For BioResire students

NEET Biology Material

Elite Batch

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BREATHING AND EXCHANGE OF GAS

Breathing:- Process involves inhalation and exchalation
- Involves exchange of gases (O_2 ,CO_2) (from air)

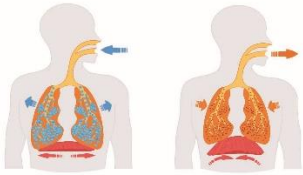
Respiration

Aerobic	Anaerobic
O_2 is required	Oxygen is not required

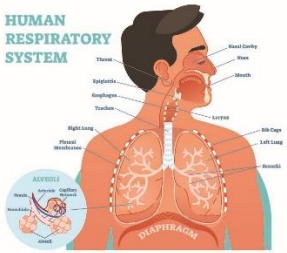
- oxidation of glucose in the presence or absence of oxygen

ATP is produced (Adenosine triphosphate)

BREATHING



Human Respiratory System



- **Pharynx** – Nasal cavities – External Nostrils
- **Larynx** – Voice box.
- **Trachea** – protected by 'C' shaped cartilaginous sings. → prevent collapsing.
- **Bronchi** – Secrete mucous.
- **Bronchioles** – Give rise to numerous Alveoli.

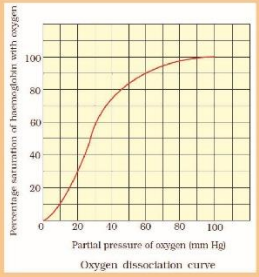
Epiglottis
- o Cartilaginous flap
- o Prevents the entry of food during swallowing.

Respiratory Organs

- Gills- Pisces, Aquatic arthropods, Molluscs.
- Skin- Earthworm.
- Moist skin and lungs- Amphibians
- Entire body surface- Sponges, coelenterate and flatworm.
- Lungs- Mammals
- Tracheal system- Insects

Oxygen dissociation curve

- Factors affecting the binding of O_2 with Hb.
- Conditions favorable for association
  - High PO_2 , low PCO_2
  - Low H^+ Concentration
  - Low Temperature
- Conditions favorable for dissociation
  - Low PO_2 , high PCO_2
  - High H^+ Concentration
  - High Temperature



Volumes

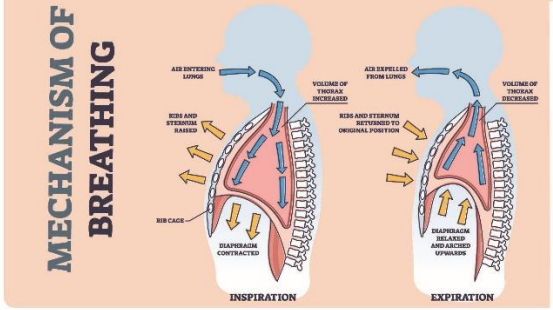
Tidal volume (TV) (500ml : 6000-8000ml/min)	Volume of air inspired or expired per breath.
Inspiratory Reserve Volume (IRV) (2500-3000 ml)	Volume of air one inhales by forced inspiration.
Expiatory Reserve volume(ERV) (1000-1100 ml)	Extra volume of air one inhales by forced expiration.
Residual volume (RV) (1100-1200 ml)	Volume of air remaining in lungs after forced exhalation.
Dead air volume of air volume	Not involved in gaseous exchange but present in the lungs (150 ml).

Capacities

Inspiratory Capacity	Volume of air one inhales after normal exhalation (IC = TV+ IRV) 3000 – 3500 ml
Expiratory Capacity	Volume of air one exhales after normal inhalation (EC = TV + ERV) 1500 – 1600 ml
Functional Residual Capacity (FRC)	Volume of air remaining in lungs after normal exhalation (FRC = ERV + RV) 2100 – 2300 ml
Vital capacity (VC)	Volume of air exhales or inhales after forced inhalation or exhalation (VC = ERV + TV + IRV 3500 – 4500 ml)

Mechanism of Breathing

Inspiration	• Air is drawn in, an active process. • Occurs due to negative pressure.
Diaphragm and external inter-Coastal muscles Contracts	• Volume of thoracic chamber increases. • Pulmonary pressure decreases. • air moves from high pressure zone to low pressure zone (PL < PA). • Air moves inside the lungs ($P \propto \frac{1}{V}$)
Expiration	• Alveolar air is expelled out, passive process • Occurs due to positive pressure
Diaphragm and external inter-coastal muscles relax	• Pulmonary pressure increases. • Air moves outside the lungs (PA < PL). • Volume of thoracic chamber decreases.



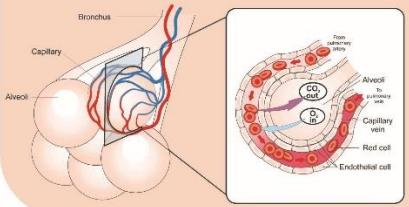
Respiratory System

Conducting Part
- Transport air (O_2) to alveoli
- Prevents the entry of foreign particle
- Humidifies and brings the air to body temperature

Respiratory or exchange part
- Site of diffusion of gases (O_2 & CO_2)
- Consists alveoli and blood vessels

exchange of gases – occurs by diffusion

Rate of diffusion influenced:-
- o Pressure/Concentration gradient of gas
- o Solubility of gas & thickness of membrane.



Disorders

Asthma-inflammation of bronchi & Bronchioles difficulty in Breathing.

Emphysema-Decreased respiratory surface.
- Caused by Smoking.
- Damaged alveolar wall.

Silicosis- Example of occupational respiratory disorder.
- Caused by inhalation of Silica dust for longtime.

Regulation of Respiration
- Pneumotaxic center – Pons of brain
- Respiratory rhythm center – Medulla oblangata

Factors affecting the binding of CO_2

For association
- Low PO_2
- High PCO_2
- High H^+ temp

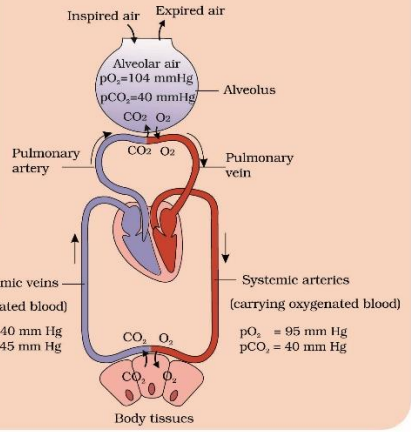
For dissociation
- High PO_2
- Low PCO_2
- Low H^+ temp.

$$HCO_3^- + H^+ \xrightarrow{\text{carbonic anhydrase}} H_2CO_3$$

$$H_2CO_2 \rightarrow CO_2 + H_2O$$

Transport of Gases

O_2	CO_2
• 97% through Hb (oxyhemoglobin) • 3% through plasma	• 70% through HCO_3^- • 7% through plasma.



BREATHING AND EXCHANGE OF GASES

Breathing

The process of exchange of O_2 from the atmosphere with CO_2 produced by the cell is called breathing. It occurs in two stages of inspiration and expiration. During inspiration air enters the lungs from atmosphere and during expiration air leaves the lungs.

Difference between Breathing and Respiration

Breathing	Respiration
It is simply an intake of fresh air and removal of foul air.	It is the oxidation of food to form carbon dioxide, water and energy.
It is a physical process.	It is a biochemical process.
No energy is released.	Energy is released in form of ATP.
It is an extracellular process.	It is an intracellular process.

Respiratory Organs

Mechanism of breathing varies in different organism according to their body structure and habitat.

Respiratory Organs	Organisms
Entire Body surface	Sponges, coelenterate, flatworms.
Skin	Earthworm.
Tracheal system	Insects
Gills	Pisces, aquatic arthropods.
Lungs	Amphibians, mammals.

Human Respiratory System

Each bronchiole terminates into an irregular walled, vascularized bag like structure called alveoli. Human respiratory system consists of a pair of nostrils, pharynx, larynx, bronchi and bronchioles that finally terminates into alveoli.

Nasal chamber open into pharynx that leads to larynx. Larynx contains voice box (sound box) that help in sound production.

The trachea, primary, secondary, and tertiary bronchi and initial bronchioles are supported by incomplete cartilaginous rings to prevent collapsing in absence of air. The branching network of bronchi, bronchioles and alveoli collectively form the lungs.

Two lungs are covered with double layered pleura having pleural fluid between them to reduce the friction on lung surface.

Respiratory System: (i) Conducting Parts (ii) Exchange Parts

Conducting parts: include nostrils, pharynx, larynx and trachea. Main functions include-

- Transport of atmospheric air to alveoli.
- Removing foreign particles from air, humidifying it and bringing it to body temperature.

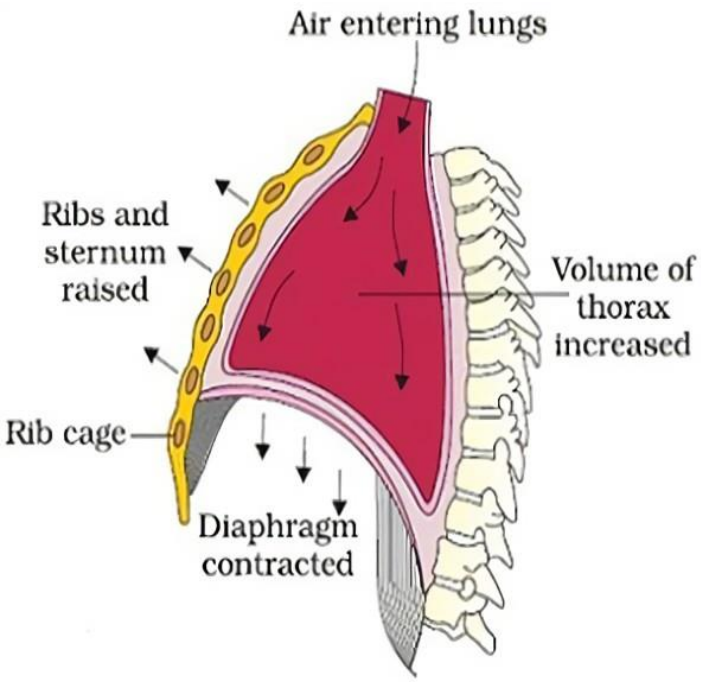
The exchange: parts are alveoli. It is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air.

Steps of Respiration

- Breathing in which Oxygen rich atmospheric air is diffused in and CO_2 rich alveolar air is diffused out.
- Diffusion of gases across alveolar membrane.
- Transport of gases by blood.
- Diffusion of CO_2 and CO_2 between blood and tissues.
- Utilization of CO_2 by cells to obtain energy and release of CO_2 (cellular respiration).

Mechanism of Breathing

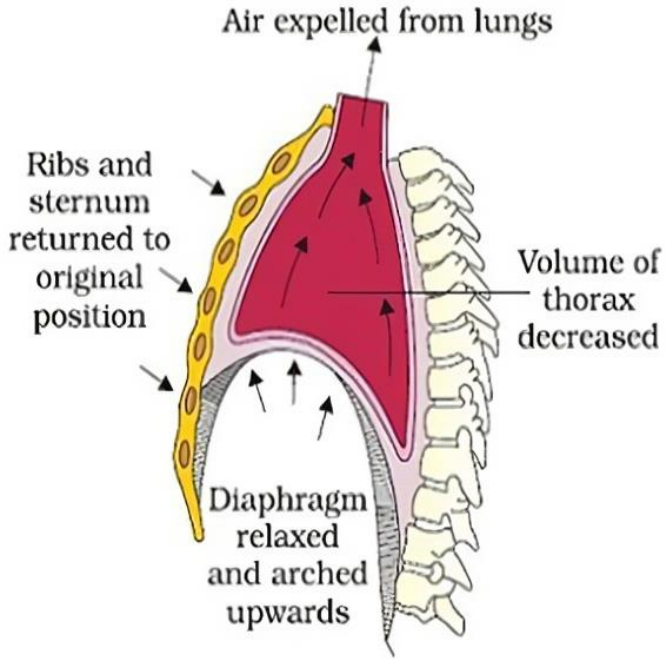
1. Breathing involves inspiration and expiration. During inspiration atmospheric air is drawn in and during expiration, alveolar air is released out.
2. Movement of air in and out takes place due to difference in pressure gradient.
3. Inspiration occurs when pressure inside the lung is less, and expiration occurs when pressure is more in lungs than outside.
4. The diaphragm and external and internal intercostal muscles between the ribs help in developing pressure gradient due to change in volume.



5. The contraction of intercostal muscles lifts the ribs and sternum causing an increase in volume of thoracic cavity that results in decrease in pressure

than the atmospheric pressure. This causes inspiration.

6. Relaxation of the diaphragm and intercostal muscles reduce the thoracic volume and increase the pressure causing expiration.
7. The volume of air involved in breathing movements is estimated by using spirometer for clinical assessment of pulmonary functions.



Respiratory Volume and Capacities

Tidal volume (TV): Volume of air inspired or expired during a normal respiration. It is about 500mL in healthy man.

Inspiratory Reserve Volume (IRV): Additional volume of air a person can inspire by forceful inspiration. It is about 2500 mL to 3000 mL.

Expiatory Reserve Volume (ERV): Additional volume of air a person can expire by forceful expiration. It is about 1000 mL to 1100mL.

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

Inspiratory Capacity (IC): TV + IRV

Expiratory Capacity (EC): TV + ERV

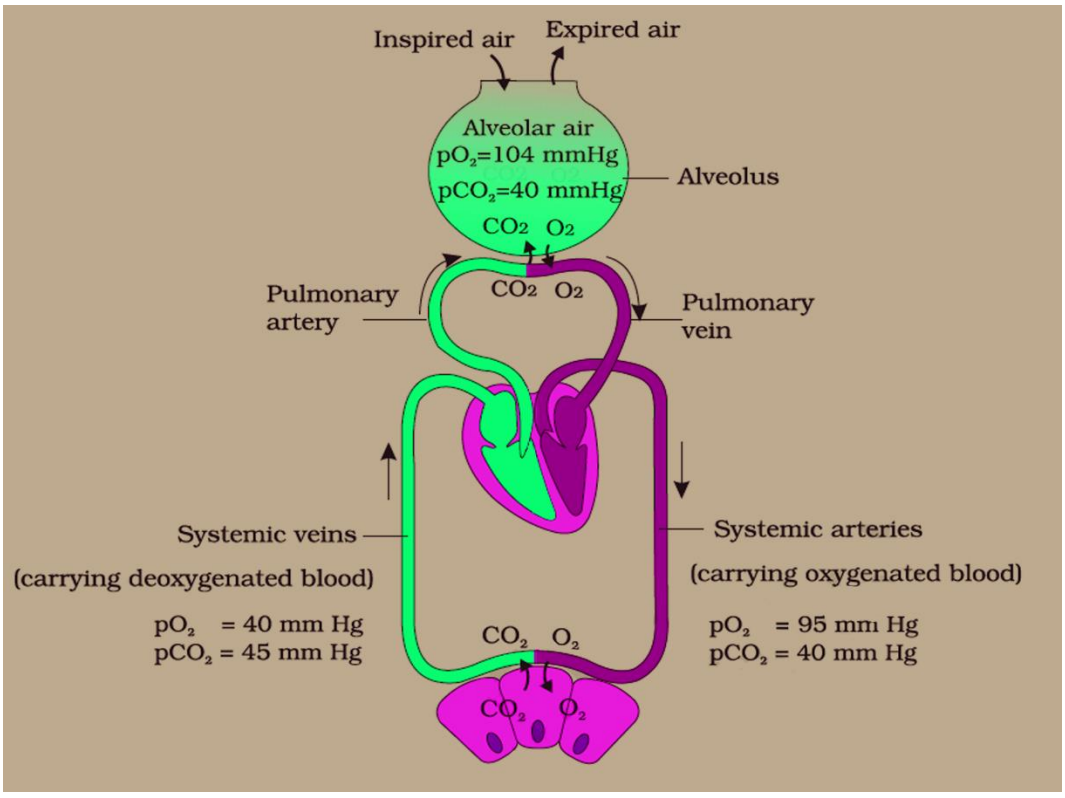
Functional Residual Capacity (FRC): ERV + RV

Vital Capacity (VC): Maximum volume of air a person can breathe in after a forceful expiration. ERV + TV + IRV

Total Lung Capacity (TLC): Total volume of air accommodated in lung at the end of forced inspiration. RV + ERV + TV + IRV or Vital capacity + Residual Volume.

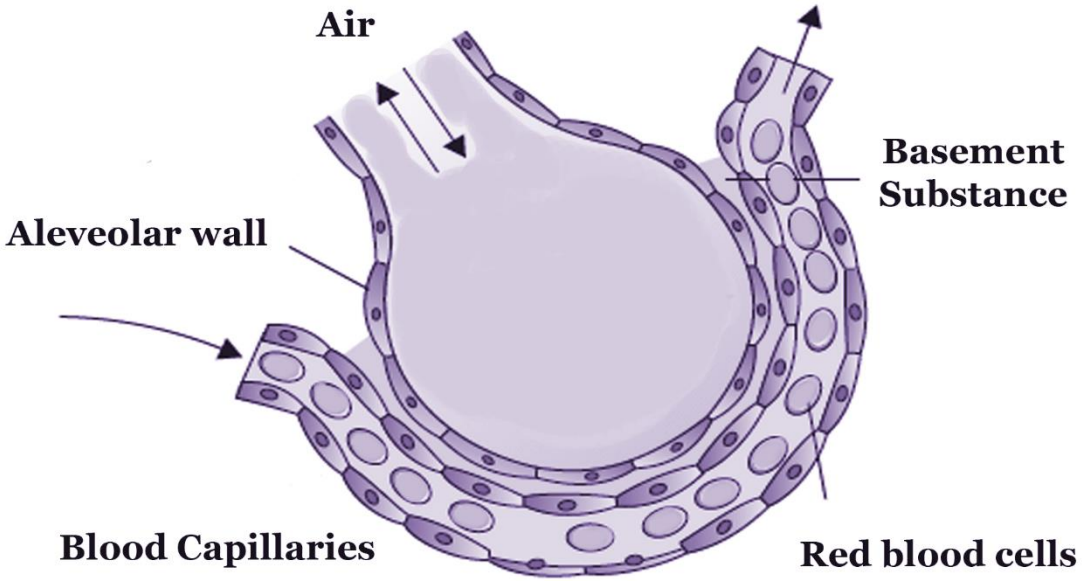
Exchange of Gases

1. Exchange of gases takes place at two sites
   - Alveoli to blood
   - Between blood and tissues.
2. Exchanges of gases occur by simple diffusion due to pressure/ concentration gradient, solubility of the gases and thickness of membrane.
3. Pressure contributed by individual gas in a mixture of gas is called partial pressure represented by pCO_2 and pO_2.
4. Partial pressure of Oxygen and carbon dioxide at different part involved in diffusion varies from one part to another and moves from higher partial pressure to lower partial pressure.
5. Solubility of CO_2 is 20-25 times more than solubility of O_2, so CO_2 diffuse much faster through membrane.
6. Diffusion membrane is three layered thick, that is alveolar squamous epithelium, endothelium of alveolar capillaries and basement substance between them.



Transport of Gases

- Blood is the medium of transport for CO_2 and O_2. Most of oxygen (97%) is transported through RBC and remaining 3% by blood plasma.
- 20-25% of CO_2 is transported by RBC, 70% as bicarbonate and rest 7% in dissolved state by blood plasma.



Transport of Oxygen

- Haemoglobin in RBC combines with O_2 to form Oxyhaemoglobin. Each haemoglobin combine with four oxygen molecules.
- Binding of O_2 is related with partial pressure of O_2 and CO_2, hydrogen ion concentration and temperature.
- Percentage saturation of haemoglobin and partial pressure of oxygen forms sigmoid curve (oxygen dissociation curve).
- In the alveoli, pO_2 is more and pCO_2 is less, less H+ ions concentration and lower temperature favour the binding of O_2 with hemoglobin. Where opposite condition in tissues favour the dissociation of Oxyhaemoglobin.

Transport of Carbon dioxide

- Carbon dioxide is transported by haemoglobin as carbamino-haemoglobin. In tissues pCO_2 is high and pO_2 is less that favour the binding of carbon dioxide with haemoglobin. Opposite condition help in dissociation of carbamino- haemoglobin in alveoli.
- Enzyme carbonic anhydrase help in formation of carbonate ions to transport carbon dioxide.

Regulation of Respiration

- Human beings have ability to maintain and moderate the rate of respiration to fulfill the demand of body tissues by neural system.
- Respiratory rhythm center is located in medulla region of hind brain. Pneumotaxic center in pons moderate the function of respiratory rhythm center.
- Chemo-sensitive area near rhythm center is highly sensitive to C and H+ ions that ultimately control the respiratory rate. Oxygen do not play major role in controlling rate of respiration.

Functions of Respiration

- Energy production.
- Maintenance of acid-base balance.
- Maintenance of temperature
- Return of blood and lymph.

Mountain Sickness

Mountain Sickness is the condition characterized by the ill effect of hypoxia (shortage of oxygen) in the tissues at high altitude commonly to person going to high altitude for the first time.

Symptoms:

- Loss of appetite, nausea, and vomiting occurs due to expansion of gases in digestive system.
- Breathlessness occurs because of pulmonary oedema.
- Headache, depression, disorientation, lack of sleep, weakness and fatigue.

Disorder of Respiratory System

Asthma: It is due to allergic reaction to foreign particles that affect the respiratory tract. The symptoms include coughing, wheezing and difficulty in breathing. This is due to excess of mucus in wall of respiratory tract.

Emphysema: Is the inflation or abnormal distension of the bronchioles or alveolar sacs of lungs. This occurs due to destroying of septa between alveoli because of smoking and inhalation of other smokes. The exhalation becomes difficult, and lung remains inflated.

Occupational Respiratory Disorders: Occurs due to occupation of individual. This is caused by inhalation of gas, fumes or dust present in surrounding of workplace. This includes Silicosis, Asbestoses due to exposer of silica and asbestos. The symptom includes proliferation of fibrous connective tissue of upper part of lung causing inflammation.

Pneumonia: It is acute infection or inflammation of the alveoli of the lungs due to bacterium streptococcus pneumoniae. Alveoli become acutely inflamed and most of air space of the alveoli is filled with fluid and dead white blood corpuscles limiting gaseous exchange.

NCERT LINE BY LINE QUESTIONS

Para-17.1
Introduction and Respiratory Organs

1. In which of the following gaseous exchange between O_2 and CO_2 occurs through general body surface? [Pg-268,E]
(A) Sponges (B) Coelenterates (C) Flatworms (D) All

2. Match the followings correctly. [Pg-268,E]

	Animals		Respiratory Organs
A.	Earthworms	1.	Lungs
B.	Most aquatic arthropods	2.	Trachea
C.	Fishes	3.	Gills
D.	Birds/Reptiles	4.	Moist cuticle
E.	Insects		

(A) A-IV, B and C-III, D-I, E-II (B) A- IV, B - III C and D -I, E - III
(C) A-II, B and C - III, D - I, E - IV (D) A-III, B and C-I, D-II, E-IV

3. Amphibians e.g. frogs respire – [Pg-268, E]
(A) Through moist skin (B) Lungs (C) Both a and b (D) Trachea

Para-17.1.1
Human Respiratory System

4. Which is the correct sequence of air passages in man? [Pg-269, E]
(A) External Nostril→ Nasal passage→Internal nostril→ Pharynx →Larynx→ Trachea → Bronchi → Bronchioles → Alveoli
(B) Nose→ Larynx→ Pharynx→ Bronchioles→ Bronchi → Alveoli
(C) Nose→ Pharynx →Trachea→ Larynx→ Bronchi → Bronchioles→ Alveoli
(D) Nose → Larynx→ Bronchi→ Pharynx→ Trachea→ Bronchioles →Alveoli

5. Which is correct about nasopharynx? [Pg-269, E]
(A) Internal nostrils open into nasopharynx
(B) It is the common passage for both air and food
(C) It opens through gullet of the larynx region into the trachea
(D) All

6. Which of the following options is wrong about the larynx (sound box)? [Pg-269, E]
(A) It is a bony box (B) Glottis is the opening into the larynx
(C) During swallowing of food glottis is covered by epiglottis to prevent food entry into the larynx
(D) All

7. Trachea divides into right and left primary bronchi at _____ thoracic vertebra. [Pg-269, E]
(A) 4 (B) 5 (C) 6 (D) 9

8. Incomplete cartilaginous rings support all of the following except- [Pg-269, E]
(A) Trachea (B) Primary, secondary and tertiary bronchi
(C) Respiratory bronchioles (D) Initial bronchioles

9. Which of the following has the smallest diameter? [Pg-269, E]
(A) Trachea (B) Terminal bronchiole (C) Tertiary bronchus (D) Secondary bronchus

10. Lungs are comprised by – [Pg-269, E]
(A) Only alveoli (B) Pleura
(C) Different types of bronchi (D) Network of bronchi, bronchioles and

11. Sites of gaseous exchange in lungs are – [Pg-270, E]

(A) Alveoli (B) Tracheoles (C) Bronchioles (D) Pleura

12. I. It is double layered and covers the lungs
II. Fluid between the layers reduces friction on lung-surface
III. Outer layer is in contact with thoracic wall
V. Inner layer is in contact with lungs The above features refer to – [Pg-269, M]
(A) Pericardium (B) Peritoneum (C) Pleura (D) None

13. The part starting with the external nostrils upto the terminal bronchioles constitute the - [Pg-270, E]
(A) Respiratory or exchange part of respiratory system
(B) Inspiratory part (C) Conducting part (D) Expiratory part

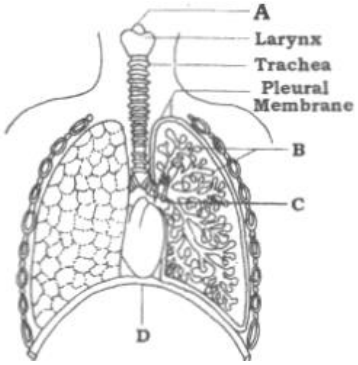
14. Respiratory or exchange part of the respiratory system consists of- [Pg-270, E]
(A) The parts starting with external nostrils upto terminal bronchioles
(B) Alveoli and their ducts (C) All bronchi and terminal bronchioles
(D) All bronchioles

15. The conducting part of the respiratory system has functions. [Pg-270, E]
(A) Filter, warm and moisten the air (B) Gaseous exchange
(C) Filtering the air only (D) Warm the air

16. The chamber formed dorsally by the vertebral column, ventrally by sternum, laterally by ribs and on the lower side by dome-shaped diaphragm is - [Pg-270, M]
(A) Abdominal cavity (B) Thoracic cavity (C) Pelvic cavity (D) Cranial cavity

17. Respiration involves following steps – [Pg-270, M]
I) Diffusion of gases O_2 and CO_2 across alveolar membrane
II) Transport of gases by blood
III) Utilization of O_2 by cell for catabolic reactions and resultant release of O_2
IV) Pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out
V) Diffusion of O_2 and CO_2 between blood and tissues
The correct sequence of steps is __
(A) I)→ II)→III)→ IV)→V) (B) V)→ IV)→III)→ II)→I)
(C) IV)→ I)→II)→ V)→III) (D) III)→II)→ V)→I)→ IV)

18. Study the given diagram and identify A, B, C and D. [Pg-269,E]



(A) A- Epiglottis, B -Alveoli, C- Bronchus, D – Diaphragm
(B) A- Epiglottis, B -Alveoli, C - Bronchioles, D – Diaphragm
(C) A- Sound box, B -Alveoli, C - Bronchus, D – Diaphragm
(D) A-Sound box, B-Alveoli, C- Bronchioles, D – Diaphragm

Para- 17.2

Mechanism of Breathing

19. The lungs expand in inspiration/inhalation because – [Pg-270, E]
(A) Diaphragm contracts upward (B) The volume of thoracic cavity increases
(C) External intercostal muscles relax (D) Diaphragm relaxes

20. The process of exhalation / expiration is begun mainly due to – [Pg-271, E]
(A) The contraction of intercostal muscles (B) The contraction of the diaphragm

(C) The relaxation of muscles (D) Low pressure in thoracic cavity

21. Which of the following statements about the mechanism of ventilation/breathing is false? [Pg-271, M] (A) As the diaphragm relaxes, air is expelled from the respiratory system
(B) During inspiration the lungs act as suction pump
(C) Inspiration is a passive and expiration is an active process.
(D) For quiet breathing external intercostal muscles and diaphragm play an important role.

22. Inspiration occurs when there is a negative pressure in the lungs with respect to atmospheric pressure. This negative pressure is achieved when – [Pg-271, M]
(A) Intrapulmonary pressure is less than the atmospheric pressure
(B) Intra pulmonary pressure is greater than the atmospheric pressure
(C) Intrapulmonary pressure is equal to the atmospheric pressure
(D) Intrapleural pressure becomes more than the intra-alveolar pressure

23. Expiration takes place when the intrapulmonary pressure is – [Pg-271, E]
(A) Greater than the atmospheric pressure (B) Lesser than the atmospheric pressure
(C) Equal to atmospheric pressure (D) Equal to intrapleural pressure

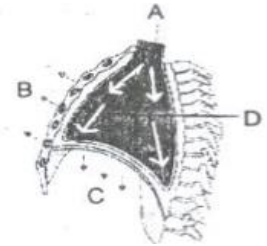
24. Which of the following sequences is correct to initiate inspiration? [Pg-270,271, M]
I. The contraction of external intercostal muscles raises the ribs and sternum
II. Volume of thorax increases in the dorso-ventral axis
III. Intrapulmonary pressure decreases IV. Diaphragm contraction
V. Air rushes into lungs
VI. Volume of thorax increases in the anterio-posterior axis
(A) I, II, IV, V, III, VI (B) I, II, III, IV, V (C) I, II, IV, VI, III, V (D) VI, I, II, III, V

25. Which of the following sequences is correct to initiate expiration? [Pg-270,271M]
I. Relaxation of external intercostal muscles and return of diaphragm and sternum to their normal position
II. Air expelled from lungs III. Volume of thorax decreases
IV. Intrapulmonary pressure increases
(A) I, III IV, II (B) II, IV, III, I (C) IV, III, II, I (D) I, II, III, IV

26. On an average, a healthy human breathes _____ times /minute- [Pg-271,E]
(A) 20 - 40 (B) 1-6 (C) 12-16 (D) 16-25

27. Additional muscles for forceful breathing are – [Pg-270, E]
(A) Diaphragm and external intercostal muscles
(B) Abdominal muscles and internal intercostal. muscles
(C) Diaphragm and abdominal muscles (D) External and internal intercostal muscles

28. Following illustration depicts the mechanism of breathing. In which of the following option all the parts A. B, C and D are correctly labelled? [Pg-271, E]



(A) A-Air entering into lungs; B- Ribs and sternum raised; C- Diaphragm contracted; D-Volume of thorax raised
(B) A - Air expelled from lungs; B - Ribs and sternum return to original position; C - Diaphragm relaxed; D - Volume of thorax decreased
(C) A-Air expelled from lungs; B- Ribs and sternum raised; C - Diaphragm relaxed; D -Volume of thorax decreased
(D) A-Air expelled from lungs; B- Ribs and sternum raised; C- Diaphragm contracted; D-Volume of thorax decreased

Para-17.2.1
Respiratory Volumes and Capacities

29. Match the following – [Pg-271,272, M]

	Column A		Column B
1.	Tidal Volume	A.	Tidal volume and inspiratory reserve volume and expiratory reserve volume
2.	Residual Volume	B.	Additional amount of air inhaled beyond tidal volume when taking a very deep breath
3.	Expiratory reserve volume	C.	Amount of air remaining in lungs after expiratory reserve volume is expelled
4.	Inspiratory reserve volume	D.	Tidal volume and inspiratory reserve volume
5.	Inspiratory Capacity	E.	Volume of air in one breath
6.	Vital Capacity	F.	Amount of air exhaled in forced exhalation

(A) 1 - C, 2 - E, 3 - B, 4 - F, 5 - D, 6 -A (B) 1 - E, 2 - F, 3 - C, 4 - B, 5 -A, 6 - D
(C) 1 - E, 2 - C, 3 - F, 4 - B, 5 - D, 6 -A (D) 1 - E, 2 - C, 3 - B, 4 - F, 5 -A, 6 – D

30. Match the following - [Pg-271,272, M]

	Column A		Column B
1.	Tidal Volume	A.	2500-3000 mL of air
2.	Inspiratory reserve volume	B.	1000 mL of air
3.	Expiratory reserve volume	C.	500 mL of air
4.	Residual volume	D.	3400-4800 mL of air
5.	Vital Capacity	E.	1200 mL of air

(A) 1 - C, 2 - D, 3 - B, 4 - A, 5 - E (B) 1 - C, 2 -A, 3 - B, 4 - E, 5 - D
(C) 1 - C, 2 -A, 3 - D, 4 - E, 5 - B (D) 1 - E, 2 -A, 3 - B, 4 - E, 5 – D

31. Arrange the following in order of increasing volume – [Pg-271,272, E]
1. Tidal volume 2. Residual volume
3. Expiratory reserve volume 4. Vital capacity
(A) 1 < 2 < 3 < 4 (B) 1 < 4 < 3 < 2 (C) 1 < 3 < 2 < 4 (D) 1 < 4 < 2 < 3

32. Different respiratory volumes are given below- [Pg-272, M]
I. Tidal Volume= 500 ml II. Residual Volume= 1000 ml
III. Inspiratory Reserve Volume= 2500 ml IV. Expiratory Reserve Volume = 1000 ml
The functional residual capacity (FRC) is-
(A) 3500 ml (B) 2000 ml (C) 600 ml (D) 3000 ml

33. Expiratory capacity is equal to – [Pg-272, E]
(A) TV+ ERV (B) ERV+ IRV (C) ERV+ RV (D) ERV+ RV

34. A spirometer cannot be used to measure – [Pg-272, E]
(A) IC (B) RV (C) ERV (D) IRV

35. The maximum volume of air you can forcefully exhale after taking the deepest possible breath is called [Pg-272, E]
(A) Tidal volume (B) Total respiratory volume

(C) Residual volume (D) Vital capacity

Para- 17.3
Exchange of Gases

36. Exchange of gases – [Pg-272, E]
(A) Occurs between the alveoli and pulmonary blood capillary
(B) Occurs between blood and tissues (C) By diffusion (D) All

37. Which of the following factors affect the diffusion of gases? [Pg-272, E]
(A) Partial pressure of diffusing gases (B) Solubility of gases
(C) The thickness of diffusion membrane (D) All

38. Which of the following statements about the partial pressure of CO_2 is true? [Pg-273, M]
(A) It is higher in alveoli than in pulmonary artery (B) It is higher in the systemic arteries than in tissues
(C) It is higher in systemic veins than in systemic arteries
(D) It is higher in the pulmonary veins than in pulmonary arteries

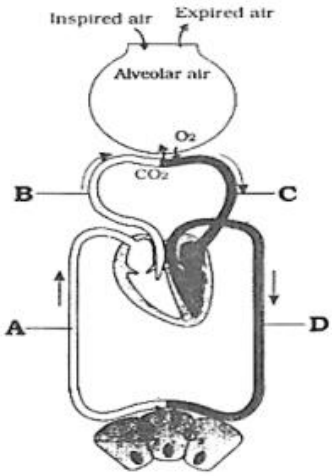
39. The partial pressure of CO_2 in the venous blood is – [Pg-273, E]
(A) Greater than in the tissue spaces (B) Lesser than in the tissue spaces
(C) Lesser than in the arterial blood (D) Less than in alveoli

40. A section of an alveolus with a pulmonary capillary indicates the presence of major layers constituting diffusion membrane- [Pg-273, E]
(A) 3 B) 2 (C) 6 (D) 10

41. Partial pressures (in mmHg) of O_2 in atmospheric air, alveoli deoxygenated blood, oxygenated blood and tissues are- [Pg-273, M]
(A) 40, 95, 40, 104, 159 (B) 104, 40, 40, 95, 159 (C) 159, 104, 40, 95, 40 (D) 195, 104, 95, 40, 40

42. Partial pressure (in mm Hg) of CO_2 in atmospheric air, alveoli, deoxygenated blood, oxygenated blood and tissues are- [Pg-273, M]
(A) 0.3, 40, 45, 40, 45 (B) 40, 45, 40, 45, 0.3 (C) 40, 40, 45, 45, 0.3 (D) 0.3, 45, 45, 40, 40

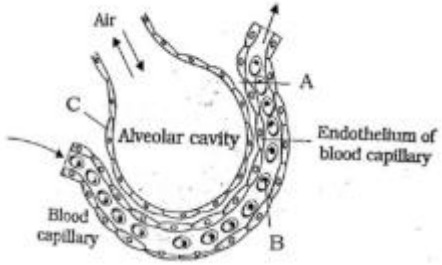
43. Name the blood vessels A to D- [Pg-273, M]



	A	B	C	D
A	Systemic vein	Pulmonary artery	Pulmonary vein	Systemic artery
B	Systemic artery	Pulmonary artery	Pulmonary vein	Systemic vein
C	Pulmonary artery	Systemic vein	Pulmonary vein	Systemic artery
D	Systemic vein	Pulmonary vein	Pulmonary artery	Systemic artery

44. In comparison to solubility of O_2 in blood the solubility of CO_2 is – [Pg-273, E]
(A) 20 - 25 times lesser (B) Slightly higher (C) Slightly greater (D) 20 - 25 times higher

45. Study the given figure and identify A to C. [Pg-273, M]



	A	B	C
(A)	Basement membrane	RBC	Alveolar wall
(B)	O_2	CO_2	Alveolar O_2
(C)	Pleura	RBC	Pericardium
(D)	Pleura	WBC	Pulmonary vein

46. The barrier between the air in alveolus and blood in pulmonary capillary consists of 3 layers and its total thickness is- [Pg-273, E]
(A) 1 mm (B) more than 1 mm (C) much less than 1 mm (D) 2 mm

Para-17.4, 17.4.1 and 17.4.2 Transport of Gases (Transport of Oxygen and Transport of Carbon dioxide)

47. Total percentage of O_2 transported by hemoglobin or RBC is – [Pg-274, E]
(A) 3% (B) 97% (C) 49% (D) 100%

48. Besides RBC blood plasma also carries O_2 in solution. The percentage is – [Pg-274, E]
(A) 3% (B) 97% (C) 49% (D) 25%

49. CO_2 is transported – [Pg-274, E]
(A) By RBC (B) As bicarbonates (C) In a dissolved state through plasma (D) All

50. The majority of CO_2 is transported as – [Pg-274, E]
(A) Carbonates (B) Bicarbonates
(C) Carbaminohaemoglobin (D) Dissolved state in blood

51. Blood carries the CO_2 in 3 forms. The correct percentages of CO_2 in these forms are- [Pg-274,M]

	As carbaminohaemoglobin in RBC	As bicarbonates	Dissolved form in plasma
A	20 -25%	70%	7%
B	70%	20 -25%	7%
C	20 -25%	7%	70%
D	7%	20 -25%	70%

52. Each molecule of hemoglobin when fully saturated carries how many molecules of O_2 – [Pg-274, E] (A) 1 (B) 2 (C) 4 (D) 20

53. Dissociation curve is associated with – [Pg-274, E]
(A) Carbonic anhydrase (B) CO (C) $CHCl_3$ (D) Oxyhemoglobin

54. Binding of O_2 with hemoglobin is primarily related to- [Pg-274, E]
(A) pO_2 (B) pCO_2 (C) H^+ conc. (D) None

55. Besides pO_2 the other factor(s) affecting the binding of O_2 with hemoglobin is/are – [Pg-274, E]
(A) pCO_2 (B) H^+nk. (C) Temperature (D)All

56. Oxygen dissociation curve is – [Pg-274, E]
(A) J-shaped (B) S-shaped (C) L-shaped (D) Zig-zag

57. Which of the following statements is wrong? [Pg-274, M]
(A) O_2 binds with hemoglobin in a reversible manner to form oxyhemoglobin.
(B) Every 100 mL of oxygenated blood can deliver around 5 ml of O2 to the tissue
(C) Occupational respiratory disorder is characterized by fibrosis (proliferation of fibrous tissues)
(D) None

58. What will be the pO_2 and pCO_2 in the atmospheric air compared to those in the alveolar? [Pg-274, M]
(A) pO_2 lesser, pCO_2 higher (B) pO_2 higher, pCO_2 lesser
(C) pO_2 higher, pCO_2 higher (D) pO_2 lesser, pCO_2 lesser

59. Which of the following would have the same O_2 content? [Pg-274]
(A) Blood entering the lungs - blood leaving the lungs
(B) Blood entering the right side of the heart - blood leaving the right side of the heart
(C) Blood entering the right side of the heart- blood leaving the left side of the heart
(D) Blood entering the tissue capillaries - blood leaving the tissue capillaries

60. CO_2 dissociates from carbaminohaemoglobin when – [Pg-274, M]
(A) $pO_2 \downarrow$, $pCO_2\downarrow$ (B) $pO_2 \uparrow$, $pCO_2\uparrow$ (C) $pO_2 \downarrow$, $pCO_2\uparrow$ (D) $pO_2 \uparrow$, $pCO_2\downarrow$

61. Which of the following situations would result in the greatest degree of O_2 saturation for hemoglobin, assuming pO_2 remains constant – [Pg-275, M]
(A) Increased CO_2 levels, decreased temperature (B) Increased CO_2 levels, increased temperature
(C) Decreased CO_2 levels, decreased temperature (D) Decreased CO_2 levels, increased temperature

62. Which of the following factors favour the formation of oxyhaemoglobin in lungs? [Pg-274, E]
(A) $pO_2 \downarrow$, $pCO_2\uparrow$, H+↑, Temperature↑ (B) $pO_2 \uparrow$, $pCO_2\uparrow$, $H^+\downarrow$, Temperature↑
(C) $pO_2 \uparrow$, $pCO_2\downarrow$, H+↓, Temperature↓ (D) $pO_2 \downarrow$, $pCO_2\uparrow$, pH↑, Temperature↓

63. All of the following favour the dissociation of oxyhaemoglobin to deliver O2 to tissues except- [Pg-274, M] (A) $pO_2 \uparrow$ (B) $pCO_2\uparrow$ OR $H^+\uparrow$ (C) Temperature↑ (D) $pO_2 \downarrow$

64. The transport of CO_2 by the blood is primarily dependent on – [Pg-274, M]
(A) The solubility of CO_2in blood (B) The presence of carbonic anhydrase in RBCs
(C) The ability of haemoglobin to bind and transport CO_2 (D) The ability of other blood proteins

65. Which of the following statements is false? [Pg-274,275, M]
(A) pO_2 is the major factor which affects the binding of CO_2 with haemoglobin
(B) pCO_2 is low and pO_2 is high as in the tissues, more binding of CO_2 with Hb occurs
(C) RBC contains a very high conc. of carbonic anhydrase and minute quantities of the same in the plasma
(D) Every 100 mL of deoxygenated blood delivers approximately 4 mL of CO_2 to the alveoli.

66. Which of the following equation is correct? [Pg-275, E]

A) $CO_2 \longrightarrow H_2CO_3 \longrightarrow HCO_3^- + H^+$

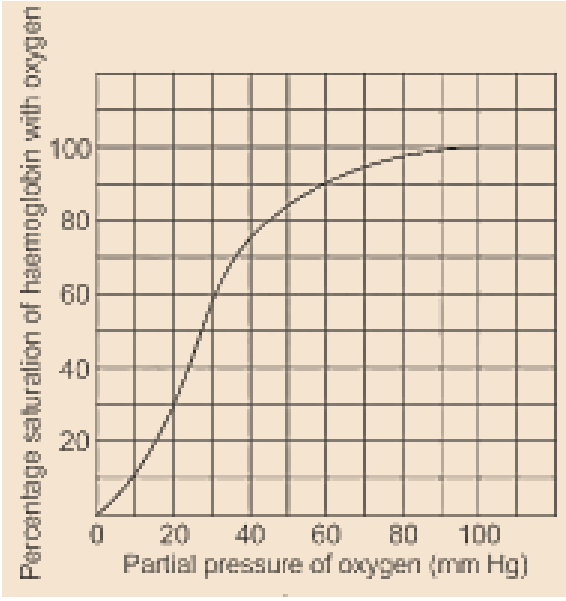
B) $CO_2 \longrightarrow H_2O \underset{\longleftarrow}{\overset{\text{Carbonic anhydrase}}{\longrightarrow}} H_2CO_3$

$\underset{\longleftarrow}{\overset{\text{Carbonic anhydrase}}{\longrightarrow}} H^+ + HCO_3^-$

C) $CO_2 \longrightarrow H_2O \longrightarrow CH_4 + 2O_2$

D) $CO_2 \longrightarrow H_2O \rightleftharpoons CO + H_2O_2$

67. Which of the following is incorrect about the given graph. [Pg-274, E]



(A) Increase in partial pressure of CO_2 shift the curve to right. (B) At low temperature the curve shifts to left.
(C) At high pH the curve shifts to right.
(D) Decrease in partial pressure of oxygen shifts the curve to right.

68. Assertion- The maximum pO_2 in alveoli is considerably less than in the atmosphere. Reason- Lungs in mammals do not completely empty with each breath and inhalation occurs through the same airways as exhalation, so each inhalation mixes fresh air with oxygen depleted residual air. [Pg-274, H]
A) Both assertion and reason are true and reason is correct explanation of assertion.
B) Both assertion and reason are true and reason is not correct explanation of assertion.
C) Assertion is true but reason is false. D) Both assertion and reason are false.

69. How does an increase in the CO_2 concentration in the blood affect the pH of CSF? [Pg-275, E]
(A) pH↑ (B) pH↓
(C) pH remains same. (D) pH may increase or decrease.

70. Assertion - A drop in the blood pH causes an increase in heart rate. Reason- Increased Heart Rate increases the rate at which CO_2 is delivered to the lungs, where CO_2 is removed. [Pg-275, H]
A) Both assertion and reason are true and reason is correct explanation of assertion.
B) Both assertion and reason are true and reason is not correct explanation of assertion.
C) Assertion is true but reason is false. D) Both assertion and reason are false.

Para-17.5
Regulation of Respiration

71. Respiratory process is regulated by certain specialized centres in the brain. One of the following listed centres can reduce the inspiratory duration upon stimulation – [Pg-275, E]
(A) Medullary inspiratory centre (B) Pneumotaxic centre
(C) Chemosynthetic centre (D) Amnestic centre

72. Pneumotaxic centre is present in – [Pg-275, E]

(A) Pons (B) Medulla oblongata (C) Cerebrum (D) Cerebellum

73. The breathing centre initiates ventilation in response to – [Pg-275, E]
(A) A decrease in air pressure (B)A decrease in O_2
(C) An increase in CO_2 (D) The rate of gas exchange in the alveoli

74. All of the following factors play role in the regulation of respiratory rhythm except – [Pg-275, E]
(A) CO_2 (B) H^+ conc. (C) O_2 (D) None of the above is correct

75. Receptors associated with aortic arch and carotid artery can recognize changes in _____ and ____ conc. and send necessary signal to _____ for remedial action. [Pg-275, E]
(A) O_2, CO_2, Pneumothorax (B) CO_2, H^+, rhythm centre
(C) CO_2, H^+, apneustic centre (D) O_2, H^+, Pneumothorax

76. Respiratory centre of brain is stimulated by- [Pg-275, E]
(A) CO_2 content in venous blood (B) CO_2 content in arterial blood
(C) O_2 content in arterial blood (D) O_2 content in venous blood

Para-17.6

Disorders of Respiratory System-

77. Asthma is caused by – [Pg-275, E]
(A) Infections of lungs (B) Infection of trachea (C) Spasm in bronchial muscles (D) Infection in nose

78. One reason for emphysema is – [Pg-275, E]
(A) Cigarette smoking (B) Drug addiction (C) Wine consumption (D) Heavy exercise

79. Emphysema is characterised by – [Pg-275, E]
(A) Permanent enlargement and destruction of alveolar area leading to reduction in respiratory surface
(B) Inhibition of respiratory centre (C) Accumulation of fluid in lungs
(D) Spasm of muscles of trachea

80. Why do human beings have difficulty breathing at high elevations? [Pg-276, M]
(A) O_2 makes up lower percentage of air there (B) The temperature is lower there
(C) The barometric pressure is higher there (D) pO_2 is lower there

81. Which of the following diseases are occupational respiratory disorder? [Pg-276, M]
(A) Silicosis, Fibrosis and asbestosis (B) Emphysema and mountain sickness
(C) Asthma and Emphysema (D) Asthma and Hepatitis

82. If an injury tore a small hole in the membrane surrounding lungs, what effect on lung function would you expect? [Pg-276, M]
(A) Pneumothorax with lung collapse (B) Pneumothorax without lung collapse
(C) Silicosis with lung collapse (D) Silicosis without lung collapse

NEET PREVIOUS YEARS QUESTIONS

1. Match the items given in column I with those in column II and select the correct option given below: **[2018]**

Column I	**Column II**
A. Tidal volume	I. 2500 – 3000 mL
B. Inspiratory Reserve volume	II. 1100 – 1200 mL
C. Expiratory Reserve volume	III. 500 – 550 mL
D. Residual volume	IV. 1000 – 1100 mL

(a) A – III; B – II; C – I; D – IV (b) A – III; B – I; C –IV; D – II
(c) A – IV; B – III; C – II; D – I (d) A – I; B – IV; C – II; D – III

2. Lungs are made up of air-filled sacs, the alveoli. They do not collapse even after forceful expiration, because of **[2017]**
(a) inspiratory reserve volume. (b) tidal volume.
(c) expiratory reserve volume. (d) residual volume.

3. Name the chronic respiratory disorder caused mainly by cigarette smoking. **[2016]**
(a) Emphysema (b) Asthma (c) Respiratory acidosis (d) Respiratory alkalosis

4. When you hold your breath, which of the following gas changes in blood would first lead to the urge to breathe? **[2015]**
(a) Rising CO2 concentration (b) Falling CO2 concentration
(c) Rising CO2 and falling O2 concentration (d) Falling O2 concentration

5. Name the pulmonary disease in which alveolar surface area involved in gas exchange is drastically reduced due to damage in the alveolar walls. **[2015]**
(a) Emphysema (b) Pneumonia (c) Asthma (d) Pleurisy

6. Due to increasing air-borne allergens and pollutants, many people in urban areas are suffering from respiratory disorder causing wheezing due to : **(NEET-2019)**
(1) benign growth on mucous lining of nasal cavity.
(2) inflammation of bronchi and bronchioles.
(3) proliferation of fibrous tissues and damage of the alveolar walls.
(4) reduction in the secretion of surfactants by pneumocytes.

7. 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? **(NEET-2019)**
(1) 1500 mL (2) 1700 mL (3) 2200 mL (4) 2700 mL

8. Select the correct statement. **(NEET-2019 ODISSA)**
(1) 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.

9. 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

10. The Total Lung Capacity (TLC) is the total volume of air accommodated in the lungs at the end of a forced inspiration. This includes : **(NEET-2020 COVID)**
(1) 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)

11. Match the following columns and select the correct option : **(NEET-2020 COVID)**

Column - I	**Column - II**
(a) Pneumotaxic	(i) Alveoli Centre
(b) O_2 Dissociation	(ii) Pons region of curve brain
(c) Carbonic	(iii) Haemoglobin Anhydrase
(d) Primary site	(iv) R.B.C. of exchange of gases

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

12. Identify the wrong statement with reference to transport of oxygen **(NEET-2020)**
1) Low pCO_2 in alveoli favours the formation of oxyhaemoglobin
2) Binding of oxygen with haemoglobin is mainly related to partial pressure of O_2.
3) Partial pressure of CO_2 can interfere with O_2 binding with haemoglobin
4) Higher H+ conc. in alveoli favours the formation of oxyhaemoglobin

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

14. The partial pressures (in mm Hg) of oxygen (O_2) and carbon dioxide (CO_2) at alveoli (the site of diffusion) are: **[NEET-2021]**
1) $pO_2 = 40$ *and* $pCO_2 = 45$ **2)** $pO_2 = 95$ *and* $pCO_2 = 40$
3) $pO_2 = 159$ *and* $pCO_2 = 0.3$ **4)** $pO_2 = 104$ *and* $pCO_2 = 40$

15. Select the favourable conditions required for the formation of oxyhaemoglobin at the alveoli. **[NEET-2021]**
1) Low pO_2, high pCO_2, more H^+, higher temperature
2) High pO_2, high pCO_2, less H^+, higher temperature
3) Low pO_2, low pCO_2, more H^+, higher temperature
4) High pO_2, low pCO_2, less H^+, lower temperature

16. Which of the following is not the function of conducting part of respiratory system? [NEET-2022]
1) 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

17. Under normal physiological conditions in human being every 100 ml of oxygenated blood can deliver _____ ml of O_2 to the tissues. [NEET-2022]
1) 2 ml 2) 5 ml 3) 4 ml 4) 10 ml

18. Which of the following factors are favourable for the formation of oxyhaemoglobin in alveoli?
(a) High pO_2 and High pCO_2
(b) High pO_2 and Lesser H^+concentration
(c) Low pCO_2 and High H^+concentration
(d) Low pCO_2 and High temperature

[NEET 2024]

19. Match List I with List II :

	List I		List II
A.	Expiratory capacity	I.	Expiratory reserve volume + Tidal volume + Inspiratory reserve volume
B.	Functional residual capacity	II.	Tidal volume + Expiratory reserve volume
C.	Vital capacity	III.	Tidal volume + Inspiratory reserve volume
D.	Inspiratory capacity	IV.	Expiratory reserve volume + Residual volume

Choose the correct answer from the options given below :
(a) A-II, B-IV, C-I, D-III
(b) A-III, B-II, C-IV, D-I
(c) A-II, B-I, C-IV, D-III
(d) A-I, B-III, C-II, D-IV

[NEET 2024]

20. Frogs respire in water by skin and buccal cavity and on land by skin, buccal cavity and lungs.
Choose the correct answer from the following :
(a) The statement is true for water but false for land
(b) The statement is true for both the environment
(c) The statement is false for water but true for land
(d) The statement is false for both the environment

[NEET 2025]

NCERT LINE BY LINE QUESTIONS – ANSWERS

Q	01	02	03	04	05	06	07	08	09	10
Ans	D	A	A	A	A	C	B	C	B	D
Q	11	12	13	14	15	16	17	18	19	20
Ans	A	C	A	A	A	B	C	A	B	C
Q	21	22	23	24	25	26	27	28	29	30
Ans	C	A	A	A	A	C	B	A	C	B
Q	31	32	33	34	35	36	37	38	39	40
Ans	C	A	A	B	D	D	D	D	C	A
Q	41	42	43	44	45	46	47	48	49	50
Ans	C	C	A	D	A	A	B	A	D	B
Q	51	52	53	54	55	56	57	58	59	60
Ans	A	C	D	A	D	B	D	B	B	C
Q	61	62	63	64	65	66	67	68	69	70
Ans	D	C	A	A	B	B	D	B	B	A

Q	71	72	73	74	75	76	77	78	79	80
Ans	B	A	C	C	B	A	C	A	A	D
Q	81	82								
Ans	A	A								

NEET PREVIOUS YEARS QUESTIONS-ANSWERS

1 (b) **2** (d) **3** (a) **4** (a) **5** (a) **6** (2) **7** (1) **8** (2) **9** (2) **10** (4)
11 (2) **12** (4) **13** (2) **14** (4) **15** (4) 16 (4) 17 (2) 18(b) 19(a) 20(c)

NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. (b) 2. (d)

3. (a) Emphysema results when the delicate linings of the air sacs in the lungs become damaged beyond repair. Most commonly, the toxins in cigarette smoke create the damage. Emphysema is called smoker's disease.

4. (a) Chemoreceptors in the medulla get stimulated by increase in CO2 concentration in the blood of arteries.
Decrease in O2 concentration has no significant effect on chemoreceptors.

5. (a) In emphysema, alveolar surface area is reduced due to destruction of alveolar walls.

12. Higher H+ concentration favours the dissociation of oxygen from oxyhaemoglobin in tissues. In the alveoli, high pO_2, low pCO_2, lesser H^+ concentration and lower temperature favour the formation of oxyhaemoglobin.

13. Inspiration is caused by the contraction of diaphragm, which increases the volume of thoracic chamber in the anterio-posterior axis whereas the contraction of external intercostal muscles increase the volume of the thoracic chamber in the dorsoventral axis.

14. **PO_2 at alveoli the site of diffusion = 95 mmHg ; PO_2 is 40 mmHg**

15. * The factors favourable for the formation of oxyhaemoglobin at the alveolar level are; high pO_2, low pCO_2, less H+ concentration and lower temperature.
*The conditions favourable for the dissociation of oxygen from oxyhaemoglobin at the tissue level are; low pO_2, high pCO_2, high H+ concentration and high temperature.

16. Diffusion of O_2 & CO_2 occurs in respiratory part.

17. Every 100ml of oxygenated blood delivers 5ml of O_2 to the tissues.

18.Ans.(b)

Explanation

The correct answer is option (b) as

Conditions favourable for formation of oxyhaemoglobin in alveoli are high pO_2, less H^+concentration low pCO_2 and low temperature.

Option (a), (c) and (d) are not correct as they do not favour the formation of oxyhaemoglobin.

19.Ans.(a)

Explanation

Expiratory capacity = Tidal volume + Expiratory reserve volume
Functional residual capacity = Expiratory reserve volume + Residual volume
Vital capacity = Expiratory reserve volume + Tidal volume + Inspiratory reserve volume Inspiratory capacity = Tidal volume + Inspiratory reserve volume

20.Ans.(c)

Explanation

Frog respires in water by skin (cutaneous respiration) whereas on land the buccal cavity, skin and lungs act as the respiratory organs.

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