Breathing and Exchange of Gases

- Oxygen (O₂) is utilised by the organisms to indirectly break down of nutrient molecules like glucose and to derive energy for performing various activities. Carbon dioxide (CO₂) which is harmful is also released during the above catabolic reactions. It is therefore, evident that O₂ has to be continuously provided to the cells and CO₂ produced by the cells have to be released out. This process of exchange of O₂ from the atmosphere with CO₂ produced by the cells is called **breathing** commonly known as **respiration**.
- Respiration is for energy liberation.

• Respiration involves the following steps:

- (i) Breathing or pulmonary ventilation by which atmospheric air is drawn in and CO₂ rich alveolar air is released out.
- (ii) Diffusion of geses (O_2 and CO_2) across alveolar membrane.
- (iii) Transport of gases by blood.
- (iv) Diffusion of O_2 and CO_2 between blood and tissues.
- (v) Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2

Respiratory	General Body	Moist Cuticle	Tracheal	Gills	Lungs	Dermal bronchi
Organs	Surface	(Skin)	Tubes			and tube feet
	- Sponges	- Earthworm	Insects	- Aquatic	- Reptiles	- Echinodermata
Examples	- Coelenterates	- Frogs		arthropods	- Birds	
	- Flatworms			- Molluscs	- Mammals	
				- Fishes		
			1			

Human Respiratory Sytstem

(1) Respiratory Tract (Conducting zone)

(2) (Exchange zone):- Alveolar duct and alveoli.

Respiratory tract - A passage by which air enters into lungs



1. Nose and Nasal- passage -

Human have a pair of external nostrils, opening out above the upper lip.

External nostriles (nares) open in vestibule region present in anterior part of nasal passage. Vestibule posteriorly connected with nasal chambers.

- Nasal passage is functionaly divided into 3 region.
 - (i) Vestibular Region:- skin, hairs, sebaceous glands.
 - (ii) Respiratory Region:- Pseudo stratified Ciliated Columnar Non-Ciliated brush border Columnar and Goblet cells
 - (iii) Olfactory Region (Nasal Conchae):- Schneidarian membrane or neuro sensory epithelium

2. Bucco-pharyngeal cavity -

- It is divided into two parts. Anterior part is called the **Buccal-cavity** and the posterior part is called **Pharyngeal-cavity**. Between the buccal and the Nasal cavity hard palate followed by soft palate is present. The terminal part of soft plate is called **Uvula**. Uvula is bent towards the pharyngeal cavity. This divides the pharyngeal-cavity incompletely into two chambers. Upper chamber is the **Nasopharyngeal chamber** and the Lower chamber is **Oropharyngeal chamber**.
- At the time of swallowing of food, the Uvula lifts up and covers the internal-nares and so prevents the food from entering the nasal-passage. In the pharyngeal chamber, 2 slit like apertures are present. Dorsal-pore is called the **gullet** which opens into the oesophagus, so this is the path of food. Ventral-pore is called the **glottis** ; and it opens into the Larynx ; and so this is the respiratory-passage.
- Near the glottis a flat elastic cartilage called the **Epiglottis** is present. At the time of swallowing food this cartilage covers the glottis, So the breathing stops.
- Pharynx is the only part where food and air passage mix together.
- **3. Larynx (voice producing organ):-** It is present in **anterior** part of **trachea** so it is considered as modification of trachea. Larynx is a cartilagenous box which helps in sound production and hence called the **sound box.** Have four vocal cords, two true and two false vocal cords.

4. Trachea:

- It is a 10-12 cm long tube like structure present in complete length of neck upto mid thoracic cavity
- In complete length of trachea 16-20 'C' shaped cartilagenous rings are present which prevent trachea from collapsing. These are composed of hyaline cartilage. These rings are **incomplete on dorsal surface** of trachea.
- 5. Bronchial tree (B. T.) & Respiratory Tree (R. T.)
- When trachea enter into thoracic cavity, it divides in two branches infront of 5th thoracic vertebra and called as primary bronchus. Branches of primary bronchus upto terminal bronchioles makes **bronchial tree**.
- Terminal bronchioles divide to form respiratory bronchioles & branches of respiratory bronchioles makes **respiratory tree**.
- In bronchial tree, cartilage rings are present up to initial bronchiole, while these are absent in respiratory tree.
- Gaseous exchange occurs in respiratory tree while it is absent in bronchial tree.
- Volume of air which is filled in B.T. is a part of **dead space volume.** which doesn't take a part in gaseous exchange. (150 ml)

There are two zones. (i) Conducting zones (ii) Exchange zone



- **Exchange zone** is the actual site of diffusion of O₂ and CO₂ between blood and atmospheric air.
- **The conducting zone/transport zone** transports the atmospheric air of the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature.

Lungs

• A pair of lungs are present in the thoracic-cavity. Lungs are covered by a double-membrane which are called the **Pleural-membranes**. Outer membrane is the **Parietal Pleura** and innermembrane is the **Visceral-pleura** Both these membranes are derived from the mesoderm. In between both the membranes a very narrow cavity called Pleural-cavity is present. In this cavity, a very thin layer of pleural fluid is present. • Sometimes due to bacterial infection the amount of this fluid increases. So, the organism feels a difficulty in breathing (**dyspnoea**). This is termed as **pleuricy or pleural effusion disease**.



• In human being right lung made up of 3 lobes & left lung made up of 2 lobes.

Alveoli:

- Each lobe is further divided into several lobules by septa of connective tissue. Each lobule is further divided into several air-sacs; and in the end, each air-sac is lastly divided into 3 or 4 alveoli; which are also termed as the units of lungs.
- Structural & functional unit of lungs is called **alveoli**
- Approximately 300 million alveoli are present in both lung.
- Inner (alveolar) surface area of both lungs is approximately 70 100 m².
- Wall of alveoli consist of two layers, outer layer is composed of yellow fibrous C.T., inner layer is composed of simple squamous epithelium
- squamous cells are called as **pneumocytes**.
- most of these pneumocytes (Pneumocyte-I) help in gaseous exchange while few pneumocytes (Pneumocyte-II) which are larger in size secrete LECITHIN (Phospholipid) this acts as surfactant which prevents alveoli from remaning collapse by reducing its surface tension.
- Alveoli internal surface is termed as the Respiratory surface. It is derived from the endoderm of the embryo.



- There are small pores present in the walls of alveoli. These pores make diffusion of gases easy. These pores are called **pores of Kohn**. It is the **characterstic feature of mammalian lungs**
- Mammalian lungs are **solid and spongy** that there is no central cavity
- Muscles are absent in the lungs of mammals. So the power of self-contraction and selfexpension is absent in these lungs. (Sucken lungs)

Thoracic cage:- Coverings of thoracic cavity makes thoracic cage.

Anterior surface	:	Clavical bones, Neck
Posterior surface	:	Diaphragm.
Dorsal surface	:	Vertebral column & Ribs
Ventral surface	:	Sternum & ribs.
Lateral surface	:	Ribs

Diaphragm:

A muscular septum which is found only in mammals (and crocodile). Normal shape of it is dome like which divides body cavity in two parts upper thoracic cavity & lower abdominal cavity.

Radial muscles are present in diaphragm. By the contraction in these muscles, diaphragm become flatten in shape, so, volume of thoracic cavity increases in **anterier posterier axis.** Therefore, diaphragm helps in inspiration.

Space between two ribs is called inter costal space in which 2 types of muscles are present

- External ICM. (EICM)
- Internal ICM. (IICM)

EICM:-

By the contraction in this muscles, rib & sternum shifts upward & outward. So thoracic volume increases in **dorso ventral axis**.

IICM:- Contracts during forcible exhalation.

Respiration involves the following steps:

- (i) Breathing or pulmonary ventilation by which atmospheric air is drawn in and CO₂ rich alveolar air is released out.
- (ii) Diffusion of gases (O_2 and CO_2) across alveolar membrane.
- (iii) Transport of gases by the blood.
- (iv) Diffusion of O_2 and CO_2 between blood and tissues.
- (v) Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2 .

Concept Builder

1.	The process of as:	oxidatio	on of g	glucos	e duri	ng wh	ich CO	2, H ₂ O	and e	nergy	are produced is known
	(1) Breatning	(2	2) Insp	oration	ו	(3)	Respir	ation	(4)	Expira	tion
2.	Which membran (1) Pericardium	e cove (2	rs the 2) Ren	lungs al cap	and p sule	rovide (3)	prote Pleura	ction? (4) Epir	neuriu	m
3.	Respiratory orga (1) Body wall	ns in a (2	quatic 2) Lun	arthro gs	opods (and n 3) Tra	nollusc chea	s are (4) Gills	3	
4.	Given below are A Insect B Scorpion C Fishes D Limulus The correct mat (1) B & D	four m - - - ching a (2	atchir E S re: 2) C &	ng of a Frache Book g Skin Book lu D	n anir a ills ıng (nal an 3) Onl <u>i</u>	d its k y A	ind of (4) A	respir	atory (organ -
5.	Diaphragm is a c (1) Coelomic cav (2) Pleural cavity (3) Thoracic cavity (4) Pelvic cavity	dome s ity fror / from ity from from a	hapme n pelv thorac n abdc bdomi	ed mus ic cavi cic cavi ominal inal ca	scular ty ity cavity vity	struc†	ture w	hich s	eprate	s:	
6.	Name of the org (1) Larynx (3) Nasal chamb	an whi	ch hel	ps in s	ound	produ	ction: (2) Int (4) Tra	ernal achea	nares		
7.	Which of the fol (1) Mammals	lowing (2	has m 2) Inve	nost we ertebra	ell-de te	velope	ed resp (3) An	iratory nphibia	y syste ans	em:- (4) Hemichordets
8.	Trachea divides (1) Secondary br (3) Bronchiloes	into rig onchi	ht and	d left:			(2) Te (4) Pri	rtiary mary	bronch bronch	ni ni	
			С	oncep	t Bui	lder (/	Answe	er key)		
		Que	1	2	3	4	5	6	7	8	
		Yuc.	2	-	4	-	2	1	1	4	
		Ans.	3	3	4	3	3	I	I	4]

Mechanism of Breathing

- Inspiration and expiration are included in breathing. Normal breathing is termed **Eupnoea**.
- Inspiration can occur if the pressure with in the lungs (**intra pulmonary pressure**) is less than the atmospheric pressure so there is a negative pressure in the lungs than the atmospheric pressure. Similarly, expiration takes place when the intra-pulmonary presssure is higher than the atmospheric pressure.

Inspiration:

- Inspiration is an active process.
- Normally it takes around 2 seconds.
- At the time of inspiration, contraction in diaphragm and external intercostal muscles takes place.
- Diaphragm becomes flat and is pushed towards abdominal cavity.
- Sternum moves towards ventral and anterior direction.
- Ribs move towards outside and ventral side. As a result of all these reactions, the **volume of thoracic cavity is increased**. So the pressure of coelomic fluid over lungs is decreased. Due to the spongy nature, lungs expand. As a result of this, air pressure in the lungs is decreased as compared to atmospheric pressure. Now air rushes from outside, through respiratory track and fills the lungs.

Ribs and sternum Volume of raised thorax increased Rib cage Diaphragm contracted (a) Ribs and sternum returned to Volume of original thorax position decreased Diaphragm relaxed and arched upwards

Air entering lungs

Expiration:

- Normal expiration is a passive activity.
- It takes around 3 seconds.
- During expiration, contraction (in any muscle) does not take place. During expiration, **relaxation in diaphragm and external intercostal muscles** takes place.
- As a result of this relaxation, diaphragm, sternum and ribs attain their actual (normal) position. Due to which the volume of thoracic cavity is decreased, and pressure of thoracic cage on lungs is increased. Thus air which was filled in lungs goes outside through respiratory tract.
- Normal breathing is also called Abdominal breathing.

Fig. Mechanism of breathing showing (a) inspiration (b) expiration

(b)

- We have ability to increase the strength of inspiration and expiration with the help of additional muscles. This is called **forceful breathing (Thoracic breathing).**
- Expiration during sneezing, coughing and yogabhyas is called **forceful expiration**. It is an active process. During forceful expiration, Internal intercostal muscles and abdominal muscles contract.

Pulmonary Volumes

The volume of Air involved in breathing movements can be estimated by using a spirometer which help in clinical assessment of pulmonary functions.

- **1. Tidal volume [T.V.]** Volume of air inspired or expired during a normal respiration. It is approx. 500 mL., i.e., a healthy man can inspire or expire approximately 6000 to 8000 mL of air per minute.
- **2. Inspiratory Reserve Volume** [I.R.V.] Additional volume of air (over TV), a person can inspire by a forcible inspiration. This averages 2500 mL to 3000 mL.
- **3. Expiratory reserve volume** [E.R.V.]- Additional volume of air, a person can expire by a forcible expiration. This averages 1000 mL to 1100 mL.
- **4. Residual volume -** [R.V.]-Volume of air remaining in the lungs even after a forcible expiration. This averages 1100 mL to 1200 mL.



Spirogram of pulmonary volumes and capacities

Pulmonary Capacities:

- **1. Inspiratory capacity** [I.C.] Total volume of air a person can inspire after a normal expiration. This includes tidal volume and inspiratory reserve volume (TV+IRV).
- **2. Expiratory Capacity (EC):** Total volume of air a person can expire after a normal inspiration. This includes tidal volume and expiratory reserve volume (TV+ERV).
- **3. Functional Residual capacity** [FRC] Volume of air that will remain in the lungs after a normal expiration. This includes ERV+RV.
- **4. Vital capacity** [V.C.] The maximum volume of air a person can breathe in after a forced expiration. This includes ERV, TV and IRV or the maximum volume of air a person can breathe out after a forced inspiration.
- **5.** Total lung capacity -[T.L.C.]. 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.

Exchange Of Gases

Alveoli are the primary sites of exchanges of gases. Exchange of gases also occur between blood and tissues. Exchange of gases in the lungs is done between alveolar air and arterial blood.

- Gaseous exchange is a passive activity. It is held by **simple diffusion**.
- Diffusion pressure for every gas (in blood or in air) is called **partial pressure**. At the time of diffusion, gases move from high partial pressure to low partial pressure.



Fig. A Diagram of a section of an alveolus with a pulmonary capillary.

Respiratory Gas	Atmospheric Air	Alveoli	Deoxygenate d Blood	Oxygenated Blood	Tissues
O ₂	159	104	40	95	40
CO ₂	0.3	40	45	40	45

- The partial pressure of O₂ in alveolar air [P_{O2}] is 104 mm Hg and its value in arterial blood is 40 mm
 Hg. So oxygen goes from alveolar air to blood.
- In alveolar air, partial pressure of CO₂ [P_{O2}] is 40 mm Hg and its value in arterial blood is 45-46 mm Hg.So CO₂ moves from arterial blood to alveoli. In this way, according to partial pressure exchange of gases takes place in the lungs.
- Inspirated air contains 19.6% oxygen and expirated air has 15.7% O₂. So approximately 4% oxygen goes to blood from air. In the same way inspirated air contains CO₂ 0.04% and expirated air has 3.6% CO₂ so approximately 3.56% CO₂ goes to air from blood.

Diffusing Capacity: Volume of gas that diffuses through the membrane per minute for a difference of 1 mm Hg. It is 21 ml/mt/mm Hg for O_2

- Diffusing capacity depends on solubility of diffusing gases, partial pressure difference and thickness of respiratory membrane.
- DC of CO₂ is 20 times more than O₂.
- As the solubility of CO₂ is 20-25 times higher than that of O₂, the amount of CO₂ that can diffuse through the diffusion membrane per unit different in partial pressure is much higher compared to that of O₂.
- Diffusion membrane is made up of three major layer:-
 - (i) Thin squamous epithelium of Alveoli.
 - (ii) Endothelium of Blood capillaries.
 - (iii) Basement substance in between them.



Transport of Gas

Blood is the medium of transport for O₂ and CO₂. About 97 per cent of O₂ is transported by RBCs in the blood. The remaining 3 per cent of O₂ is carried in a dissolved state through the plasma. Nearly 20-25 per cent of CO₂ is transported by RBCs whereas 70 per cent of it is carried as **Bicarbonate**. About 7 per cent of CO₂ is carried in a dissolved state through plasma.

Transport of oxygen:

- As much oxygen comes in the blood from air, approximately 3% dissolves in the blood plasma. Remaining 97% oxygen combines with haemoglobin to form **oxyhaemoglobin.** O₂ can bind with Hb in a reversible manner to form oxyhaemoglobin.
- One molecule of haemoglobin combines with 4 molecules of oxygen.
- Haemoglobin is made up of 4 units. Every unit of it, reacts with one molecule of oxygen.
- 1 gm of haemoglobin transports 1.34 ml of oxygen. 100 ml (1 dL) of blood contains normally 15 gm of haemoglobin, so 100 ml blood transports approximately 20 ml of oxygen.
- Oxygen does not oxidise haemoglobin. Formation of oxyhaemoglobin is a process of oxygenation. The valency of iron is +2 in oxyhaemoglobin. Some gases (e.g. Ozone) oxidise haemoglobin. This oxidised haemoglobin is called **Methamoglobin**. This is a colourless compound. This type of gases are environmental pollutant.
- At the time, oxyhaemoglobin reaches upto the tissues it dissociates. O₂ freed from it goes into the tissue fluid from blood. In place of it, CO₂ from tissue fluid comes into blood. Gaseous exchange between blood and tissue is called internal respiration or tissue respiration. It is also done by simple diffusion.
- In a conducting cycle blood gives its 25% O₂ to tissues. So every 100 ml oxygenated blood can deliver around 5 ml of O₂ to tissue under normal physiological condition.
 Oxyhaemoglobin dissociation curve:-
- A graph is plotted between O₂ concentration and percentage saturation of haemoglobin with oxygen (we get a sigmoid curve), this curve is called Dissociation curve.
- Dissociation curve for haemoglobin is **sigmoid shape.** The meaning of right side shifting of dissociation curve is that,O₂ is readily dissociating from oxyhaemoglobin.



Partial pressure of oxygen (mm Hg)

Fig. Oxygen dissociation curve

- Shift to left Means that increase in affinity between O_2 and Hb.
- **Shift to Right** Means that decrease in affinity between O₂ & Hb. The meaning of right side shifting of dissociation curve is that,O₂ is readily dissociating from oxyhaemoglobin.
- in tissue following conditions are favourable for dissociation of oxygen from oxyhaemoglobin:
 - (ii) High PCO₂ (iii) High H+ concentration
 - (i) Low PO₂(iv) Low pH
- (v) Higher temperature

- In the alveoli high PO_{2'}, low PCO_{2'} lesser H⁺ concentration and lower temperature factors are favourable for the formation of oxyhaemoglobin.
- Hb can not take up O_2 beyond a saturation level of 97%.
- **P**₅₀ value PO₂ at which the Hb is 50% saturated with O₂. Hb is 50% saturated with O₂ at 30mm Hg. Higher the P₅₀ lower is the affinity of Hb for O₂.
- 2, 3 diphosphoglycreate (2, 3 DPG) a substance formed during glycolysis.
 1, 2, 3, DPG will cause dissociation of oxyhaemoglobin.
- **Bohr's effect:** Dissociation of oxyhaemoglobin due to high CO₂ concentration in tissue is called Bohr's effect.
- During heavy exercise 100 ml blood delivered 15 ml O₂ to muscle.

Transport of Carbon dioxide:

- The blood transports carbon dioxide comparatively easily because of its higher solubility.
- Every 100 ml deoxygenated blood delivers around 4 ml CO₂ to alveoli.
- There are three ways of transport of carbon dioxide.

(a) In dissolved state: Approximately 5-7 per cent of carbon dioxide is transported, being dissolved in the plasma of blood. Hence 0.3 ml of carbon dioxide is transported per 100 ml of blood plasma.
(b) As carbamino haemoglobin About 20-25% CO₂ react with the amine group of Haemoglobin and form carbamino-haemoglobin.

(c) In the form of bicarbonate: Bulk of CO₂ (about 70%) is transported by plasma as bicarbonate.

- Carbon dioxide produced by the tissues, diffuses passively into the blood stream and passes into the red blood corpuscles, where it reacts with water to form **carbonic acid** (H₂CO₃). This reaction is catalysed by the enzyme, **carbonic anhydrase**, RBC contain a very high concentration of this enzyme.
- Immediately after its formation, carbonic acid dissociates into Hydrogen (H⁺) and bicarbonate (HCO₃⁻) ions.



- The oxyhaemoglobin (HbO₂) of the erythrocytes is weakly acidic and remains in association with K⁺ ions as KHbO₂.
- The hydrogen ions (H⁺) released from carbonic acid combine with haemoglobin and from **haemoglobinic acid** (H.Hb).
- The majority of bicarbonate ions (HCO₃⁻) formed within the erythrocytes diffuse out into the plasma along a concentration gradient. In the plasma hydrogen carbonate ions (HCO₃⁻) in the plasma combine with Na⁺ to form sodium bicarbonate (NaHCO₃). Nearly 70 per cent of carbon dioxide is transported from tissues to the lungs in this form.

- In response, of HCO₃- ions chloride ions (Cl⁻) diffuse from plasma into the erythrocytes to maintain the ionic balance. Thus, electrochemical neutrality is maintained. This is called **Chloride shift** or **Hamburger Phenomenon**. The chloride ions (Cl⁻) inside RBC combine with potassium ions (K⁺) to form potassium chloride (KCl),
- When the deoxygenated blood reaches the alveoli of the lung, it contains carbon dioxide as dissolved in plasma, as carbaminohaemoglobin, and as bicarbonate ions. In alveoli due to low PCO₂ and high PO₂ carbaminohaemoglobin and bicarbonate ions are dissociated.
- When bicarbonates and carbamino compounds reach in the lungs, then they dissociate. Thus CO₂ is formed.
- This dissociation is stimulated by oxyhaemoglobin. This CO₂ freed from blood goes into atmosphere. The effect of oxyhaemoglobin on the dissociation of these compounds is known as Haldane -effect. In this reaction oxyhaemoglobin acts like a strong acid i.e, it frees H⁺ in the medium.

	Concept Builder							
1.	Every 100 mL of deoxyge (1) 4 mL	nated blood delivers ap (2) 3mL	proximatelyof ((3) 5 mL	CO ₂ in the alveoli. (4) 15 mL				
2.	During normal conditions (1) 5 ml	, amount of O ₂ transpor (2) 150 ml	t by 1 litre of Deoxygena (3) 50 ml	ated blood from tissues is (4) 1500 ml				
3.	 What would happen if human blood becomes acidic - (1) Oxygen carrying of haemoglobin decreases (2) Oxygen carrying capacity of haemoglobin increases (3) RBCs count increases (4) RBCs count decreases 							
4.	Hb_4 (haemoglobin) +4O ₂ = (0	──── Hb(O₂)₄ Oxyhaemoglobin)						
	In this reaction when f oxyhaemoglobin. It is cal (1) Oxidation	errous ion of haem as led as - (2) Oxygenation	ssociated with one mc (3) Reduction	elecule of oxygen to form (4) Redox reaction				
5.	Many chloride ions diffus (1) Chloride shift (3) Both 1 and 2	e from plasma into RBC	s and bicarbonate ions (2) Hamburger phenor (4) Haldane effect	pass out. This is termed as nenon				
6.	The pH of venous blood i (1) CO ₂ is a weak base (2) There is no carbonic a (3) The H ⁺ generated from (4) The H ⁺ generated from	s only slightly more acio anhydrase in the venous n CO2 and H2O is buffere n CO2 and H2O is buffere	d than the pH of arteria blood d by HCO₃ ⁻ in venous b d by deoxyhemoglobin	ll blood because: lood in venous blood				
7.	Oxygen binding to haemo (1) Directly proportional (2) Inversely proportional (3) Directly proportional (4) Independent of the co	globin in blood is: of the concentration of to the concentration o to the concentration of oncentration of CO in th	CO2 in the medium f CO2 in the medium CO in the medium Ne medium					

Concept Builder (Answer Key)								
Que. 1 2 3 4 5 6 7								
Ans.	1	2	1	2	3	4	2	

Regulation of Respiration

- Human beings have a significant ability to maintain and moderate the respiratory rhythm to suit the demand of the body tissue. This is done by neural system.
- The respiratory rhythm centre in the Medulla is primarily responsible for this regulation.
- Following respiratory groups regulate respiration: -
 - (i) The **dorsal respiratory group (DRG)** is present in the dorsal portion of medulla oblongata. The signals from these neurons generate the basic respiratory rhythm. The nervous signal released from this group is transmited to the diaphragm & EICM.
 - (ii) The **ventral respiratory group (VRG)** of neurons are located anterolateral to the dorsal respiratory group. During normal respiration, this remains inactive and even does not play any role. In the enhanced respiratory drive, the respiratory signal of this group contributes to fulfil the demand by regulating both inspiration and expiration. Few of the neurons of this group control inspiration, while few other control expiration, thus regulating both.
 - (iii) The **pneumotaxic centre** is located on **pons**. It transmits signals to the inspiratory area. Primarily, it controls the **switch off point of inspiration**. Neural signal from this centre can reduce the duratoin of inspiration and thereby alter the respiratory rate. When this center send strong signal then lungs are filled partially.
- A chemosensitive area is situated adjacent to the rhythm centre which is highly sensitive to CO₂ and hydrogen ions. Increase in these substances can activate this centre which in turn can signal the rhythm centre and increase breathing rate. The role of oxygen in the regulation of respiratory rhythm is quite insignificant.
- Aortic body and carotid body are chemorecptors associated with aortic arch and carotid artery. As a result of this respiratory centre. becomes activated and this increases the rate of respiration. This centre can recognise changs in CO₂ and H⁺ concentration.
- The activity of respiratory centre is also affected by body temperature and blood pressure. Whenever body temperature is increased or blood pressure goes high, respiratory centre becomes more activated and this increases the respiration rate.

Respiratory Disorders:

- (a) Bronchitis: It is the inflammation of the bronchi, which is characterised by hypertophy and hyperplasia of sero-mucous gland and goblet cells lining the bronchi. The symptom is regular coughing, with thick greenish yellow sputum that indicates the underlying infection, resulting into excessive secretion of mucous. It may also be caused by cigarette smoking and exposure to air pollutants like carbon monoxide.
- (b) Bronchial Asthma: This is characterised by the spasm of the smooth muscles present in the walls of the bronchiole. It is generally caused due to the hypersensitivity of the bronchiole to the foreign substances present in the air passing through it. Asthma is a difficulty in breathinng causing wheezing due to inflamation of bronchi and bronchioles.
- (c) Emphysema: is a chronic disorder in which alveolar walls are damaged due to which respiratory surface is decreases. One of the major cause of this is cigarette smoking.
- (d) Occupational Respiratory Disorders: In certain industries, especially those involving grinding or stone breaking, so much dust is produced that the defense mechanism of the body cannot fully cope with the situation. Long exposure can give rise to inflammation leading to fibrosis (proliferation of fibrous tissues) and thus causing serious lung damage. Workers in such industries should wear protective masks.

Concept Builder



C	Concept Builder (Answer-Key)								
Que. 1 2 3 4 5									
Ans.	4	1	2	4	3				

Special Points:

- 1. Anatomical dead space:- Amount of air which is inhaled but never reaches the alveoli. (it remain in the conduction zone, which extends from external nostrils to terminal branchiole) This air does not take part in exchange of gases. It is 150 ml in volume.
- 2. Asphyxia It is the state of suffocation due to high CO₂ concⁿ or low O₂ concⁿ.
- **3.** Hypoxia Low O₂ supply to tissues.
- **4**. One molecule of haemoglobin combine with four molecules of **carbon mono oxide** gas to form **carboxyhaemoglobin**. Its colour is cherry red. Due to this O₂ transported to tissue reduce.
- **5.** One molecule of myoglobin has 1 Fe^{++} ions metal.
- 6. Dyspnoea It is the state of discomfort due to difficulty in breathing.
- 7. Foetal haemoglobin differs from adult haemoglobin in structure. Foetal haemoglobin has higher aftinity for O₂ than adult haemoglobin. When PO₂ is low, foetal Hb can carry up to 30% more O₂ than maternal Hb. So dissociation curve for foetal Hb will appear on the left side.

8. Decompression sickness:

During deep sea diving the diver inhales gases at an increased pressure in depth, as a result the nitrogen also gets dissolved in the blood. When the diver comes back to the surface, where the pressure has again decreased, the dissolved nitrogen start getting released from blood in the form of Bubbles which cause a number of problems, example air embolism infarction due to blocked vessel etc.

		Exer	cise - I				
1.	Which has the sm	nallest diameter ?	7.	Inflammation of the lung covering causing severe chest pain is:			
	(1) Right phillip (2) Secondary bro	nchuc		(1) Emphysema		(2) Pleurisy	
	(2) Traches	nenus		(3) Asphyxia		(4) Hypoxia	
	(3) Trachea	anahiala					
	(4) Respiratory br	onchiote	8.	The function of	traci	neal cilia is to:	
2.	Larynx is a modifi	ed portion of:		(1) Pass mucus	out	(2) Pass mucus in	
	(1) Pharvnx	(1) Pharvnx (2) Trachea		(3) Pass air out		(4) Pass air in	
	(3) Bronchus	(4) Lungs	9.	The structure w of food into res	vhich pirate	prevents the entry ory tract is:	
3.	Cartilaginous rir	ngs in trachea are		(1) Pharynx	•	(2) Larynx	
	incomplete at wh		(3) Glottis		(4) Epiglottis		
	(1) Dorsal	(2) Ventral				() _p.8.000.0	
	(3) Lateral	(4) Ventrolateral	10.	Number of alv lungs is:	reoli	present in human	
4.	The most importa	ant muscular structure		(1) 100 million		(2) 70-100 million	
	in		(3) 300 million		(4) 600 million		
	(1) Future lister						
	(1) External interc	ostal muscles	11.	Match the colur	nns:		
	(2) Internal interc	ostal muscles		Column I		Column II	
	(3) Diaphgram		(A)	Larynx	(p)	Lid of larynx	
	(4) Vertebral colu	mn	(B)	Trachea	(q)	Air sacs	
-	Well of alwooli is	ampaged of	(C)	Alveoli	(r)	Voice box	
5.			(D)	Epiglottis	(s)	Wind pipe	
	(1) Simple squame	ous epithelium			(L)	Common	
	(2) Simple cuboid	al epithelium		(1) A—r, B—s, C	—q, I	D—р	
	(3) Pseudostratifi	ed epithelium		(2) A—t, B—s, C	—р,	D—q	
	(4) Simple colum	nar epithelium		(3) A—r, B—s, C	—q,	D—t	
6.	Very high number	of alveoli present in a		(4) A—r, B—t, C	—q,	D—p	
	lung is meant for:		12.	In which part of	lung	s gaseous exchange	
	(1) More space fo	r increasing volume of		takes place:		n duat	
	(2) More area for	diffusion		(1) Trachea & all	veola		
	(2) Moking the ar			(2) Hachea & Dr	t& a	lveoli	
	(3) waking the or	gan spongy			. u a		

(4) Increasing nerve supply

(4) Alveoli & Trachea

- Presence of large number of alveoli around alveolar ducts opening into bronchioles in mammalian lungs is:
 - (1) Inefficient system of ventilation with little of residual air
 - (2) Inefficient system of ventilation with high percentage of residual air
 - (3) An efficient system of ventilation with no residual air
 - (4) An efficient system of ventilation with little residual air
- **14.** Which is the **correct** sequence of the air passage in man ?
 - (1) Nasal cavity → Pharynx → Trachea
 → Larynx → Bronchi → Bronchioles
 → Alveoli
 - (2) Nasal cavity \rightarrow Pharynx \rightarrow Larynx \rightarrow Trachea \rightarrow Bronchi \rightarrow Bronchioles \rightarrow Alveoli
 - (3) Nasal cavity \rightarrow Larynx \rightarrow Pharynx \rightarrow Trachea \rightarrow Bronchi \rightarrow Bronchioles \rightarrow Alveoli
 - (4) Nasal cavity \rightarrow Larynx \rightarrow Bronchi \rightarrow Pharynx \rightarrow Trachea
 - \rightarrow Bronchioles \rightarrow Alveoli
- **15.** If expiratory reserve volume is 1100 ml residual volume is 1200 ml and tidal volume is 500 ml, what shall be the **functional residual capacity:**
 - (1) 1600 ml (2) 2800 ml
 - (3) 2300 ml (4) 1200 ml
- **16.** Expiration involves:
 - (1) Relaxation of diaphragm and intercostal muscles
 - (2) Contraction of diaphragm and intercostal muscles
 - (3) Contraction of diaphragm muscles
 - (4) Contraction of intercostal muscles

- 17. Maximum expiration after full inspiration is called:
 (1) Vital capacity
 (2) Lung capacity
 (3) Tidal volume
 (4) Residual volume
 18. Air that remains in lung after most
- Air that remains in lung after most powerful expiration is:
 (1) Inspiratory air
 (2) Dead space air
 (3) Tidal air
 (4) Residual air
- **19.**Residual air mostly occurs in:
(1) Alveoli
(3) Nostrils(2) Bronchus
(4) Trachea
- 20. Volume of air inspired or expired with each normal breath is known as:
 (1) Inspiratory capacity
 (2) Total lung capacity
 (3) Tidal volume
 (4) Residual volume
- 21. The impulse for voluntary muscles for forced breathing starts in:
 (1) Medulla oblongata (2) Vagus nerve
 (3) Cerebellum (4) Cerebrum
- **22.** Residual volume is:
 - (1) Lesser than tidal volume
 - (2) Greater than inspiratory volume
 - (3) Greater than vital capacity
 - (4) Greater than tidal volume
- 23. Match the items in column I with columnII and choose the correct option:

	Column I		Column II
(A)	Tidal volume	(i)	2500 to 3000 ml of air
(B)	Inspiratory reserve volume	(ii)	1000 ml of air
(C)	Expiratory reserve volume	(iii)	500 ml of air
(D)	Residual volume	(iv)	4600 ml air
(E)	Vital capacity	(v)	1200 ml air

	Α	В	С	D	Е
(1)	(iii)	(iv)	(ii)	(i)	(v)
(2)	(iii)	(i)	(ii)	(v)	(iv)
(3)	(iii)	(ii)	(i)	(v)	(iv)
(4)	(iv)	(iii)	(ii)	(i)	(v)

- **24.** During normal respiration without any effort the volume of air inspired or expired is called:
 - (1) Tidal volume
 - (2) Inspiratory Reserve Volume
 - (3) Residual volume
 - (4) Expiratory Reserve Volume
- 25. What is the functional residual capacity (FRC) in an adult human being ?
 (1) 3000 mL
 (2) 2300 mL
 (3) 1500 mL
 (4) 500 mL
- Haldane effect is due to an increase in:
 (1) CO₂
 (2) Lactic acid
 (3) pH
 (4) Oxyhaemoglobin
- **27.** Select the **incorrect** statement from the following:
 - (1) Pleural fluid reduces friction on the lung surface.
 - (2) The anatomical setup of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the lung (pulmonary) cavity. Such an arrangement is essential for breathing, as we cannot directly alter the pulmonary volume.
 - (3) The trachea, primary, secondary and tertiary bronchi, and initial bronchioles are supported by complete **Bony** rings.
 - (4) During swallowing glottis can be covered by a thin elastic cartilaginous flap called epiglottis to prevent the entry of food into the larynx.
- 28. Receptors associated with aortic and carotid artery can recognise changes in__and __ concentration and send necessary signals to __ for remedial action:
 - (1) O_2 ; CO_2 ; pneumotaxic
 - (2) CO_2 ; H⁺; rhythm centre
 - (3) CO₂; H⁺; apneustic centre
 - (4) O₂; H⁺; pneumotaxic

- 29. Which animal among the following respires via the buccal cavity, moist skin and lungs ?
 (1) Sycon
 (2) Hydra
 - (3) Earthworm (4) Frog
- 30. Epiglottis is made up of:(1) Fibrous cartilage(2) Hyaline cartilage
 - (3) Elastic cartilage
 - (4) Calcified cartilage
- **31.** If the,thoracic wall but not the lungs is punctured:
 - (1) The lungs get inflated.
 - (2) The man dies as the lungs get collapsed.
 - (3) The breathing rate decreases.
 - (4) The breathing rate increases.
- **32.** The urge to inhale in humans results from:
 - (1) Rising pCO₂
 (2) Rising pO₂
 (3) Falling pCO₂
 (4) Falling pO₂

33.

- The maximum volume of air a person can breath in after a forced expiration is: (1) TV + ERV (2) TV + IRV
- $(3) TV + ERV + IRV \qquad (4) ERV + RV$

34. Match the following column:

	Column I		Column II
(A)	Inspiratory	(i)	Total air, a person can
	capacity (IC)		inspire after normal
			expiration
(B)	Expiratory	(ii)	Maximal volume of the
	capacity (EC)		air, a person can breath
			in after a forced
(C)	Functional	(iii)	Volume of the air that
	residual capacity		will remain in lungs
	(FRC)		after a normal
(D)	Vital capacity (VC)	(iv)	Total volume of air a
			person can expire after
			a normal inspiration
Code	es:- A	E	B C D

Codes:- A B C (1) (i) (ii) (iii) (2) (i) (iv) (iii) (3) (i) (iv) (ii)

(iv)

(i)

(iii)

(4)

(iv)

(ii)

(iii)

(ii)

- **35.** Considering the following labels for mentioned structures and select the **correct** sequence of their arrangement:
 - A = Terminal bronchiole
 - B = Respiratory bronchiole
 - C = Tertiary bronchi
 - D = Primary bronchi
 - E = Secondary bronchi
 - F = Initial bronchioles
 - (1) $D \rightarrow E \rightarrow C \rightarrow F \rightarrow A \rightarrow B$
 - (2) $A \rightarrow B \rightarrow D \rightarrow E \rightarrow C \rightarrow F$
 - (3) $C \rightarrow F \rightarrow A \rightarrow B \rightarrow D \rightarrow E$
 - (4) $D \rightarrow E \rightarrow F \rightarrow C \rightarrow B \rightarrow A$
- **36.** Which of the following lung volumes or capacities can be measured by spirometer:
 - (1) Functional residual capacity (FRC)
 - (2) Residual volume
 - (3) Total lung capacity (TLC)
 - (4) Vital capacity
- 37. Consider the following four statements (a-d) and select the option which include all the correct ones only:
 - (a) At the time of inspiration, contraction in diaphragm and external intercostal muscles take place.
 - (b) Normal breathing is also called as abdominal breathing.
 - (c) Expiration during sneezing, coughing, yoga is normal expiration during which IICM and abdominal muscles relax.
 - (d) Inspiration can occur if the pressure within lungs (intra pulmonary pressure) is more than the atmospheric pressure.
 - (1) Statements (a), (b), (c), (d)
 - (2) Statements (a) only
 - (3) Statements (a), (b), (c)
 - (4) Statements (a) & (b)

- **38.** Air filled in dead space is:
 - (1) 150 CC (2) 350 CC
 - (3) 500 CC (4) 1500 CC
- 39. Oxygen in expired air:(1) 10% (2) 16%
 - (3) 19% (4) 4%
- 40. Which one has the lowest value:(1) Tidal volume(2) Vital capacity

 - (3) Inspiratory reserve volume
 - (4) Expiratory reserve volume
- **41.** What percentage of CO₂ flows in blood in form of bicarbonates:
 - (1) 7% (2) 23%
 - (3) 50% (4) 70%
- - (1) Bohr's effect (2) Haldane effect
 - (3) Hamburger effect (4) Root effect
- **43.** "Methemoglobin" refers to:
 - (1) A colourful respiratory pigment
 - (2) Oxidized haemoglobin
 - (3) Oxygenated haemoglobin
 - (4) Deoxygeneted haemoglobin
- **44.** What would happen when blood is acidic:
 - (1) Binding of oxygen with haemoglobin increases
 - (2) Red blood corpuscles are formed in higher number
 - (3) Binding of oxygen with haemoglobin decreases
 - (4) There is no change in oxygen binding nor
 number of RBC
- **45.** Oxygen haemoglobin dissociation curve will shift to right on decrease of:
 - (1) Acidity
 - (2) Carbon dioxide concentration
 - (3) Temperature
 - (4) pH

- **46.** Ratio of oxyhaemoglobin and haemoglobin in blood is based upon:
 - (1) Partial pressure of O_2
 - (2) Carbon-di-oxide tension
 - (3) Carbonate tension
 - (4) Bicarbonate tension
- **47.** Body tissues obtain O₂ from haemoglobin because of its dissociation in tissues caused by:
 - (1) Low oxygen concentration and high CO_2
 - concentration
 - (2) High O_2 concentration
 - (3) Low CO₂ concentration
 - (4) High CO₂ concentration
- **48.** A molecule of haemoglobin can carry oxygen molecule:
 - (1) 2 (2) 4 (3) 6 (4) 8
- **49.** Which of the following structures is not supported by incomplete cartilaginous rings ?
 - (1) Trachea
 - (2) Secondary bronchi
 - (3) Alveolar duct
 - (4) Primary bronchi
- **50.** Exchange of gases in lung alveoli occurs through:
 - (1) Active transport (2) Osmosis
 - (3) Simple diffusion (4) Passive transport
- **51.** Determination of oxygen carried by haemoglobin is done by:
 - (1) pH
 - (2) Partial pressure of oxygen
 - (3) Partial pressure of carbon dioxide
 - (4) All the above
- **52.** Hiccough (hiccup) is due to improper movement of:
 - (1) Intercostal muscle
 - (2) Food in air tract
 - (3) Diapharagm
 - (4) Inadequate oxygen in environment

- 53. Exchange of bicarbonates and chloride ions between RBC and plasma is called: (1) Chloride shift. (2) Bohr's effect. (3) Haldane's effect. (4) Intra cellular respiration. 54. Haemoglobin shows maximum affinity with: (1) Carbon monoxide (2) Carbon dioxide (3) Oxygen (4) Ammonia 55. Dissociation curve shifts to the right when: (1) CO_2 concentration decreases (2) CO_2 concentration increases (3) O_2 concentration increases
 - (4) Cl⁻ concentration increases
- **56.** Haemoglobin-oxygen dissociation curve is:
 - (1) Hyperbolic(2) Sigmoid(3) Straight(4) Constant
- **57.** How much oxygen, blood supplies to tissues in one circulation in normal condition:
 - (1) 75%(2) 4%(3) 25%(4) 20%

58. What happens in Hamburger shift ?

- (1) HCO_{3}^{-} ions move out from the RBC and
 - Cl⁻ ions enters into RBC
- (2) Cl⁻ ions move out from the RBC and HCO_3^- ions enters into RBC
- (3) H⁺ ions move out from the plasma and Cl⁻ ions enterrs into RBC
- (4) HCO₃⁻ ions move out from the plasma and Cl⁻ ions enters into plasma
- **59.** Effect of 2, 3-DPG on the human blood is that:
 - (1) It increases the affinity of O_2 for haemoglobin
 - (2) It decreases the affinity of O_2 for haemoglobin
 - (3) It increases association of Hb and O_2
 - (4) It decreases the value of P_{50}

- **60.** Whether a child died after normal birth or dies before birth can be confirmed by measuring:
 - (1) Tidal volume of air
 - (2) Residual volume of air
 - (3) The weight of the child
 - (4) The dead space air
- 61. In Lungs there is difinite exchange of ions between RBC and Plasma. Removal of CO₂ from blood involves:
 - (1) Efflux of Cl⁻ ions from RBC
 - (2) Influx of Cl^- ions into RBC
 - (3) Influx of HCO_3 ions into plasma.
 - (4) Efflux of HCO_3 ions from RBC
- **62.** The chloride content of RBC will be higher than that of plasma in:
 - (1) Systemic arteries and pulmonary veins
 - (2) Systemic veins and pulmonary arteries
 - (3) Systemic arteries and pulmonary arteries
 - (4) Systemic veins and pumonary veins
- **63.** Find out the **correct** match from the following table:

	Column I	Column II	Column III
(i)	At tissue	$Po_2 = 40 \text{ mm}$	Pco ₂ = 45
	level	Hg	mm Hg
(ii)	In	Po ₂ = 95 mm	Pco ₂ = 50
	pulmonary	Hg	mm Hg
	vein		
(iii)	In systemic	Po ₂ = 40 mm	Pco ₂ = 40
	artery	Hg	mm Hg
(iv)	In alveoli	Po ₂ = 104 mm	Pco ₂ = 40
		Hg	mm Hg

- (1) Both (i) and (ii)
- (2) Both (iii) and (iv)
- (3) (i), (ii) and (iii)
- (4) Both (i) and (iv)

- **64.** Which of the following statement is **not correct:**
 - High concentration of CO₂ activates dissociation of oxyhaemoglobin is called Bohr's effect.
 - (2) Every 100 ml of oxygenated blood can deliver around 5 ml of O₂ to tissue under normal physiological condition
 - (3) Dissociation curve is curve between percentage saturation of Hb with oxygen and partial pressure of oxygen.
 - (4) Formation of oxyhaemoglobin is a process of oxidation.
- 65. Pneumotaxic centre is present on:
 - (1) Pons (2) Medulla
 - (3) Cerebrum (4) Cerebellum
- **66. Respiratory** centre of brain is stimulated by:
 - 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
- **67.** Rate of respiration is directly affected by:
 - (1) CO₂ concentration
 - (2) O₂ in trachea
 - (3) Concentration of O_2
 - (4) Diaphragm expansion
- **68.** If a man from sea coast goes to Everest peak then:
 - (1) His breathing and heart beat will increase
 - (2) His breathing and heart beat will decrease
 - (3) His Breathing rate decrease and Heart rate increase
 - (4) His heart beat decrease and Breathing rate increase

- **69.** CO is more toxic than CO₂ because it:
 - (1) Damages lungs
 - (2) It destryos haemoglobin
 - (3) Affects the nervous system
 - (4) Reduces the oxygen carrying capacity of haemoglobin
- 70. Carbon monoxide has greater affinity for Haemoglobin as compare to oxygen:
 (1) 1000 Times
 (2) 200 Times
 - (3) 20 Times (4) 2 Times
- **71.** Volume of thoracic chamber increases in anteroposterior and-dorso-ventral axis in human by:
 - (1) Contraction of diaphragm and external intercostal muscles respectively
 - (2) Relaxation of diaphragm and external intercostal muscles respectively
 - (3) Relaxation of diaphragm and abdominal muscles respectively
 - (4) Contraction of abdominal muscles and relaxation of external intercostal muscles respectively
- **72.** Pneumotaxic centre can moderate the functions of respiratory rhythm centre by:
 - (1) Reducing the duration of inspiration
 - (2) Increasing the duration of inspiration only
 - (3) First increasing and then reducing the duration of expiration
 - (4) Increasing the duration of expiration only
- **73.** Which of the following are the respiratory organs of insects ?
 - (1) Trachea (2) Skin
 - (3) Cuticle (4) Lungs

- 74. Which of the following volume is not included in vital capacity:(1) ERV (2) TV (3) IRV (4) RV
- 75. In which of the following disorders there is difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles ?

 (1) Emphysema
 (2) Asthma
 (3) Pleurisy
 (4) Tuberculosis
- **76.** The haemoglobin of a human foetus:
 - (1) Has higher affinity for oxygen than that of an adult
 - (2) Has a lower affinity for oxygen than that of the adult
 - (3) Its affinity for oxygen is the same as that of adult
 - (4) Has two protein sub-units instead of four
- **77.** Which of the following factors are favourable for the formation of oxyhaemoglobin ?
 - (A) High pO₂, low pCO₂
 - (B) Lesser H⁺ concentration, lower temperature
 - (C) Low pO_2 , high pCO_2
 - (D) High H⁺, higher temperature
 - (1) A only (2) A and B
 - (3) B and C (4) C and D

	ANSWER KEY																								
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	4	2	1	3	1	2	2	1	4	в	1	3	2	2	3	1	1	4	1	в	4	4	2	1	2
Que.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Ans.	4	3	2	4	3	2	1	3	2	1	4	4	1	2	1	4	1	2	3	4	1	1	2	3	3
Que.	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	4	3	1	1	2	2	3	1	2	2	1	2	4	4	1	2	1	1	4	2	1	1	1	4	2
Que.	76	77																							
Ans.	1	2							,																

Exercise – II

- 1. Arrange the given steps of respiration mechanism in the order they occur in:
 - (i) Diffusion of gases across the alveolar membrane
 - (ii) Diffusion of O₂ and CO₂ between blood and tissue
 - (iii) Breathing or pulmonary ventilation
 - (iv) Utilisation of O₂ by the cells

(v) Transport of gases by the blood.

Correct sequence of these steps is:

- (1) (i) \rightarrow (ii) \rightarrow (iii) \rightarrow (iv) \rightarrow (v)
- (2) (iii) \rightarrow (i) \rightarrow (ii) \rightarrow (v) \rightarrow (iv)
- (3) (iii) \rightarrow (i) \rightarrow (v) \rightarrow (ii) \rightarrow (iv)
- (4) (iii) \rightarrow (ii) \rightarrow (iv) \rightarrow (i) \rightarrow (v)
- **2.** Which is a common passage for food and air:

(1) Trachea	(2) Oesophagus
(3) Pharynx	(4) Glottis

- The function of conducting part in respiratory system of human is:
 (1) Clears foreign particles.
 - (2) Humidifies atmospheric air
 - (3) Brings the air to body temperature
 - (4) All of the above
- **4.** When there is no air in initial bronchioles, they does not collapse. it is due to:
 - (1) Presence of Lecithin
 - (2) Presence of incomplete cartilagenous rings
 - (3) Presence of complete cartilagenous rings
 - (4) Presence of mucous
- **5.** Which of the following steps not involved in respiration:
 - (1) Diffusion of gases across alveolar membrane
 - (2) Transport of gases by the blood
 - (3) Provide nutrients, O₂ to all the living cells of body
 - (4) Utilisation of O₂ by the cells for catabolic reactions and resultant release of CO₂.

- 6. Inspiration can occur, when:
 - (1) Pressure within the lungs is less than the atmospheric pressure.
 - (2) Pressure within the lungs is more than the atmospheric pressure.
 - (3) Pressure within the lungs and atmospheric air is same.
 - (4) No effect of pressure on inspiration.
- **7.** By the contraction in diaphragm volume of thoracic chamber increases in the:
 - (1) Dorso-ventral axis
 - (2) Antero-posterior axis
 - (3) Dorso-posterior axis
 - (4) Antero-ventral axis
- **8.** The primary muscle of inspiration is:
 - (1) Diaphragm
 - (2) Intercostal muscle
 - (3) Abdominal muscle
 - (4) Oblique muscle
- **9.** Total volume of air a person can expire after normal inspiration is:
 - (1) Vital capacity
 - (2) Functional residual capacity
 - (3) Inspiratory capacity
 - (4) Expiratory capacity
- **10.** Which of the following factor can affect the rate of diffusion of gases ?
 - (1) Thickness of the membrances involved in diffusion
 - (2) Solubility of the gases
 - (3) Pressure of the gases
 - (4) All of these
- **11.** Which of the following is correct ?

	Alveoli	Dexogy genated blood	Tissue				
(1)	PO ₂ = 159 mm	PCO ₂ = 40 mm	PCO ₂ = 20 mm				
	Hg	Hg	Hg				
(2)	PCO ₂ = 40 mm	PO ₂ = 95 mm	PO ₂ = 40 mm				
	Hg	Hg	Hg				
(3)	PO ₂ = 104 mm	PCO ₂ = 45 mm	PCO ₂ = 45 mm				
	Hg	Hg	Hg				
(4)	PO ₂ = 40 mm	PO ₂ = 40 mm	PCO ₂ = 45 mm				
	Hg	Hg	Hg				

- **12.** What is true about diffusion capacity:
 - Diffusion capacity of CO₂ is much higher than O₂.
 - (2) Diffusion capacity of O₂ is much higher than CO₂
 - (3) Diffusion capacity of O_2 and CO_2 is same.
 - (4) None of the above
- **13.** Which of the following statement is true:
 - (1) 20-25 percent CO_2 is transported by RBCs.
 - (2)97 percent O_2 is transported by RBCs.
 - (3)70 percent CO_2 is carried as bicarbonate.
 - (4)All of these are true.
- **14.** Binding of oxygen with haemoglobin is primarily related to:
 - (1) Partial pressure of O_2
 - (2) Partial pressure of CO₂
 - (3) H⁺ ion concentration
 - (4) Temperature
- Which of the following factors can alter binding of O₂ with haemoglobin:
 - (A) P_{O_2} (B) P_{CO_2}
 - (C) H⁺ ion concentration
 - (D) Temperature
 - (1) Only A
 (2) B, C and D only
 (3) A and D only
 (4) A, B, C, D
- 16. The conditions which are favourable for the formation of oxyhaemoglobin:
 (1) PO₂↑, PCO₂↑, H⁺conc.↓, Temperature↓
 (2) PO₂↓, PCO₂↓, H⁺conc.↑, Temperature↑
 (3) PO₂↑, PCO₂↓, H⁺conc.↓, Temperature↓
 - (4) PO_2^{\uparrow} , PCO_2^{\uparrow} , H^+ conc. \downarrow , Temperature \uparrow
- **17.** Which of the following statement/s is/are correct ?
 - A- A high concentration of carbonic anhydrase is present in RBC.
 - B- Minute quantities of carbonic anhydrase is present in plasma.

- C- Every 100 ml blood delivers approximately
 4 ml of CO₂ to the alveoli.
- D- 20-25% CO₂ is carried by haemoglobin as carbaminohaemoglobin.
- (1) A, C and D (2) A and D
- (3) A, B, C and D (4) Only A
- 18. Which of the following centre can moderate the functions of the respiratory rhythm centre:
 (1) Dorsal respiratory centre
 (2) Ventral respiratory centre
 - (3) Pneumotaxic centre
 - (4) Chemosensitive centre
- 19. A chemosentive area is situated adjacent to respiratory rhythm centre. Which is highly sensitive to_____ and ions.

(1) O ₂ , H ⁺	(2) CO₂, OH⁻
(3) CO ₂ , H ⁺	(4) CO ₂ , O ₂

- 20. Respiratory rhythm centre is present in:
 (1) Pons region (2) Aortic arch
 (3) Medulla region (4) Carotid artery
- 21. Chronic disorder in which alveolar wall are damged due to which respiratory surface is decreased. One of the major causes of this is cigarette smoking:
 - (1) Asthma (2) Emphysema
 - (3) Bronchitis (4) Fibrosis
- **22.** Regarding the functions of our conduction respiratory system, mark the wrong entry:
 - (1) Humidifies the air
 - (2) Warms up the air
 - (3) Diffusion of gases
 - (4) Clean up the air

- **23.** Total volume of air accomodate in the lungs at the end of forced inspiration:
 - (1) TV + IRV (2) TV+ IRV+ ERV
 - (3) TV + ERV (4) TV +IRV+ERV+RV
- **24.** Mark the true statement among the following with reference to normal breathing:
 - (1) Inspiration is a passive process where as expiration is active
 - (2) Inspiration is a active process where as expirationn is passive
 - (3) Inspiratoin and expiration are active processes
 - (4) Inspirationn and expiration are passive processes
- **25.** A person breathes in some volume of air by forced inspiration after having a forced expiration. This quantity of air taken in is:
 - (1) Total lung capacity
 - (2) Tidal Volume
 - (3) Vital capacity
 - (4) Inspiratory capacity
- **26.** The oxygen -haemoglobin dissociation curve will show a right shift in case of:
 - (1) High pCO₂
 - (2) High pO₂
 - (3) Low pCO₂
 - (4) Less H⁺ concentration
- **27.** Match the followng and mark the correct options

	Animal		Respiratory Organ
(A)	Earthworm	(i)	Moist cuticle
(B)	Arthropods	(ii)	Gills
(C)	Fishes	(iii)	lungs
(D)	Birds/Reptiles	(iv)	Trachea

Options:

- (1) A -ii, B-i, C-iv, D-iii
- (2) A-i, B-iv, C-ii, D-iii
- (3) A-i, B-iii, C-ii, D-iv
- (4) A-i, B-ii, C-iv, D-iii

- 28. Mark the correct pair of muscles involved in the normal breathing in humans:
 - (1) External and internal intercostal muscles
 - (2) Dia phragm and abdominal muscles
 - (3) Diaphragm and external intercostal muscles
 - (4) Diaphragm and internal intercostal muscles
- 29. A person suffers punctures in his chest cavity in an accident, without any damage to the lungs its effect could be:
 (1) Reduced breathing rate
 (2) Rapid increase in brathing rate
 - (3) No change in respiration
 - (4) Cessation of breathing
- Which of t he following group of animals, is uses Lungs for respiration ?
 (1) Fishes, Frog, Tadpole Larva
 (2) Fish, Mollusca, aquatic arthropods
 (3) Reptiles, Birds, Mammals
 (4) Insects, Earthworm, Mollusca
 - (4) Insects, Earthworth, Mottus
 - (5) Cessation of breathing
- **31.** At which level of vertebrae of the vertebral column, trachea divides and forms bronchus ?
 - (1) 4^{th} thorasic vertebrae
 - (2) 5th thorasic vertebrae
 - (3) 7^{th} thorasic vertebrae
 - (4) 3rd thorasic vertebrae
- **32.** Vital capacity of lungs is:
 - (1)TV + IRV+ERV (2) TV+IRV+RV (3) TV + ERV (4) IRV+ ERV
- **33.** Partial pressure of carbon dioxide in Alveoli, atmospheric air and tissues will be: (1) 0.3, 40, 45 (2) 40, 0.3, 45

(1) 010, 10, 10	(_),,
(3) 0.3, 104, 128	(4) 104, 159, 40

34. Every 100 ml deoxygenated blood delivers around -----CO₂ to alveoli:
(1) 20 ml
(2) 4 mll

(3) 5 ml (4) 25 ml

- **35.** Ciliated epithelium lining the trachea and bronchi is advantageous because:
 - (1) Cilia act as sensory hairs
 - (2) Cilia increase the surface area of absorption
 - (3) Cilia kill foreign microbes
 - (4) Ciliary movement propels the mucus and foreign particle towards the larynx.
- **36.** Which factor in tissues favours the formation of HCO_3^- and H^+ ions in the blood ?

(1) Low pCO ₂	(2) High pO2
(3) High pCO ₂	(4) High alkalinity

- 37. The number of lobes in the right and left lung of man respectively are:
 (1) 2 and 3
 (2) 3 and 2
 (3) 4 and 2
 (4) 2 and 4
- **38.** People living at sea level have around 5 million RBC per cu.mm of their blood where as those living at an altitude of 5400 metres have around 8 million. This is because at high altitude.:
 - (1) People eat more nutritive food, therefore more RBC are formed
 - (2) People get pollution free air to breath and more oxygen is available
 - (3) Atmospheric O₂ level is less and more RBC are needed to absorb the required amount of O₂ to survive
 - (4) There is more UV radiation which enhances RBCs production
- **39.** An asthmatic patient has difficulty in breathing. Which of the following would you administer to the patient ? Why ?
 - (1) Histamine, to cause vasodilation in the alveoli
 - (2) Histamine, to contract smooth muscles in the bronchioles
 - (3) Antihistamine, to counteract the bronchoconstriction caused by histamine
 - (4) Acetylcholine, to cause bronchoconstriction
- 40. How many animals in the given list have gills for respiration ?
 Earthworm, Frog, Fish, Insects, Reptiles, Aquatic arthropods, Flatworm, Molluscs, Birds

 (1) Six
 (2) Four
 (3) Three

41. The air tight thoracic chamber is formed dorsally by ___(A)___ and laterally by ___(B)___

Fill up the blanks.

- (1) A Ribs B Intercostal muscles
- (2) A Sternum B Phrenic muscles
- (3) A Vertebrae B Dome-shaped diaphragm
- (4) A Backbone B Ribs
- **42.** Find out the correct match from the following table:

	Column-I	Column-II	Column-III						
<i>(</i> 1)	Tidal volume		500 ml						
(1)	(TV)	(EC-ERV)							
	Expiratory								
(ii)	reserve	(VC-IRV-TV)	3000 ml						
	volume (ERV)								
(;;;;)	Vital capacity		4500 ml						
(11)	(VC)	INVTERVTRV							
(1)	Residual		1200 ml						
(10)	volume (RV)	FRC-ERV	1200 ml						
(1) (i) and (ii) (2) (i), (iii) and									
3) (3) (i), (ii) and (iii) (4) (i) and (iv)								

43. Given below graph graph shows an oxygen dissociation curve:



Where in the body will haemoglobin be saturation at the percentage shown at points X, Y and Z.

- (1) X Pulmonary artery, Y Pulmonary vein,Z Carotid artery
- (2) X- Systemic artery, Y- Pulmonary artery,Z Pulmonary vein
- (3) X- Pulmonary vein, Y Systemic vein,Z Systemic vein during exercise
- (4) X Lift ventricle, Y Right ventricle,
 - Z Systemic artery

44. The following diagram shows exhange of gases between alveolus and body tissues with direction of flow of blood indicated.



Which option **correctly** indicates increasing order in A, B and C of the normal pCO₂ levels (in mm Hg) -

- (1) $B \rightarrow C \rightarrow A$ (2) $A \rightarrow C \rightarrow B$
- $(3) C \rightarrow B \rightarrow A \qquad (4) A \rightarrow B \rightarrow C$

45. Given below is a list of some structure of human respiration system in a box.

Trachea, Primary bronchi, Alveoli,
Tertiary bronchi, Initial bronchiole,
Terminal bronchiole, Respiratory
bronchiole Secondary bronchiHow many of them do not possess
incomplete cartilaginous rings.
(1) Two
(2) Four
(3) Five

- **46.** Respiratory distress syndrome of new borne is primarily due to -
 - (1) Non-functioning of diaphragm
 - (2) Non-functioning of intercostals
 - (3) Little or no surfactant formation in alveoli
 - (4) Inability of secreation of NO
- **47.** What is the last step involved in respiration ?
 - (1) Diffusion of gases
 - (2) Breathing
 - (3) Utilisation of O_2 by body cells and resultant release of CO_2
 - (4) Transport of gases
- **48.** In high mountains, difficulty in breating is due to-
 - (1) Decrease in amount of oxygen
 - (2) Increases in carbon dioxide concentration
 - (3) Decrease in partial pressure of oxygen
 - (4) All of these

	ANSWER KEY																								
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	3	3	4	2	3	1	2	1	4	4	3	1	4	1	4	3	3	3	3	3	2	3	4	2	3
Que.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48		
Ans.	1	2	3	4	3	2	1	2	2	4	3	2	3	3	3	4	4	3	2	4	3	3	3		

Exercise – III (Previous Year Questions)

AIPMT-2006

- Which one of the following statements is incorrect:
 - The residual air in lungs slightly decreases the efficiency of respiration in mammals
 - (2) The presence of non-respiratory air sacs, increase the efficiency of respiration

in birds

- (3) In insects, circulating body fluids serve to distribute ooxygen to tissues
- (4) The principle of countercurrent flow facilitates efficient respiraton in gills of fishes.
- The majority of carbon dioxide produced by our body cells is transported to the lungs:
 - (1) Dissolved in the blood
 - (2) As bicarbonates
 - (3) As carbonates
 - (4) Attached to hemoglobin

AIPMT-2007

 Arrange the following in the order of increasing

volume:

- (A) Tidal Volume
- (B) Residual Volume
- (C) Inspiratory reserve volume
- (D) Vital capacity

(1) A < B < C < D	(2) A > C > B > D

(3) A < D < C < B (4) A > D > B > C

AIPMT-2008

- 4. What is vital capacity of our lungs ?
 - (1) Inspiratory reserve volume plus expiratory reserve volume
 - (2) Total lung capacity minus residual volume
 - (3) Inspiratory reserve volume plus tidal volume
 - (4) Total lung capacity minus expiratory reserve volume

AIPMT-2010

- 5. What is true about RBCs in humans ?
 - (1) They do not carry CO_2 at all
 - (2) They carry about 20-25 percent of CO₂
 - (3) They transport 99.5 percent of CO₂
 - (4) They transport about 80 percent of it is transported in dissolved state in blood plasma
- 6. Listed below are four respiratory capacities (a-d) and four jumbled respiratory volumes of a normal human adult:

Respiratory	Respiratory								
Capacities	volume								
(a) Residual vol.	2500 mL								
(b) Vital capacity	3500 mL								
(c) Inspiratory reserve vol. 1200mL									
(d) Inspiratory capacity	4500 mL								
Which one of the followir	ng is the correct								
matching of two capacitie	s and volumes ?								
(1) (a) 4500 mL (b) 3500	mL								
(2) (b) 2500 mL (c) 4500 mL									
(3) (c) 1200 mL (d) 2500 mL									
(4) (d) 3500 mL (a) 1200	mL								

AIPMT PRE - 2011

7. The figure given below shows a small part of human lung where exchange of gases takes place. In which one of the options given below, the one part, A, B, C or D is correctly identified along with its functions:



- C: arterial capillary passes oxygen to tissues
- (2) **A:** Alveolar cavity-main site of exchange of respiratory gases
- (3) D: Capillary wall-exchange of O₂ and CO₂ takes place here
- (4) **B:** red blood cell transport of CO₂ mainly
- 8. A large proportion of oxygen is left unused the human blood even after its uptake by the body tissues. This O₂:
 - (1) Acts as a reserve during muscular exercise.
 - (2) Raises the pCO₂ of blood 75 mm of Hg.
 - (3) Is enough to keep oxyhaemoglobin saturation at 96%
 - (4) Helps in releasing more O₂ to the epithelial tissues.
- 9. Two friends are eating together on a dining table. One of the them suddenly starts coughing while swallowing some food. This coughing would have been due to improper movement of:
 - (1) Epiglottis (2) Diaphragm
 - (3) Neck (4) Tongue

AIPMT MAINS - 2011

- **10.** Bulk carbon dioxide (CO₂) released from body tissues into the blood is present as:
 - (1) Carbamino-haemoglobin in RBCs
 - (2) Bicarbonate in blood plasma and RBCs
 - (3) Free CO_2 in blood plasma
 - (4) 70% carbamino haemoglobin and 30% as bicarbonate

AIPMT PRE - 2012

- **11.** Which one of the following is the correct statement for respiration in humans ?
 - Workers in grinding and stone breaking industries may suffer, from lung fibrosis
 - (2) Abut 90% of carbon dioxide (CO₂) is carried by haemoglobin as carbamino haemoglobin
 - (3) Cigaret and smoking may lead to inflammation of bronchi
 - (4) Neural signals from pneumotoxic centre in pons region of brain can increase the duration of inspiration.
- **12.** People who have migrated from the planes to an area adjoining Rohtang pass about six months back:
 - (1) Suffer from altitude sickness with symptoms like nausea, fatifue, etc.
 - (2) Have the usual RBC count but their haemoglobin has very high binding affinity to O₂
 - (3) Have more RBCs and their haemoglobin has a lower binding affinity to O₂
 - (4) Are not physically fit to play games like football.

AIIMS-2012

- **13.** During swallowing of food which of the following structures prevent the entering of food into the glottis ?
 - (1) Semilunar Valve
 - (2) Circular Muscular flap
 - (3) Cartilaginous flap
 - (4) Circular sphincter

NEET - UG -2013

14. The figure showns a diagramatic view of human respiratory system with labels A, B, C and D. Select the option which given correct indentification and main function and /or characteristic:



- D- Lower end of lungs- diaphragm pulls it down during inspiration
- (2) A- trachea long tube supported by complete cartilaginous rings for conducting inspired air
- (3) B- pleural membrane surrounded ribs on both sides to provide cushion against rubbing.
- (4) C- Alveoli-thin walled vascular bag like structures for exchange of gases.

AIPMT-2014

- 15. Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs:
 - (1) As bicarbonate ions
 - (2) In the form of dissolved gas molecules
 - (3) By binding of RBC
 - (4) As carbamino- haemoglobin

AIPMT-2015

- **16.** When you hold your breath, which of the following gas changes in blood would first lead to the urge to breathe ?
 - (1) Rising CO₂ concentration
 - (2) Falling CO₂ concentration
 - (3) Rising CO_2 and falling O_2 concentration
 - (4) Falling O₂ concentration

AIIMS-2015

17. Given figure is showing spirogram of pulmonary volumes and capacities:



Which represent expiratory reserve volume:

- (1) A (2) B (3) C (4) D
- **18.** Oxygen dissociation curve shifts to right when:
 - (1) P_{0} decreases
 - (2) P_{CO_3} decreases
 - (3) pH increases
 - (4) Temperature decreases

NEET - UG - 2016

- **19.** Name the chronic respiratory disorder caused mainly by cigarette smoking:
 - (1) Emphysema
 - (2) Asthma
 - (3) Respiratory acidosis
 - (4) Respiratory alkalosis

- **20.** Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because:
 - (1) There is a positive intrapleural pressure
 - (2) Pressure in the lungs in higher than the atomospheric pressure
 - (3) There is a negative pressure in the lungs
 - (4) There is a negative intrapleural pressure pulling at the lung walls
- **21.** The partial pressure of oxygen in the alveoli of the lungs is:
 - (1) Less than that in the blood
 - (2) Less than that of carbon dioxide
 - (3) Equal to that in the blood
 - (4) More than that in the blood

NEET - 2017

- **22.** Lungs are made up of air-filled sacs, the alveoli. They do not collapse even after forceful expiration, because of:
 - (1) Inspiratory Reserve Volume
 - (2) Tidal Volume
 - (3) Expiratory Reserve Volume
 - (4) Residual Volume

AIIMS - 2017

- **23.** 'CO' poisoning causes the decrease in oxygen availability to the tissues because:
 - (1) It binds the haemoglobin and to form stable compound carboxyhaemoglobin
 - (2) It increases CO₂ concentration in our body
 - (3) It is a toxic gas so main body organs like brain, failure occured.
 - (4) 'CO' impedes the CO_2 transportation.

NEET - 2018

- 24. Which of the following is an occupational respiratory disorder ?(1) Emphysema (2) Anthracis
 - (3) Botulism (4) Silicosis
- 25. Which of the following options correctly represents the lung conditions in asthma and emphysema, respectively ?
 - (1) Decreased respiratory surface; Inflammation of bronchioles
 - (2) Inflammmation of bronchioles; Decreased respiratory surface
 - (3) Increased respiratory surface; Inflammation of bronchioles
 - (4) Increased number of bronchiloes; Increased respiratory surface
- 26. Match the items given in column I with those in Column-II and select the correct options given below:

		Colum	ın-l		Column-II			
a.	Tidal	volum	e	i.	2500-3000 mL			
b.	Inspi volur	ratory ne	Reserve	ii.	1100 – 1200 mL			
c.	Expir volur	atory l ne	Reserve	iii.	500 – 550 mL			
d.	Resid	lual vo	lume	iv.	1000 – 1100 mL			
		a	b	с	d			
	(1)	iv	iii	ii	i			
	(2)	2) iii ii		i	iv			
	(3)	i	iv	ii	iii			
	(4)	iii	i	iv	ii			

AIIMS - 2018

- **27.** O₂ dissociation curve is plotted between pO₂ and
 - (1) % Hb saturation.
 - (2) pCO₂
 - (3) Hb concentration
 - (4) RBC/mm³ of blood

NEET - 2019

28. 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 ?
(1) 2200 mL
(2) 2700 mL

(3) 1500 mL (4) 1700 mL

- **29.** What would be the heart rate of a person it the cardiac output is 5L, blood volume in the ventricles at the end of diastole is 100 mL and at the end of ventricular systole is 50 mL ?
 - (1) 100 beats per minute
 - (2) 125 beats per minute
 - (3) 50 beats per minute
 - (4) 75 beats per minute
- **30.** Due to increasing air-borne allergens and pollutants, many people in urban areas are suffering from respiratory disorder causing wheezing due to:
 - (1) proliferation of fibrous tissues and damage of the alveolar walls.
 - (2) reduction in the secretion of surfactants by pneumocytes.
 - (3) benign growth on mucous lining of nasal cavity.
 - (4) inflammation of bronchi and bronchioles.

NEET(UG) 2019 (ODISHA)

- **31.** Select the correct statement.
 - Expiration occurs due to external intercostal muscles
 - (2) Intrapulmonary pressure is lower than the atmospheric pressure during inspiration.
 - (3) Inspiration occurs when atmospheric pressure is less than intrapulmonary pressure.
 - (4) Expiration is initiated due to contraction of diaphragm.

- **32.** The maximum volume of air a person can breathe in after a forced expiration is known as:
 - (1) Expiratory Capacity
 - (2) Vital Capacity
 - (3) Inspiratory Capacity
 - (4) Total lung Capacity

NEET - 2020

- **33.** Identify the wrong statement with reference to transport of oxygen.
 - Binding of oxygen with haemoglobin is mainly related to partial pressure of O₂.
 - (2) Partial pressure of CO₂ can interfere with O₂ binding with haemoglobin.
 - (3) Higher H⁺ conc. in alveoli favours the formation of oxyhaemoglobin.
 - (4) Low pCO₂ in alveoli favours the formation of oxyhaemoglobin.
- **34.** Select the correct events that occur during inspiration.
 - (a) Contraction of diaphragm
 - (b) Contraction of external inter-costal muscles
 - (c) Pulmonary volume decreases
 - (d) Intra pulmonary pressure increases
 - (1) (a) and (b)
 - (2) (c) and (d)
 - (3) (a), (b) and (d)
 - (4) only (d)

NEET - 2020 (COVID-19)

- **35.** The total lung capacity (TLC) is the total volume of air accomodated in the lungs at the end of a forces inspiration. This includes:
 - RV; IC (Inspiratory Capacity);
 EC (Expiratory Capacity); and ERV
 - (2) RV; ERV; IC and EC
 - (3) RV; ERV; VC (Vital Capacity) and FRC; (Functional Residual Capacity)
 - (4) RV (Residual Volume);
 - ERV (Expiratory Reserve Volume);
 - TV (Tidal Volume); and
 - IRV (Inspiratory Reserve Volume)

- (a) Pneumotaxic Centre(i)(b) O2 Dissociation curve(ii)(c) Carbonic Anhydrase(iii)Haemoglobin
- **36.** Match the following columns and select the correct option:

(1) (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)

(iv) R.B.C.

Primary site of

exchange of gases

(d)

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

NEET - 2021

37. Select the favourable conditions required for the

formation of oxyhaemoglobin at the alveoli.

- (1) High pO_2 , low pCO_2 , less H^+ , lower temperature
- (2) Low pO₂, high pCO₂, more H⁺, higher temperature
- (3) High pO₂, high pCO₂, less H⁺, higher temperature
- (4) Low pO₂, low pCO₂, more H⁺, higher temperature
- **38.** The partial pressures (in mm Hg) of oxygen (O₂) and carbon dioxide (CO₂) at alveoli (the site of diffusion) are :
 - (1) $pO_2 = 104$ and $pCO_2 = 40$
 - (2) $pO_2 = 40$ and $pCO_2 = 45$
 - (3) $pO_2 = 95$ and $pCO_2 = 40$
 - (4) $pO_2 = 159$ and $pCO_2 = 0.3$

NEET - 2022

- **39.** Which of the following is **not** the function of conducting part of respiratory system?
 - It clears inhaled air from foreign particles
 - (2) Inhaled air is humidified
 - (3) Temperature of inhaled air is brought to body temperature
 - (4) Provides surface for diffusion of O_2 and CO_2

40. Under normal physiological conditions in human being every 100 ml of oxygenated blood can deliver ____ml of O₂ to the tissues.

- (1) 2 ml (2) 5 ml
- (3) 4 ml (4) 10 ml

RE-NEET – 2022

- **41.** Which of the following statements are correct with respect to vital capacity?
 - (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 breath 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:-

- (1) (b), (d) and (e)
- (2) (a), (c) and (d)
- (3) (a), (c) and (e)
- (4) (a) and (e)

ANSWER KEY																									
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	3	2	1	2	2	4	2	1	1	2	1	3	3	4	1	1	3	1	1	4	4	4	1	4	2
Que.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41									
Ans.	4	1	3	1	4	2	2	3	1	4	2	1	1	4	2	3									