

# **BIOLOGY**

**NEET**

**CRASH COURSE**

**BREATHING AND  
EXCHANGES OF GASES**

**SMART ACHIEVERS**  
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**BREATHING AND EXCHANGES OF GASES**

1. Cells perform cellular respiration and produce energy. As a result harmful substances like carbon dioxide formed and hence removed from the body. Animals have evolved different mechanisms for the transport of oxygen to the cells and for the removal of carbon dioxide. Human have a well developed respiratory system comprising of pair of lungs and associated air passages to perform this function.
2. The first step in respiration is breathing by which atmospheric air is taken in (inspiration) and the alveolar air is released out (expiration). Exchange of O<sub>2</sub> and CO<sub>2</sub> between deoxygenated blood and alveoli, transport of these gases throughout the body by blood, exchange of O<sub>2</sub> and CO<sub>2</sub> between the oxygenated blood and tissues and utilisation of O<sub>2</sub> by the cells (cellular respiration) are the other steps involved.
3. Inspiration and expiration are carried out by creating pressure gradients between the atmosphere and the alveoli with the help of specialised muscles -intercostals and diaphragm. Volumes of air involved in these activities can be estimated with the help of spirometer and are of clinical significance.
4. Exchange of O<sub>2</sub> and CO<sub>2</sub> at the alveoli and tissues occurs by diffusion. Rate of diffusion is dependent on the partial pressure gradients of O<sub>2</sub> (pO<sub>2</sub>) and CO<sub>2</sub> (pCO<sub>2</sub>), their solubility as well as the thickness of the diffusion surface. These factors in our body facilitate diffusion of O<sub>2</sub> from the alveoli to the deoxygenated blood as well as from the oxygenated blood to the tissues. The factors are favourable for the diffusion of CO<sub>2</sub> in the opposite direction, i.e., from tissues to alveoli.
5. Oxygen is transported mainly as oxyhaemoglobin. In the alveoli where pO<sub>2</sub> is higher, O<sub>2</sub> gets bound to haemoglobin which is easily dissociated at the tissues where pO<sub>2</sub> is low and pCO<sub>2</sub> and H<sup>+</sup> concentration are high. Nearly 70 per cent of carbon dioxide is transported as bicarbonate (HCO<sub>3</sub><sup>-</sup>) with the help of the enzyme carbonic anhydrase. 20-25 per cent of carbon dioxide is carried by haemoglobin as carbamino-haemoglobin. In the tissues where pCO<sub>2</sub> is high, it gets bound to blood whereas in the alveoli where pCO<sub>2</sub> is low and pO<sub>2</sub> is high, it gets removed from the blood.
6. Respiratory rhythm is maintained by the respiratory centre in the medulla region of brain. A pneumotaxic centre in the pons region of the brain and a chemosensitive area in the medulla can alter respiratory mechanism.

**EXERCISE**

- Q.1 During hibernation frog performs  
 (1) Pulmonary respiration (2) Cutaneous respiration  
 (3) Bucco-pharyngeal respiration (4) Both cutaneous and pulmonary respiration
- Q.2 Skin is an accessory organ of respiration in  
 (1) Humans (2) Frog (3) Rabbit (4) Lizard
- Q.3 Diffusion of oxygen in tissues of Cockroach occurs through  
 (1) Blood (2) Integument (3) Tracheae (4) Tracheoles
- Q.4 Book lungs are respiratory structures of  
 (1) Arachnida (2) Mollusca (3) Mammals (4) Earthworm
- Q.5 In frog, cutaneous respiration takes place:  
 (1) only on land  
 (2) only in water with pulmonary respiration  
 (3) only in water when pulmonary respiration is not occurring  
 (4) always
- Q.6 Arytenoid cartilage occurs in  
 (1) Larynx (2) Nose (3) Hyoid (4) Sternum
- Q.7 Lining of trachea is made of  
 (1) Simple squamous epithelium (2) Simple cuboidal epithelium  
 (3) Pseudostratified epithelium (4) Stratified cuboidal epithelium
- Q.8 Covering of the lungs is called :  
 (1) Perichondrium (2) Pleural membrane (3) Pericardium (4) Peritoneum
- Q.9 Thyroid cartilage is found in:  
 (1) Nose (2) Pharynx (3) Larynx (4) Ear pinna
- Q.10 Mammalian lungs contain an enormous number of minute alveoli. This is to allow :  
 (1) more space for increasing the total volume of inspired air  
 (2) more surface area for diffusion of gases  
 (3) more spongy texture for keeping lungs in proper shape  
 (4) more nerve supply to keep, the organs working more efficiently
- Q.11 Diaphragm present in mammals is  
 (1) Membrane between external and middle ear  
 (2) Membrane around the brain  
 (3) Partition between the thoracic and abdominal cavities  
 (4) Membrane around lungs
- Q.12 In lungs, air is separated from venous blood by  
 (1) Squamous epithelium + tunica externa of blood vessel  
 (2) Squamous epithelium + endothelium of blood vessel  
 (3) Transitional epithelium + tunica media of blood vessel  
 (4) Columnar epithelium + 3 layered wall of blood vessel
- Q.13 Which is the correct sequence of the air passage in man?  
 (1) Nasal cavity → pharynx → trachea → larynx → bronchi → bronchioles → alveoli  
 (2) Nasal cavity → pharynx → larynx → trachea → bronchi → bronchioles → alveoli  
 (3) Nasal cavity → larynx → pharynx → trachea → bronchi → bronchioles → alveoli  
 (4) Nasal cavity → larynx → bronchi → pharynx → trachea → bronchioles → alveoli

- Q.14 Sites of gaseous exchange in lungs are:  
 (1) tracheioles (2) alveoli (3) bronchioles (4) pulmonary chambers
- Q.15 Intercostal muscles are found attached with :  
 (1) pelvic cavity (2) ribs  
 (3) space between fingers (4) digits
- Q.16 Rate of breathing in an adult human is:  
 (1) 10-12/min (2) 12-16/min (3) 20-25/min (4) 25-30/min
- Q.17 The structure which does not contribute to the breathing movements in mammals is :  
 (1) Larynx (2) Ribs (3) Diaphragm (4) Intercostal muscles
- Q.18 In expiration, diaphragm becomes  
 (1) Flattened (2) Relaxed (3) Straightened (4) Arched
- Q.19 Tidal volume in human beings is  
 (1) 1000 ml (2) 1500 ml (3) 500 ml (4) 4.5 litres
- Q.20 Vital capacity of lungs is  
 (1) 500 ml (2) 3.5 – 4.5 L (3) 2.5 – 3.9 L (4) 1.5 – 2.5 L
- Q.21 Vital capacity of lung is equal to  
 (1) IRV + ERV + TV (2) IRV + ERV + TV -RV  
 (3) IRV + ERV + TV + RV (4) IRV + ERV
- Q.22 Residual volume in the lungs of an average human is  
 (1) 500 ml (2) 3-4.5 litres (3) 1000 ml (4) 1500 ml
- Q.23 Volume of air remaining in lungs after maximal expiratory effort is :  
 (1) Vital capacity (2) Total lung capacity (3) Tidal volume (4) Residual volume
- Q.24 Oxyhaemoglobin dissociates at  
 (1) Low  $P_{O_2}$  in tissues (2) High  $P_{O_2}$  in tissues  
 (3) Equal  $P_{O_2}$  (4) All times irrespective of  $P_{O_2}$
- Q.25 In lungs there is definite exchange of ions between RBC and plasma. Removal of  $CO_2$  from blood involves  
 (1) Influx of  $Cl^-$  into RBC (2) Efflux of  $Na^+$  from RBC  
 (3) Influx of  $HCO_3^-$  ions in RBC (4) Efflux of  $HCO_3^-$  ions from RBC
- Q.26 Oxygen dissociation curve of myoglobin is  
 (1) Hypobolic (2) Hyperbolic (3) Linear (4) Sigmoid
- Q.27 Bicarbonate ion is produced inside  
 (1) Lymphocytes (2) Erythrocytes (3) Neutrophils (4) Basophils
- Q.28 Blood cells possess  $CO_2$  in the form  
 (1)  $NaHCO_3$  (2)  $H_2CO_3$  (3) Hb- $CO_2$  (4) Hb- $CO_2$  and Hb-CO
- Q.29 Exchange of  $O_2$  and  $CO_2$  at the respiratory surface occurs through  
 (1) Facilitated transport (2) Active transport  
 (3) Osmosis (4) Diffusion.

- Q.30 Dissociation curve is connected with  
 (1) Carbonic anhydrase (2) Carbon dioxide  
 (3) Oxygen (4) Oxyhaemoglobin
- Q.31 Hamburger's phenomenon is also known as  
 (1)  $\text{HCO}_3^-$  shift (2)  $\text{Na}^+$  shift (3)  $\text{H}^+$  shift (4) Chloride shift
- Q.32 Oxygen carrying capacity of blood is  
 (1) 20% (2) 30% (3) 40% (4) 50%.
- Q.33 Chloride shift is required for transport of  
 (1) Nitrogen (2) Oxygen  
 (3) Carbon dioxide (4) Carbon dioxide and oxygen
- Q.34 Oxygen haemoglobin dissociation curve will shift to right on decrease of  
 (1) Acidity (2) Carbon dioxide concentration  
 (3) Temperature (4) pH
- Q.35 Haldane believes oxyhaemoglobin to act as  
 (1) Acid (2) Alkali (3) Buffer (4) None of the above
- Q.36 Percentage of oxygen transported by haemoglobin is  
 (1) 97% (2) 100% (3) 49% (4) 3%
- Q.37 One molecule of haemoglobin carries  
 (1) One molecule of  $\text{O}_2$  (2) Two molecules of  $\text{O}_2$   
 (3) Three molecules of  $\text{O}_2$  (4) Four molecules of  $\text{O}_2$
- Q.38 Gaseous exchange between blood and alveolar air across respiratory membrane occurs by:  
 (1) Osmosis (2) Diffusion (3) Active transport (4) Phagocytosis
- Q.39 During oxygen transport the oxyhaemoglobin at the tissue level liberates oxygen to the cells because in tissue:  
 (1)  $\text{O}_2$  concentration is high and  $\text{CO}_2$  is low (2)  $\text{O}_2$  concentration is low and  $\text{CO}_2$  is not high  
 (3)  $\text{O}_2$  tension is high and  $\text{CO}_2$  tension is low (4)  $\text{O}_2$  tension is low and  $\text{CO}_2$  tension is high
- Q.40 The blood leaving the lungs has all its haemoglobin oxygenated and gives up oxygen to the tissues, because:  
 (1) The tissue can absorb  $\text{O}_2$  from oxyhaemoglobin  
 (2)  $\text{O}_2$  concentration in tissues is lower and  $\text{CO}_2$  concentration higher than in lungs  
 (3)  $\text{O}_2$  concentration in tissues is higher and  $\text{CO}_2$  concentration lower than in lungs  
 (4) Oxyhaemoglobin undergoes reduction
- Q.41 When, under certain conditions, the  $P_{50}$  value of haemoglobin rises the affinity of the pigment of combining with  $\text{O}_2$  will:  
 (1) remain same (2) rise (3) fall (4) first rise and then fall
- Q.42 When partial pressure of  $\text{CO}_2$  ( $P_{\text{CO}_2}$ ) rises, the oxygen dissociation curve of haemoglobin at  $37^\circ\text{C}$  will:  
 (1) shift towards right (2) shift towards left (3) become irregular (4) remain unchanged
- Q.43  $\text{O}_2$  content of air we expire is:  
 (1) 4% (2) 20% (3) 25% (4) 16%

- Q.44 The percentage of  $O_2$  in inhaled air is about :  
 (1) 21% (2) 16% (3) 79% (4) 4%
- Q.45 During transport of  $CO_2$ , blood does not become acidic due to :  
 (1) neutralization of  $H_2CO_3$  by  $Na_2CO_3$  (2) absorption by leucocytes  
 (3) blood buffers (4) non accumulation
- Q.46  $CO_2$  is transported as :  
 (1) dissolved in blood plasma (2) as bicarbonate  
 (3) in carbaminohaemoglobin (4) All of the above
- Q.47 Respiratory movements are controlled by  
 (1) Cerebellum (2) Cerebrum (3) Medulla oblongata (4) Crura cerebri
- Q.48 Respiratory centre of brain is stimulated by  
 (1) Carbon dioxide content in venous blood (2) Carbon dioxide content in arterial blood  
 (3) Oxygen content in venous blood (4) Oxygen content in arterial blood
- Q.49 Rate of breathing is controlled by :  
 (1) the amount of freely available oxygen (2) muscular functions of the body  
 (3) carbon dioxide (4) stress
- Q.50 Respiratory mechanism is controlled by :  
 (1) Central nervous system (2) Sympathetic nervous system  
 (3) Parasympathetic nervous system (4) Autonomic nervous system
- Q.51 Asphyxia occurs due to  
 (1) Combination of hypoxia and hypercapnea  
 (2) Combination of hypoxia and hypocapnea  
 (3) Combination of hyperoxamia and hypocapnea  
 (4) Combination of hyperoxamia and hypercapnea
- Q.52 Emphysema is characterised by  
 (1) Abnormal distension of alveoli (2) pulmonary haemorrhage  
 (3) Increased number of air sacs (4) Infection of Mycobacterium trabeculae
- Q.53 At high altitude, RBCs of human blood will :  
 (1) increase in size (2) increase in number (3) decrease in size (4) decrease in number

## AIIMS Special

### Instructions for following questions (Q.54 to Q.70).

- (1) If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).
  - (2) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).
  - (3) If Assertion is true statement but Reason is false, then mark (3).
  - (4) If both Assertion and Reason are false statements, then mark (4).
- Q.54 **Assertion :** Pneumotoxic centre controls rate of respiration.  
**Reason :** Primarily it controls switch off point of inspiration.
- Q.55 **Assertion :** Asthmatic patients use bronchiodilator drugs as well as inhalers for symptomatic relief.  
**Reason :** Asthma is characterized by the spasm of smooth muscles in the wall of bronchioles due to allergen.

- Q.56 **Assertion :** Major part of carbondioxide is transported in the form of sodium bicarbonate.  
**Reason :** 0.3 ml of carbon dioxide is transported per 100 ml of blood in dissolved state in plasma of blood.
- Q.57 **Assertion :** In cockroach, inspiration is a passive process.  
**Reason :** Expansion of abdominal cavity allows the space of expansion of tracheal trunk, as a result air enters through spiracle.
- Q.58 **Assertion :** Diffusion of carbondioxide is 20 times faster than oxygen.  
**Reason :** It is due to difference in partial pressure as well as solubility of diffusing gases.
- Q.59 **Assertion :** Oxidation of nutrients releases bond energy.  
**Reason :** Oxidation of nutrients is done by using molecular oxygen.
- Q.60 **Assertion :** Aerobic respiration involves the exchange of respiratory gases twice.  
**Reason :** Exchange occurs from lung to heart and then heart to lung.
- Q.61 **Assertion :** Respiratory gas exchange occurs through osmosis.  
**Reason :** Respiratory gas goes from lower partial pressure region to the region of higher partial pressure.
- Q.62 **Assertion :** First step of gas exchange occurs through body surface in some animals.  
**Reason :** Body surface or membrane of amphibia is thick in nature.
- Q.63 **Assertion :** Abdominal muscle is related with respiration in animals.  
**Reason :** Relaxation of abdominal muscles draws in air.
- Q.64 **Assertion :** Forceful expiration occurs through expiratory muscles.  
**Reason :** Expiratory muscles expires quickly.
- Q.65 **Assertion :** Oxyhaemoglobin carries 1 - 4 molecules of oxygen in the blood.  
**Reason :** The capacity of oxyhaemoglobin depends on the degree of (Fe<sup>2+</sup>) saturation with oxygen.
- Q.66 **Assertion :** Gaseous exchanges continue in the lungs without interruption even during expiration.  
**Reason :** Residual volume of air can never be driven out by respiration.
- Q.67 **Assertion :** During expiration, volume of thorax decreases and air is expelled out.  
**Reason :** This happens due to the contraction of inspiratory muscles.
- Q.68 **Assertion :** Symptoms of emphysema develops when a person living on plains ascends and stays on a mountain.  
**Reason :** Air pressure and partial pressure of oxygen falls with the decrease in altitude.
- Q.69 **Assertion :** Coughing and sneezing are necessary.  
**Reason :** Coughing and sneezing are reflex actions..
- Q.70 **Assertion :** Alveoli of lung of man are lined by lecithin phospholipid.  
**Reason :** Lecithin lowers the surface tension and prevents collapsing of alveolar walls.

**ANSWER KEY**

Q.1	2	Q.2	2	Q.3	4	Q.4	1	Q.5	4	Q.6	1	Q.7	3
Q.8	2	Q.9	3	Q.10	2	Q.11	3	Q.12	2	Q.13	2	Q.14	2
Q.15	2	Q.16	2	Q.17	1	Q.18	2	Q.19	3	Q.20	2	Q.21	1
Q.22	4	Q.23	4	Q.24	1	Q.25	3	Q.26	2	Q.27	2	Q.28	3
Q.29	4	Q.30	4	Q.31	4	Q.32	1	Q.33	3	Q.34	4	Q.35	1
Q.36	1	Q.37	4	Q.38	2	Q.39	4	Q.40	2	Q.41	3	Q.42	1
Q.43	4	Q.44	1	Q.45	3	Q.46	4	Q.47	3	Q.48	2	Q.49	3
Q.50	1	Q.51	1	Q.52	1	Q.53	2	Q.54	1	Q.55	1	Q.56	2
Q.57	1	Q.58	1	Q.59	2	Q.60	3	Q.61	4	Q.62	3	Q.63	1
Q.64	3	Q.65	1	Q.66	1	Q.67	4	Q.68	4	Q.69	2	Q.70	1