced hemoglobin is more acidic than oxygenated Hb
 - b. 100 ml of blood can carry 19.8 ml of oxygen
 - c. Every deciliter of blood releases in lungs 3.7 ml of CO₂

- d. About 7% of CO_2 entering blood is converted into H_2CO_3 .
9. P_{50} means
- $p\text{O}_2$ at which the hemoglobin is half saturated with O_2
 - At $p\text{O}_2$ of 50 mm Hg, hemoglobin is half saturated with O_2
 - Amount of O_2 carried by blood does not change much even if $p\text{O}_2$ falls to 50 mm Hg
 - All of the above
10. The following are the statements regarding the transport of oxygen
- Very little amount of O_2 is transported by plasma in dissolved state
 - Major part of O_2 is transported by the RBC
 - The effect of CO_2 on O_2 carrying capacity is known as Bohr Effect
 - In tissues, where O_2 concentration is high oxyhaemoglobin dissociates and releases O_2
- Which of the above are correct?
- All except I
 - All except II
 - All except III
 - All except IV
11. The following are the statements regarding transport of gases in rabbit
- Most of the CO_2 is transported as carbamino compounds
 - Carbaminohemoglobin is formed in blood plasma
 - Carbonic anhydrase helps in both the formation and dissociation of carbonic acid
 - Most of the O_2 is transported in the form of oxyhaemoglobin
- Which of the above are correct?
- I and II only
 - III and IV only
 - I and III only
 - II, III and IV
12. Study the following statements regarding transport of gases and lung volumes and capacities
- Reaction between CO_2 and water in plasma occurs faster than in RBC
 - Formation and breakdown of carbonic acid in RBC are enhanced by carbonic anhydrase
 - Haemoglobin is 75% saturated when $p\text{O}_2$ is 40mm Hg
 - Maximum percentage of CO_2 is transported as carbamino compounds
- Which of the above are correct?
- III and IV
 - II, III and IV
 - I, III and IV
 - II and III

13. An increase in carbon dioxide concentration shifts the oxygen dissociation curve appears to the right because
- A higher CO_2 concentration displaces oxygen at a very rapid rate
 - A higher CO_2 concentration causes more oxygen to be given up at any given O_2 partial pressure
 - A higher CO_2 concentration drives more oxygen into blood
 - A higher CO_2 concentration drives less oxygen into blood
14. Percentage of hemoglobin saturated in pulmonary vein is
- 40%
 - 97%
 - 45%
 - 95%
15. Bohr Effect is due to the influence of
- An increase in blood glucose
 - Normal temperature
 - CO_2 and H^+ on the oxygen - affinity of hemoglobin
 - An increase in O_2 concentration
16. Blood transported to the lungs contain
- More amounts of MgCl in the plasma
 - More amounts of bicarbonates in the plasma
 - More amounts of urea in RBC
 - More amounts of oxyhaemoglobin in RBC
17. Hamburgers phenomenon is related to the
- Shifting of Cl^- ions from RBC into blood plasma and HCO_3^- into RBC from blood plasma
 - Shifting of HCO_3^- ions from RBC into blood plasma and Cl^- into RBC from blood plasma
 - Shifting of H^+ ions from RBC into blood plasma and Cl^- into RBC from blood plasma
 - Shifting of HCO_3^- ions from blood plasma into RBC and H^+ from RBC into blood plasma

Key

1. a 2. d 3. b 4. c 5. d 6. D 7. b 8. d 9. a 10. d
11. d 12. D 13. b 14. b 15. c 16. b 17. b

EXERCISE - III

In each of the following question a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as

- (a) If both assertion and reason are true and reason is the correct explanation of assertion
- (b) If both assertion and reason are true but reason is not the correct explanation of assertion
- (c) If assertion is true but reason is false
- (d) If both assertion and reason are false
- (e) If assertion is false but reason is true.

1. **Assertion (A):** Major part of carbondioxide is transported in the form of sodium bicarbonate

Reason (R): 0.3ml of carbondioxide is transported per 100ml of blood in dissolved state in plasma of blood

2. **Assertion (A):** Diffusion of carbondioxide is 20 times faster than oxygen

Reason (R): It is due to difference in partial pressure as well as solubility of diffusing gases.

3. **Assertion (A):** CO₂ is carried in the plasma mainly as HCO₃⁻ ions.

Reason (R) : Zinc containing enzyme carbonic anhydrase of RBC catalyses the formation of HCO₃⁻ ions that enter plasma

4. **Assertion (A):** Oxygen dissociation curve of hemoglobin is sigmoid.

Reason (R): Oxygen dissociation curve moves towards left-side with increase in CO concentration in the air.

5. **Assertion (A):** Chloride shift facilitates the transport of carbon dioxide as sodium bicarbonate in plasma.

Reason (R): For each Cl⁻ ion, one HCO₃⁻ ion diffuses into RBC from plasma to maintain electrical neutrality

6. **Assertion (A):** Oxygenation of blood promotes the release of carbon-dioxide from the blood in the lungs

Reason (R): Carbon dioxide is carried as bicarbonates in erythrocytes of blood

7. **Assertion (A):** At the level of lungs, as concentration of declines in RBC, HCO_3^- diffuses from plasma into RBC in exchange for Cl^- ions
- Reason (R):** At the level of tissues, to maintain electrical balance Cl^- ions diffuse from plasma into RBC
8. **Assertion (A):** Only about 10% of CO_2 from tissues is transported to lungs as carbonic acid
- Reason (R):** If all the CO_2 is transported as carbonic acid by plasma the pH of blood lowered from 7.4 to 4.4, which causes fatal effects
9. **Assertion (A):** More of oxygen is released from oxyhaemoglobin in a more active tissue than in a less active one
- Reason (R):** This is because partial pressure of carbon dioxide is very low in an active tissue than in active one
10. **Assertion (A):** Respiratory gas exchange occurs through osmosis
- Reason (R):** Respiratory gas goes from higher partial pressure region to the region of lower partial pressure
11. **Assertion (A):** Oxyhaemoglobin carries 1 to 4 molecules of oxygen in the blood
- Reason (R):** The capacity of oxyhaemoglobin depends on the degree of (Fe^{2+}) saturation with oxygen

Key : 1. a 2. a 3. b 4. c 5. a 6. C 7. c 8. a 9. c 10. a 11. c

EXERCISE - IV

1. The amount of oxygen transported by one liter of blood under strenuous condition is approximately
- a. 5ml b. 50ml c. 15ml d. 150ml
2. If oxyhaemoglobin dissociation curves are drawn for maternal and foetal hemoglobin, which of the following is true?
- a. Maternal curve will be on the right side b. Foetal curve will be on the right side
- c. Both will overlap each other d. It will depend upon level

3. Reverse of the chloride shift occurs during
 - a. Internal respiration
 - b. External respiration
 - c. Cellular respiration
 - d. Anaerobic respiration
4. Percentage amount of CO_2 carried or transported by Hb is
 - a. 10%
 - b. 80%
 - c. 70%
 - d. 23%
5. With the increase of temperature the respiratory rate will
 - a. increase
 - b. Decrease rapidly
 - c. Remain unaffected
 - d. Decrease slowly
6. The amount of oxygen which can be carried by one gm of hemoglobin is
 - a. 4.3 ml
 - b. 3.3 ml
 - c. 2.3 ml
 - d. 1.3 ml
7. The amount of oxygen which can be transported by 1 liter of blood is
 - a. 50 ml
 - b. 2 ml
 - c. 200 ml
 - d. 2000 ml
8. Number of oxygen molecules that can be carried by a molecule of haemoglobin are
 - a. 2
 - b. 4
 - c. 6
 - d. 8
9. What will be the change in graph depicting percentage saturation of oxyhaemoglobin and PO_2 (mm of Hg) with increase in H^+ concentration in blood?
 - a. Graph shifts to right
 - b. Graph shift to left
 - c. No change
 - d. Depends upon number of other factors so can't be predicted
10. How much time will take for consumption of 7500 ml O_2 by body tissue?
 - a. 100 min
 - b. 30 min
 - c. 15 min
 - d. Approx. 20 min
11. CO_2 content in arterial and venous blood respectively is:
 - a. 48 ml% and 52 ml%
 - b. 52 ml% and 48 ml%
 - c. 67 ml% and 52 ml%
 - d. 52 ml% and 67 ml%
12. Under normal conditions, the volume of O_2 delivered to the tissues by every 100ml of oxygenated blood is
 - a. 50ml
 - b. 5ml
 - c. 0.5ml
 - d. 4ml
13. During transportation of CO_2 from the tissues to the lungs, about 23% of CO_2 is transported in the form of carbamino compound through
 - a. Erythrocytes only
 - b. blood plasma only
 - c. Erythrocytes & blood plasma
 - d. Leucocytes only

14. A person met with an accident and died instantly without injury to heart brain, stomach and kidney. Which one of the following is the reason of death?
- a. intestine became twisted b. Red blood cells became coagulated
c. Stomach stopped digestion d. Diaphragm got punctured.

Key

1. a 2. a 3. b 4. a 5. a 6. D 7. a 8. b 9. a 10. b 11. a 12. b
13. c 14. d

RESPIRATORY DISORDERS & ABNORMALITIES

EXERCISE - I

1. When the separating wall of the alveoli breaks-up and the gas exchange area of the lung is reduced, the state is known as
- a. Pneumonia b. Tuberculosis c. Emphysema d. Cough
2. The mountain sickness in persons climbing to high altitudes without an aid of oxygen cylinders is one to
- a. Anemic hypoxia b. Arterial hypoxia
c. Lack of sufficient amount of hemoglobin d. Lack of sufficient number of erythrocytes
3. Cyanide poisoning will load to
- a. Hypoxic hypoxia b. Histotoxic hypoxia c. Stagnant hypoxia d. Anemic hypoxia
4. Asthma is caused due to
- a. Infection of trachea b. Infection of lungs
c. Bleeding into pleural cavity d. Spasm in bronchial muscles
5. Which of the following is related to occupational lung disease?
- a. Silicosis b. Asbestosis
c. Fibrosis of upper part of lung d. All of these
6. Breakdown of alveoli of lungs resulting in the reducing surface area for gas exchange is known as
- a. Emphysema b. Sneezing c. Pneumonia d. Tuberculosis

7. Protective respiratory blast is
a. Hiccapping b. Coughing c. Sneezing d. None of these
8. Low oxygen tension in the blood causes
a. Coughing b. Hiccups c. Sneezing d. Yawning
9. Pneumonia can be caused by
a. Bacteria (*Streptococcus pneumoniae*) b. Protozoan c. Fungi d. All of these
10. Asbestosis or silicosis is characterized by proliferation of fibrous tissue in
a. Respiratory tract b. Upper part of lung
c. Lower part of lung d. Pulmonary capillary
11. Compound soluble in water which does not impede oxygen transportations?
a. SO_2 b. SO_3 c. CO d. NO
12. O_2 intoxication occurs by:
a. Polycythemia b. Hyperventilation
c. Inhaling O_2 at high pressure d. Inhaling O_2 at normal atmospheric pressure
13. Hyperpnoea in exercise is because of:
a. Hypoxemia b. Reflex
c. Stimulation of cortex and proprioceptors d. Hypercapnoea
14. Yawning is caused by
a. Low CO_2 level in blood
b. High O_2 level in blood
c. Low O_2 level in blood
d. Low CO level in blood
15. Absence of oxygen in inspired gases is called
a. Asphyxia b. Anoxia c. Hypoxia d. Siderosis
16. What is usually present at the time of asphyxiation?
a. Oxyhaemoglobin b. Methaemoglobin
c. Carbaminohaemoglobin d. Haemoglobin without oxygen
17. Which one is not a respiratory disorder?
a. Emphysema b. Pneumonia c. Caissons disease d. Murmurs
18. A condition that causes prolonged interference with the aeration of the blood accompanied by increased CO_2 concentration is called
a. Dyspnoea a. Apnoea c. Asphyxia d. Eupnoea

19. Asthma is a respiratory disease caused due to
- a. Infection of trachea
 - b. Infection of lungs
 - c. Bleeding into pleural cavity
 - d. Psalm in bronchial muscles
20. Disorder/disease related with bubbling of N_2 in the blood resulting in pain or severe problem is
- a. Caisson's disease
 - b. Cheyne - stokes respiration
 - c. Hypopnoea
 - d. Asthma
21. Severe Acute Respiratory Syndrome (SARS)
- a. Is caused by a variant of Pneumococcal pneumonia
 - b. Is caused by a variant of the common cold virus (Corona Virus)
 - c. Is an acute form of asthma
 - d. Affects the non- vegetarian much faster than the vegetarians.
22. O_2 therapy has significant value in all the following types of hypoxia except :
- a. Atmospheric hypoxia
 - b. Hypoxia due to pulmonary edema
 - c. Histotoxic hypoxia due to cyanide poisoning
 - d. Hypoventilation hypoxia
23. 'Caisson's disease' occurs in
- a. Person living on high altitude
 - b. Person who smokes heavily
 - c. A diver who has been beneath the sea for a long period
 - d. Person whose alveoli are acutely inflamed

Key

1. c 2. b 3. b 4. d 5. d 6. A 7. a 8. d 9. a 10. c 11.c 12. c
13. c 14. a 15. b 16. b 17. d 18. C 19. b 20. a 21. b 22. c 23. c

EXERCISE - III

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- (c) If assertion is true but reason is false
- (d) If both assertion and reason are false
- (e) If assertion is false but reason is true.

1. **Assertion (A):** Asthmatic patients use bronchodilator drugs as well as inhalers for symptomatic relief

Reason (R): Asthma is characterized by the spasm of smooth muscles in the wall of bronchiole due to allergen

2. **Assertion (A):** Person has died because of carbon monoxide poisoning

Reason (R): A person slept in a closed room with a lamp burning

3. **Assertion (A):** Symptoms of emphysema develops when a person living on plains ascends and stays on a mountain

Reason (R): Air pressure and partial pressure of oxygen falls with the rise in attitude

4. **Assertion (A):** Chronic exposure to tobacco smoke leads to respiratory disorders

Reason (R): It damages ciliated cells in the respiratory tract

Key

1. a 2. a 3. e 4. a

EXERCISE - IV

1. If thorax is injured and pleura damaged, the air enters the pleural cavity and the lungs are collapsed. This condition is known as

- a. Hyponea b. Orthopnoea c. Dyspnoea d. Pneumothorax

2. A child was killed through asphyxiation, postmortem confirmed it because when a piece of lung was put in water it

- a. Settled down b. Kept floating c. Had blood spots d. None of these

3. A diver when goes very deep, he loses his strength to work and feel drowsy because
- Compressed air is used
 - More CO_2 diffuses in muscles
 - More N_2 is diffusing in blood
 - Nervous system does not work properly

Key

1. d 2. c 3. C

AERODYNAMICS

EXERCISE - I

1. Which of the following pulmonary volume can't be measured by spirometer directly?
- Tidal volume
 - Vital capacity
 - Inspiratory capacity
 - Residual volume
2. Vital capacity in a normal male is:
- 1000 cc
 - 2000 cc
 - 3000 cc
 - 4000 cc
3. Spirometer can not measure:
- Tidal volume
 - Vital capacity
 - Expiratory reserve volume
 - Residual volume
4. The functional residual capacity (FRC) is equivalent to
- $\text{RV} + \text{ERV}$
 - $\text{TV} + \text{IRV}$
 - $\text{VC} + \text{RV}$
 - $\text{TV} + \text{RV}$
5. Which of the following represents inspiratory capacity?
- IRV
 - $\text{IRV} + \text{TV}$
 - $\text{IRV} + \text{ERV} + \text{TV}$
 - $\text{IRV} + \text{ERV} + \text{TV} + \text{RV}$
6. The greatest quantity of air that can be expired after a maximum inspiratory affects its
- Residual volume
 - Tidal volume
 - Vital capacity
 - Total lung volume

Key

1. d 2. d 3. d 4. a 5. b 6. C

EXERCISE - II

20. Tidal volume is
- The volume of air breathed in or out in one normal inspiration / expiration
 - Volume of air breathed out by forced inspiration after normal inspiration
 - Volume of air breathed out by forced expiration after normal expiration
 - Volume of air that remains in lungs even after maximum expiration
23. Functional residual capacity (FRC) include
- TV
 - IRV
 - RV
 - ERV
- a. a + c b. b + d c. c + d d. a + b + d

Key : 1. a 2. c

EXERCISE - III

In each of the following question a statement of **Assertion (A)** is given followed by a corresponding statement of

Reason (R) just below it. Of the statements, mark the correct answer as

- If both assertion and reason are true and reason is the correct explanation of assertion
- If both assertion and reason are true but reason is not the correct explanation of assertion
- If assertion is true but reason is false
- If both assertion and reason are false
- If assertion is false but reason is true.

1. **Assertion (A):** Vital capacity of the athletes is higher than that of non-athletes.

Reason (R): In athletes, both tidal volume and rate of respiration is higher than non- athletes.

2. **Assertion (A):** Vital capacity is higher in athletes than non-athletes

Reason (R): Vital capacity is about 3.5 to 4.5litres in a normal adult person

3. **Assertion (A):** Gaseous exchanges

continue in the lungs without interruption ever during expiration

Reason (R): Residual volume of air can ever be driven out by respiration

Key : 1. b 2. b 3. a

EXERCISE - IV

1. If a person exhales out forcefully by applying all his efforts. What will the pulmonary volume inhaled by him immediately under normal condition without applying any extra effort?
a. TV + IRV b. TV only c. TV + ERV d. TV + IRV + ERV
2. If the tidal volume is 500ml and the breathing rate is 12 per minute, then the alveolar ventilation rate is
a. 500 ml x 12 b. $\frac{500}{12}$ ml c. 350ml x 12 d. $\frac{12}{500}$ ml
3. After a maximum inspiratory effort, the greatest quantity of air that can be expired out is
a. Tidal volume b. Inspiratory reserve volume
c. Vital capacity d. Residual volume
4. Which of the following is incorrect match?
a. Tidal volume - 500 ml during normal breathing
b. Vital capacity - 5000 ml during normal breathing
c. Eupnoea - Normal breathing
d. Orthopnoea - Breathing difficulty in horizontal position

Key

1. d 2. a 3. c 4. b

RESPIRATORY QUOTIENT

EXERCISE - I

1. R. Q. means:
a. Volume of O₂ consumed/minute
b. Volume of CO₂ consumed/minute
c. Ratio of CO₂ output and O₂ intake
d. Increase in O₂ intake with rise in temperature
2. In an organism utilizing carbohydrates as source of energy anaerobically, the R.Q. is likely to be
a. 0.7 b. 1.0 c. 0.9 d. Infinity

Key: 1. C 2. b

RESPIRATORY PIGMENTS

- Which of the following respiratory pigment is without iron?
a. Chlorocruorin b. Echinochrome c. Pinna globin d. Haemoerythrin
- One of the following is not a respiratory pigment
a. Hemoglobin b. Chlorocruorin c. Haemocyanin d. Haemozoin

Key: 1. c 2. d

MISCELLANEOUS

- Fill in the blanks
 - During normal quiet breathing, on an average, approximately ____ ml of air is inspired or expired by adult human male in each breath. It is termed as ____ volume.
 - Actually, only about ____ ml of air enters the lung alveoli for the exchange of gases. The remaining fills the respiratory passage and is termed ____.
 - The amount of air which one can inhale with maximum effort and also exhale with maximum effort is termed as _____. It is about _____ in normal adult person.
 - The air that always remains in the lungs even after forceful expiration is called _____. It is about _____.
 - The ratio of the volume of CO₂ produced to the volume of O₂ used in a unit time is called _____. For fats it is _____.
- State whether the following statements are true or false
 - Fishes respire with their skin
 - Aerobic respiration produces lactic acid at the end
 - Gas exchanges continuous interrupted in the lungs after forceful expiration.
 - A person can expel all the air from the lungs by a forceful expiration
 - Expiration is normally brought about by the relaxation of inspiratory muscles.
 - Vital capacity represents the maximum capacity to ventilate the lungs.
 - A rise in P_{CO2} increases the oxygen-affinity of hemoglobin.
 - Forceful expiration results from a forceful contraction of diaphragm.
 - Oxyhaemoglobin can hold much less carbon dioxide in the form of carbamino haemoglobin than what deoxyhaemoglobin can

Key:

1. (i) 500ml, tidal
(ii) 350ml, dead space air
(iii) Vital capacity, 4000ml
(iv) Residual volume, 1500ml
(v) Respiratory Quotient, less than 1 (0.7)
2. (i) F (ii) T (iii) T (iv) F (v) T (vi) F (vii) F (viii) F (ix) T

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