

17. Breathing and Exchange of Gases



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Topic-wise Questions

1. (d) The process of exchange of O_2 from the atmosphere with CO_2 produced by the cells is called respiration or breathing.
2. (b) Earthworms exchange gases across their skin.
3. (b) Mechanism of breathing vary among different groups of animals depending mainly on their habitats and level of organisation.
4. (d) 5. (a)
6. (b) Conduction part of the respiratory system is formed from external nostrils up to the terminal bronchioles.
7. (d) The hypothalamus and pons control respiration.
8. (d) The respiratory or the exchange part of the respiratory system is formed by alveoli and duct of alveoli.
9. (d)
10. (d) Exchange or respiratory part is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air.
11. (a)
12. (d) The anatomical setup of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the pulmonary cavity (lung cavity).
13. (a) 14. (a)
15. (d) The process by which O_2 rich atmospheric air is drawn in and CO_2 rich alveolar air is released out is breathing or pulmonary ventilation.
16. (c) Human have two lungs which are covered by a double layered pleura, with pleural fluid between them.
17. (b) In crustacean, respiration occurs through gills.
18. (d) Prawn and crabs (class crustacean) respire through gills.
19. (a) Book lungs are respiratory structures in Arachnida (scorpion, spider, etc).
20. (c) Layer of uneven columnar cells which form tracheal lining are component of pseudostratified epithelium.
21. (b) 22. (d)
23. (d) Diffusion of oxygen in tissues of cockroach occurs through tracheoles.
24. (c) Air is breathed through nostrils \rightarrow pharynx \rightarrow larynx \rightarrow trachea \rightarrow bronchi \rightarrow bronchioles \rightarrow alveoli
25. (b) Pressure within the lungs is called intra-pulmonary pressure.
26. (c) 27. (d)
28. (d) Inspiration is initiated by the contraction of diaphragm.
29. (a) Contraction of diaphragm increases the volume of thoracic chamber in the antero-posterior axis.
30. (a)
31. (d) External and internal intercostal muscles are present in between the ribs.
32. (d)
33. (c) The ventilation movement of the lungs is governed by diaphragm and intercostal muscles.
34. (c) Normal breathing rate of a healthy human is 12-16 times/minute.
35. (b) 36. (d)
37. (b) Additional volume of air, a person can expire by a forcible expiration is called ERV.
38. (a) Volume of air inspired or expired during a normal respiration is called TV.
39. (b) The tidal volume is about 500 ml, and is the amount of air that moves into and out of the lungs during normal breathing.
40. (b) Volume of air remaining in the lungs even after a forcible expiration is called RV.
41. (b) Total volume of air accommodated in the lungs at the end of a forced inspiration is called TLC.
42. (c) Additional volume of air a person can inspire by a forcible inspiration is called IRV.
43. (b) Vital capacity, the maximum volume of air a person can inhale, is measured with spirometer.
44. (a) This decreases the size of the thoracic cavity, which increases the pressure within the thoracic cavity, forcing air out of the lungs
45. (a) Muscles attached to diaphragm contract during inspiration to make it flat/flattened.
46. (d) During inspiration the diaphragm get flattened and ribs get raised
47. (b) Residual volume (1100-1200 ml) is greater than tidal volume (500 ml).

- 48. (c)** Inspiration is initiated by the contraction of diaphragm which increases the volume of thoracic chamber in the anterior-posterior axis. During inspiration, diaphragm contracts and become flat. The contraction of external inter-coastal muscles lifts up the ribs and the sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis. The overall increase in the thoracic volume causes a similar increase in pulmonary volume.

49. (b) **50. (c)**

51. (a) Forced deep breathing during rest for some time followed by temporary stoppage of breathing is because of little CO_2 in blood.

52. (b) Volume of air remaining in lungs after maximum respiratory effort is residual volume.

53. (b) The primary sites of the gaseous exchange are alveoli

54. (b) Alveoli are the site of the respiratory exchange of gases. Oxygen from the alveolar air diffuses through the alveolar epithelium and the capillary endothelium into the capillary blood and carbon dioxide diffuses in the opposite direction.

55. (a) CO_2 from the respiratory tissues to the lungs is transported by the blood in 3 ways:

 - In dissolved state by blood
 - Bicarbonate ions
 - Carbamino haemoglobin

56. (a) Gaseous (O_2 and CO_2) exchange between alveoli and blood, and blood and tissues takes place by simple diffusion.

57. (d)

58. (b) pO_2 higher and pCO_2 lesser in the atmospheric air compared to those in the alveolar air.

59. (c) The direction of concentration gradient for oxygen is from alveoli to blood and blood to tissues.

60. (b)

61. (a) Gases diffuse over the respiratory surface because of pO_2 is more in alveoli (104 mm Hg) than in blood (40 mm Hg).

62. (d) Exchange of O_2 and CO_2 at the respiratory surface occurs through diffusion/simple diffusion.

63. (c) Nearly 20-25% of CO_2 is transported by RBCs whereas 70% of it is carried as bicarbonate (sodium bicarbonate). About 7% of CO_2 is carried in a dissolved state through plasma.

64. (d)

65. (a) During the transport of CO_2 through the blood, bicarbonate ions diffuse out of RBCs while chloride ions from plasma enter the RBCs to maintain ionic equilibrium. This is called chloride shift.

66. (b)

67. (d) Oxyhaemoglobin is converted into haemoglobin during the internal respiration because oxyhaemoglobin is unstable.

68. (b) About 97% of oxygen is transported by RBC. The remaining 3% is dissolved in plasma and transported.

69. (b) **70. (c)**

71. (b) Factors which shift oxygen dissociation curve to right are decrease in pO_2 , increase in pO_2 (Bohr effect), increase in body temperature, increase in H^+ ion concentration and decrease in pH.

72. (b)

73. (d) Bicarbonate ions which are formed inside the RBC diffuse from RBC into the plasma. To maintain the ionic balance Cl^- ions move from plasma into RBCs. This ionic exchange is called chloride shift or Hamburger's phenomenon.

74. (c)

75. (b) Right shifting indicates dissociation of O_2 from Hb.

76. (c) Bicarbonate formed inside erythrocytes passes out into plasma while chloride of plasma pass into erythrocytes. The phenomenon is called hamburger phenomenon.

77. (a) CO_2 is carried in blood as sodium bicarbonate.

78. (c) Dissociation curve shifts to the right when CO_2 concentration increase.

79. (d) Each haemoglobin molecule can carry a maximum of four molecules of O_2 . Thus, chemical formula of oxyhaemoglobin is $\text{Hb}(\text{O}_2)_4$.

80. (b) Increased temperature dissociates O_2 from oxyhaemoglobin while low temperature favours the binding of O_2 to haemoglobin.

81. (a) RBCs contain a very high concentration of the enzyme, carbonic anhydrase and minute quantities of the same is present in the plasma too. This enzyme facilitates the following reaction in both directions.

$$\text{CO}_2 + \text{H}_2\text{O} \xrightleftharpoons[\text{anhydrase}]{\text{Carbonic}} \text{H}_2\text{CO}_3 \xrightleftharpoons[\text{anhydrase}]{\text{Carbonic}} \text{H}^+ + \text{HCO}_3^-$$

Bicarbonate

Carbonic anhydrase is the fastest enzyme.

82. (a) Blue copper protein complex contained in some molluscs in their plasma for oxygen transport is Haemocyanin.

83. (d) Binding of oxygen with haemoglobin is primarily related to partial pressure of O_2 . Partial pressure of CO_2 , hydrogen

ion concentration and temperature are the other factors which can interfere with this binding.

NCERT Based Questions

84. (c) In the tissues, where low pO_2 , high pCO_2 , high H^+ concentration and higher temperature exist, the condition are favourable for dissociation of oxygen from the oxyhaemoglobin. A higher CO_2 concentration of blood causes quick diffusion of O_2 from blood.

85. (a) 86. (a)

87. (c) In carbon monoxide poisoning there is decrease in free haemoglobin.

88. (a) Human beings have a significant ability to maintain the respiratory rhythm to suit the demands of the body tissues. This is done by the neural system.

89. (d)

90. (b) Respiratory rhythm centre, a specialised center is primarily responsible for the regulation of respiratory rhythm.

91. (c) A centre present on the pons region of the brain called pneumotaxic centre can moderate the functions of the respiratory rhythm centre. Neural signal from this centre can reduce the duration of inspiration and thereby alter the respiratory rate. In human beings, in each breath, inspiration accounts for 2 seconds and expiration accounts for 3 seconds.

92. (d) 93. (c)

94. (c) In response to CO_2 and H^+ concentration, the chemosensitive area and receptors associated with aortic arch and carotid artery, send necessary signals for remedial actions to respiratory rhythm centre.

95. (c) 96. (a) 97. (c)

98. (b) Respiratory centre of brain is stimulated by CO_2 content in arterial blood.

99. (d) 100. (a) 101. (d)

102. (c) Respiratory movement are controlled by medulla oblongata.

103. (a) 104. (b)

105. (c) In asthma, due to flattening of tracheal vessels, alveoli are deprived of oxygen.

106. (b) 107. (a) 108. (c)

109. (b) Alveoli become enlarged and damaged with reduced surface area in heavy smokers. The condition is called emphysema.

110. (a) The under developed state of the premature infant lung means that surfactant is not produced in the alveoli and breathing is therefore very difficult.

1. (d) Trachea is a straight tube extending up to the mid thoracic cavity, which divides at the level of fifth thoracic vertebra into right and left 1st bronchi.

2. (d) Brain is the most vital organ. It stops functioning in the absence of O_2

3. (d)

4. (d)

A. Fishes	4. Gills
B. Reptiles	2. Lungs
C. Coelentrates	3. Entire body surface
D. Insects	5. Tracheal tubes
E. Aquatic arthropods	4. Gills

5. (b) The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature.

6. (a) Respiration involves the following steps:

(i) Breathing or pulmonary ventilation by which atmospheric air is drawn in and CO_2 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 cell for catabolic reactions and resultant release of CO_2 (cellular respiration).

7. (c) Fish brought out of water dies because of inability to respire.

8. (b) In lungs, air is separated from venous blood by squamous epithelium (of alveoli) + endothelium of blood vessel.

9. (a) The direction of concentration gradient for CO_2 is from tissues to blood and blood to alveoli.

10. (a) pCO_2 of deoxygenated blood is 45 mm Hg.

11. (b)

12. (a) Wind pipe (trachea) arises from larynx.

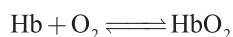
13. (d) Maximum amount of oxygen is lost from blood in capillaries surrounding the tissues.

14. (d) Presence of large number of alveoli around alveolar ducts opening into bronchioles in mammalian lungs is an efficient system of ventilation with little residual air.

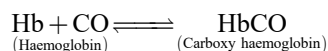
15. (d) Debris normally gets trapped in mucus lining the respiratory passageways. This mucus is then swept up and away from the lungs by the action of cilia.

Breathing and Exchange of Gases

16. (d) Mammalian lungs have numerous alveoli for increasing surface area for gaseous diffusion.
17. (a) Carbonic anhydrase is mostly active in RBC.
18. (d)
19. (b) At higher O_2 concentration, oxygen dissociation curve of haemoglobin will move to right.
20. (a) Body tissues obtain oxygen from haemoglobin because of its dissociation in tissues caused by low oxygen concentration and high carbon dioxide concentration.
21. (d) Insects have a network of tubes (tracheal tubes) to transport atmospheric air within the body. These openings lead to tracheae. The cells exchange O_2/CO_2 directly with the air in the spiracles present on insects body.
22. (d) All of the listed choices have a larger volume than the resting tidal volume.
23. (c) $f = \frac{A}{T - D} = \frac{4000 \text{ ml / min}}{500 \text{ ml} - 300 \text{ ml}}$
 $\frac{4000}{200} = 20 \text{ breaths / min}$
24. (c) Diffusion of gases is a physical phenomenon that takes place between the tissue and blood vessels, and does not occur during breathing whereas bringing air to the body temperature, its cleaning and warming occurs during the process of breathing.
25. (d) The movement of air into and out of the lungs is carried out by creating a pressure gradient between the lungs and the atmosphere. The pressure within the lungs is less than the atmospheric pressure so there is a negative pressure in the lungs with respect to atmospheric pressure. The puncture in the chest affects this pressure gradient maintained by the lungs and thus may cause cessation of breathing.
26. (b) Haemoglobin consist of a protein globin and pigment heme. The four portion of iron in heme combine with molecule of oxygen. It is an easily reversible reaction to form oxyhaemoglobin



Whereas, the complex formed by the reaction of carbon monoxide and haemoglobin is incredibly strong



As a result of this strong reaction between the haemoglobin and carbon monoxide, the haemoglobin loses its affinity to oxygen thus may lead to choking or even death.

27. (b) Inspiration is a active process whereas expiration is a passive process. Inspiration occur when the muscles of diaphragm contract to increase the overall volume of thoracic cavity.

Thus the pressure within the lungs (intra-pulmonary pressure) is less in comparison to the atmospheric pressure, i.e., there is a negative pressure in the lungs with respect to atmospheric pressure. As the muscles use energy for contraction inspiration is called active process. Whereas, during the expiration diaphragm muscles relax without the use of energy intra-pulmonary pressure becomes higher than the atmospheric pressure and air pushes out. Thus, it is a passive process.

28. (d) The blood contains several buffering systems.
29. (d) Carbon dioxide is transported via blood to lungs mostly as carbamino haemoglobin and carbonic acid. It is released in lungs in exchange with oxygen.
30. (c) The maximum volume of air that a person can breathe in after forced expiration or the maximum volume of air that a person can breathe out after forced inspiration is called vital capacity

The value of vital capacity varies from 3400 mL to 4800 mL.

31. (c)
32. (d) There are various factors which affect the binding of O_2 with Hb. These factors are :
- (i) High temperature
 - (ii) Low H^+ concentration (low pH).
 - (iii) Low diphosphoglyceraldehyde.
- So, higher pO_2 is the incorrect statement.
33. (b) CO_2 enters RBC and reacts with water to form carbonic acid. Carbonic acid dissociates to form bicarbonate and hydrogen ions. Some bicarbonate ions are transported in erythrocytes while some diffuse into the blood plasma. Exit of bicarbonate ions change the ionic balance between the plasma and erythrocytes. To restore this balance chloride ions diffuse from plasma into erythrocytes. Due to this the pH of blood is maintained.

34. (a)

35. (d) The diaphragm and a specialised set of muscles, called intercoastal muscles present between the ribs are involved in the normal breathing in humans. They are involved in generating pressure gradient of air between the lungs and the atmosphere, so as to facilitate the intake of air.

36. (b) Emphysema is a chronic disorder in which alveolar walls are damaged due to the infection It is a respiratory

disorder caused by cigarette smoking and inhalation of other smoke or toxic substances over a period of time.

37. (b) Pneumotaxic centre located in the dorsal part of pons varolii of the brain can reduce the duration of inspiration and thus alter the respiratory rate.

Pneumotaxic centre is located in the lower part of pons varoli is responsible for promoting inspiration process.

38. (b) When the $p\text{CO}_2$ is low and $p\text{O}_2$ is high as in the lung alveoli, dissociation of CO_2 from carbamino-haemoglobin takes place, CO_2 which is bound to haemoglobin from the tissue is delivered at the alveoli, to maintain the concentration of CO_2 thus increasing $p\text{CO}_2$.

39. (c)

40. (c)

Multi-Concept Questions

1. (b) Pulmonary surfactant prevents the collapsing of lungs in low oxygen conditions.

2. (c)

3. (c)

4. (a) Total minute ventilation = Dead space + Alveolar ventilation

Minute ventilation = Respiratory frequency \times Tidal volume

$$= 12 \text{ breaths/min} \times 500 \text{ mL/breath}$$

$$= 6000 \text{ mL/min}$$

$$\therefore \text{Dead space} = 6000 - 4200 = 1800 \text{ mL/min}$$

5. (b)

6. (c) Capillaries are most abundant in tissues and organs that are metabolically active. Therefore, maximum amount of oxygen is lost from the blood in the capillaries surrounding the alveoli.

7. (b)

8. (d) The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature. Exchange part is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air.

9. (b) The standard curve is shifted to the right by an increase in temperature, high $p\text{CO}_2$ or a decrease in pH. A rightward shift causes a decrease in the affinity of hemoglobin for oxygen.

10. (a)

11. (c)

12. (a)

13. (b)

14. (b)

15. (d)

16. (d)

17. (d)

18. (b) 100ml of blood contains 2.4 ml CO_2 . Thus, nearly 2.4 ml CO_2 /100 ml of blood is transported as bicarbonate.

19. (c)

20. (d)

21. (d) Blood is the medium of transport for O_2 and CO_2 .

RBCs transport 97 percent of O_2 and nearly 20-25 per cent of CO_2 . Plasma transports 3 percent of O_2 and about 7 percent of CO_2 .

22. (a) Small animals have a larger surface area to volume ratio than large animals. That is why respiratory rate is higher in them.

23. (d)

24. (d) Normal partial pressure of carbon dioxide of deoxygenated blood is 45 mmHg. A decrease in CO_2 shifts the curve to the left, while an increase in CO_2 shifts the curve to the right. Thus, when $p\text{CO}_2$ of deoxygenated blood of a person becomes 48 mm Hg, this O_2 dissociation curve remains shifted towards right. The increase in $p\text{CO}_2$ reduces the affinity of oxygen to haemoglobin in two ways:

i. Accumulation of CO_2 causes formation of carbamino compounds, which bind to oxygen and form carbamino-haemoglobin.

ii. Accumulation of CO_2 causes an increase in H^+ ion concentration and a decrease in the pH, which will shift the curve to the right.

NOTE: A right shift indicates decreased oxygen affinity of haemoglobin allowing more oxygen to be available to the tissues.

25. (d) Vital Capacity (VC): 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.

According to the question,

$$\begin{aligned} \text{IC} + \text{FRC} - \text{RV} &= \text{TV} + \text{IRV} + \text{ERV} + \text{RV} - \text{RV} \\ &= \text{TV} + \text{ERV} + \text{IRV} \\ &= \text{VC} \end{aligned}$$

26. (a)

27. (b)

28. (c)

29. (d) Spirometer is the device used to measure the volume of air involved in breathing movements and it also helps in clinical assessment of pulmonary functions.

30. (b) Vital Capacity (VC): Tidal Volume + Inspiratory Reserve Volume + Expiratory Reserve Volume. ($\text{TV} + \text{ERV} + \text{IRV}$)

NEET Past 10 Year Questions

1. (b) NCERT (XI) Ch - 17, Pg. 274

In tissues, higher H^+ concentration favours the dissociation of oxygen from oxyhaemoglobin. In the alveoli, high $p\text{O}_2$, low $p\text{CO}_2$, lesser H^+ concentration and lower temperature are the factors favourable for the formation

of oxyhaemoglobin.

2. (d) NCERT (XI) Ch - 17, Pg. 270

Inspiration is initiated by the contraction of diaphragm which increases the volume of thoracic chamber in the antero-posterior axis. The contraction of external intercostal muscles lifts up the ribs and the sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis. The overall increase in the thoracic volume causes a similar increase in pulmonary volume. An increase in pulmonary volume decreases the intra-pulmonary pressure.

3. (a) NCERT (XI), Ch - 17, Pg. 274-275

Pneumotaxic centre can moderate the functions of the respiratory rhythm centre. It is present in the pons region of brain.

Alveoli is the primary site for gaseous exchange.

Nearly 70 per cent of carbon dioxide is transported by RBC as bicarbonate (HCO_3^-) with the help of the enzyme carbonic anhydrase.

A sigmoid curve is obtained when percentage saturation of haemoglobin with O_2 is plotted against the pO_2 . This curve is called the Oxygen dissociation curve.

4. (c) NCERT (XI), Ch - 17, Pg. 272

Total Lung Capacity: 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.

5. (b) NCERT (XI) Ch - 17, Pg. 275

Asthma is a difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles. It can be due to increasing air-borne allergens and pollutants. Asthma is an allergic condition. Many people in urban areas are suffering from this respiratory disorder.

6. (a) NCERT (XI) Ch - 17, Pg. 271

Tidal Volume = 500 ml

Expiratory Reserve Volume = 1000 ml

Expiratory Capacity = TV + ERV

$$= 500 + 1000$$

$$= 1500 \text{ ml}$$

7. (a) NCERT (XI) Ch - 17, Pg. 275

Asthma is a chronic lung disease that inflames and narrows the airways. It is the result of chronic inflammation of conducting zone of airways, especially the bronchi and bronchioles. Emphysema is a chronic disorder in which alveolar walls are damaged due to which respiratory surface is decreased.

8. (b) NCERT (XI) Ch - 17, Pg. 271-272

Tidal volume represent the normal volume of air displaced between normal inhalation and exhalation, measures about 500 ml.

Inspiratory reserve volume – maximal amount of additional air that can be drawn into lungs by determined effort, it is 2500-3000 ml.

Expiratory reserve volume – forceful expiration after normal inspiration, it's volume is 1000-1100 ml.

Residual volume – volume remaining in lungs after forceful expiration, measures 1100-1200 ml.

9. (b) NCERT (XI) Ch - 17, Pg. 276

Silicosis is caused by inhalation of dust containing silica. It is a form of occupational lung disease.

10. (a) NCERT (XI) Ch - 17, Pg. 272

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

11. (d) NCERT (XI) Ch - 17, Pg. 271

Spirometer is used in the estimation of the volume of air involved in breathing movements. Vital capacity, tidal volume, inspiratory reserve and expiratory reserve can all be measured with a spirometer.

12. (b) NCERT (XI) Ch - 17, Pg. 275

Emphysema is chronic damage to air sacs or alveoli leading to abnormal reduction in respiratory surface area. It can be caused due to air pollution.

13. (d) NCERT (XI) Ch - 17, Pg. 271

Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because there is a negative intrapleural pressure pulling at the lung walls.

14. (d) NCERT (XI) Ch - 17, Pg. 272.

The partial pressure of oxygen in the alveoli of the lungs is more than that in the blood.

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

15. (c) NCERT (XI) Ch - 17, Pg. 274

Reduction in pH of blood will decrease the affinity of hemoglobin with oxygen.

16. (b) NCERT (XI) Ch - 17, Pg. 275

Asthma is a difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles.

17. (a) NCERT (XI) Ch - 17, Pg. 275

Emphysema is a chronic disorder in which alveolar walls are damaged due to which respiratory surface is decreased. One of the major causes of this is cigarette smoking.

18. (a) NCERT (XI) Ch - 17, Pg. 275

A chemosensitive area is situated adjacent to the rhythm centre which is highly sensitive to CO_2 and H^+ ions. Increase in these substances can activate this centre, which in turn can signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated. The role of oxygen in the regulation of respiratory rhythm is quite insignificant.

19. (a) NCERT (XI) Ch - 17, Pg. 275

Emphysema is a chronic disorder in which alveolar walls are damaged due to which respiratory surface is decreased. Cigarette smoking is the major cause.

20. (b) NCERT (XI) Ch - 17, Pg. 274-275

Bicarbonate = 70% of CO_2

RBCs = 20-25% of CO_2

Plasma = 7% of CO_2

21. (d) NCERT (XI) Ch - 17, Pg. 275-276

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 lung fibrosis (proliferation of fibrous tissues).

Alveolar walls are damaged by cigarette smoking. CO_2 is carried by haemoglobin as carbamino-haemoglobin (about 20-25 per cent).

Neural signals from pneumotoxic centre in pons region of brain can reduce the duration of inspiration and thereby alter the respiratory rate.

- 22. (b)** As a person moves up a hill, the pO_2 and total atmospheric pressure decreases. Decrease in pO_2 due to increasing altitude, stimulates the JG - cells of kidney to secrete erythropoietin hormone, increasing the number of RBCs (polycythemia) to compensate the supply of O_2 . At higher altitude, haemoglobin has lower binding affinity to O_2 because the primary factor responsible for binding is pO_2 , which decreases at higher altitude.

23. (a) NCERT (XI) Ch - 17, Pg. 270

One can consciously breathe in and breathe out by moving the diaphragm alone, without moving the ribs at all.

24. (c) NCERT (XI) Ch - 17, Pg. 274

Nearly 20-25% of CO_2 is transported by RBCs whereas 70% of it is carried as bicarbonate.

About 7% of CO_2 is carried in a dissolved state through plasma.

- 25. (b)** Our tissue is able to utilise only 25% of O_2 carried by arterial blood. Our venous blood is still 75% saturated with O_2 . This O_2 act as a reserve during muscular exercise.

26. (c) NCERT (XI) Ch - 17, Pg. 273

Alveolar cavity - Main site for gaseous exchange.