Chapter 4

Breathing and Exchange of Gases

Solutions

SECTION - A

Objective Type Questions

(Respiratory Organs)

1. Which group of animals respire through lungs?

(1) Earthworm and insects
(2) Sponges, coelenterates and flatworms
(3) Fishes and aquatic arthropods
(4) Amphibians, reptiles, birds and mammals

Sol. Answer (4)

(i) Earthworm → Respires through moist cuticle

(ii) Insects (Cockroach) → Tracheal system

(iii) Sponges
(iv) Coelenterates
(v) Flatworms
} Well-developed respiratory organs are not is present. Exchange of gases occurs by simple diffusion.

(vi) Fish
(vii) Aquatic arthropods
} Gills

(viii) Amphibians
(ix) Reptiles
(x) Birds
(xi) Mammals
} Lungs

2. Skin of man **cannot** act as a respiratory organ because

(1) It is dry
(2) It is not thin
(3) It is not permeable to O_2 and CO_2
(4) All of these

Sol. Answer (4)

Human skin is dry (does not allow exchange of gases), it is not thin (gases can pass through thin membrane) and it is impermeable to O_2 and CO_2).

3. What is the function of respiratory part of human respiratory system?

(1) It clears the incoming air from foreign particles
(2) It brings the temperature of air upto the body temperature
(3) It transports the atmospheric air
(4) It exchanges O_2 and CO_2 between blood and atmospheric air

Sol. Answer (4)

Respiratory part of human respiratory system includes alveoli and their ducts.
It is the main site of human respiratory system where diffusion of gases (O_2 and CO_2) occurs.

4. Ventrally and laterally, the thoracic chamber is formed by

(1) Diaphragm and sternum respectively (2) Ribs and sternum respectively

(3) Sternum and ribs respectively (4) Vertebral column and diaphragm respectively

Sol. Answer (3)

Thoracic cavity is formed :

Dorsally – By the vertebral column

Ventrally – By the sternum

Laterally – By the ribs

5. Adam's apple is another name for

(1) Sound box in birds (2) Sound box in man

(3) Epiglottis (4) Thyroid cartilage

Sol. Answer (4)

Its shape is like apple. It is composed of hyaline cartilage and more prominent in males.

6. Ring like cartilage of larynx is known as

(1) Thyroid cartilage (2) Arytenoid cartilage (3) Cricoid cartilage (4) Cartilage of Santorini

Sol. Answer (3)

Cricoid cartilage has signet ring-like structure lie below the thyroid cartilage and it is made up of hyaline cartilage.

7. Which of the following prevents collapsing of trachea?

(1) Muscles (2) Diaphragm (3) Ribs (4) Cartilaginous rings

Sol. Answer (4)

Trachea is lined by C-shaped cartilagenous ring, which prevents the collapsing of trachea.

8. Number of alveoli in the human lungs has been estimated to be approximately

(1) 100 million (2) 300 million (3) 125 million (4) 300 billion

Sol. Answer (2)

9. In humans, oblique fissure is present in

(1) Right lung (2) Left lung (3) Both the lungs (4) None of these

Sol. Answer (3)

Both right and left lungs have oblique fissure whereas only right lung also has a horizontal fissure.

10. A pair of external nostrils present in humans opens out

(1) Below the upper lip (2) Above the upper lip

(3) Between upper and lower lips (4) Above the larynx

Sol. Answer (2)

11. During inspiration, the volume of thoracic cavity increases because of

(1) Contraction of diaphragm and external intercostal muscles

(2) Relaxation of diaphragm and external intercostal muscles

(3) Contraction of diaphragm and relaxation of external intercostal muscles

(4) Relaxation of diaphragm and contraction of external intercostal muscles

Sol. Answer (1)

During inspiration, the contraction of diaphragm muscle causes it to become flat and lowered down, thereby increasing the volume of thoracic cavity in antero-posterior axis.

The contraction of external intercostal muscles, lift ribs and sternum up and outward causing an increase in volume of thoracic cavity in the *dorso-ventral* axis *i.e.,* backward-forward direction.

12. Volume of thoracic chamber increases in antero-posterior and dorso-ventral axis in rabbit 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

Sol. Answer (1)

During inspiration, the contraction of diaphragm causes it to become flat and lowered down, thereby increasing the volume of thoracic cavity in antero-posterior axis.

The contraction of external intercostal muscles, lift ribs and sternum up and outward causing an increase in volume of thoracic cavity in the *dorso-ventral* axis *i.e.*, backward-forward direction.

13. Which instrument helps in clinical assessment of pulmonary functions?
    (1) Sphygmomanometer (2) Stethoscope (3) Spirometer (4) Electrocardiograph

Sol. Answer (3)

Sphygomomanometer $\rightarrow$ Used to measure the blood pressure.

Stethoscope $\rightarrow$ To check the normal rhythm of heart (*i.e.,* to listen normal and abnormal heart sound).

Spirometer $\rightarrow$ To assess pulmonary function.

Electrocardiograph $\rightarrow$ Instrument use for taking ECG.

14. Normal expiration occurs due to
    (1) Relaxation of diaphragm and external intercostal muscles
    (2) Contraction of internal intercostal muscles and diaphragm
    (3) Relaxation of abdominal and internal intercostal muscles
    (4) Contraction of diaphragm and relaxation of abdominal muscles

Sol. Answer (1)

Expiration : It is the moving of air out of lungs if the pressure within the lungs is more than the atmospheric pressure.

Relaxation of the diaphragm and the external intercostal muscle returns the diaphragm and sternum to their normal thoracic volume and thereby pulmonary volume.

15. What happens to the volume of pulmonary cavity when there is an decrease in the volume of chest chamber?
    (1) It decreases (2) It increases
    (3) It remains same (4) First decreases and then increases

Sol. Answer (1)

Decrease in the volume of chest cavity

$\downarrow$ Leads to

Similar decrease in the volume of pulmonary cavity

$\downarrow$ Causes

Increase in pressure within the pulmonary cavity

$\downarrow$ Causes

Expulsion of air from lungs to atmosphere.

16. Diaphragm is a dome-shaped muscular structure which separates

(1) Coelomic cavity from pelvic cavity (2) Pleural cavity from thoracic cavity

(3) Thoracic cavity from abdominal cavity (4) Pelvic cavity from abdominal cavity

Sol. Answer (3)

Thoracic is closed below by the diaphragm which is a dome-shaped structure made up of muscles and separates thoracic cavity from abdominal cavity (containing most of the digestive organs).

17. What happens when pressure within the pulmonary cavity is higher than the atmospheric pressure?

(1) Inhalation of air (2) Expulsion of air

(3) No inhalation and expulsion of air occurs (4) Lungs inflate and rupture

Sol. Answer (2)

High pressure in pulmonary cavity compared to atmosphere results in explusion of air. Air moves high pressure to low pressure.

18. An additional volume of air, a person can inspire by a forceful inspiration is known as

(1) Inspiratory capacity (2) Expiratory capacity

(3) Expiratory reserve volume (4) Inspiratory reserve volume

Sol. Answer (4)

IRV is the additional volume of air a person can inspire by a forceful inspiration.

IRV = 2500 – 300 ml

IC = IRV + TV

3000 – 3500 ml

19. Volume of air remains in the lungs after normal expiration is

(1) ERV + RV (2) IRV + RV (3) RV + IRV + ERV (4) TV

Sol. Answer (1)

Volume of air remains in the lungs after normal expiration is known as functional residual capacity (FRC).

FRC = ERV + RV = 2500 ml

20. If a person exhales out forcefully by applying all his efforts. What will the pulmonary volume inhaled by him immediately under normal condition without applying any extra effort?

(1) TV + IRV (2) TV only (3) TV + ERV (4) TV + IRV + ERV

Sol. Answer (3)

After a normal inspiration, the total volume of air a person can expire is known as expiratory capacity (EC) = TV + ERV

Exhaled forcefully $\Rightarrow$ TV goes out, ERV goes out

Normal inspiration $\Rightarrow$ ERV + TV has to be filled

(Exchange of gases, Transport of gases)

21. Solubility of CO_2 is _____ times higher than that of O_2

(1) 40 - 45 (2) 20 - 25 (3) 100 - 200 (4) 200 - 300

Sol. Answer (2)

$CO_2 : O_2$ (Solubility of $CO_2 : O_2$)

25 : 1

22. What are the characteristics of alveoli?

(1) Very thin, irregular walled and highly vascularised (2) Thick and smooth membrane

(3) Network of blood capillaries and thick-walled (4) Thick, regular walled and lack of blood vessels

Sol. Answer (1)

Alveolar membrane is very thin, irregular, richly supplied with blood vessels because of which exchange of gases easily occurs here.

23. What is the value of pO_2 in alveoli and tissues respectively?

(1) 104 mm Hg and 150 mm Hg
(2) 45 mm Hg and 0.3 mm Hg
(3) 104 mm Hg and 40 mm Hg
(4) 95 mm Hg and 159 mm Hg

Sol. Answer (3)

Respiratory gas	Atmospheric air	Alveoli	Blood (oxygenated)	Blood (Deoxygenated)	Tissue
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

24. Which are the three main layers that form the diffusion membrane?

(1) Thin squamous epithelium of alveoli, basement membrane of bronchioles and basement substance
(2) Thin squamous epithelium of alveoli, endothelium of alveolar capillaries and the basement substance
(3) Basement substance, cuboidal epithelium of alveoli and stratified epithelium of bronchiole
(4) Ciliated epithelium of trachea, endothelium of capillaries and basement substance

Sol. Answer (2)

Diffusion of O_2 and CO_2 depends on the thickness of diffusion membrane.

25. Which of the following is **not** a character of respiratory surface?

(1) Thin, permeable to gases
(2) Extensive
(3) Least vascular
(4) Moist

Sol. Answer (3)

Respiratory surface should be highly vascular for the easy transport of gases or exchange of gases with the blood.

26. What is the percentage of O_2 transported in dissolved form through the plasma?

(1) About 7%
(2) About 3%
(3) About 20–25%
(4) About 15%

Sol. Answer (2)

Oxygen transport by plasma = 3%

Oxygen transport by oxyhaemoglobin = 97%

27. How many O_2 molecules can bind with single molecule of Hb?

(1) 8
(2) 6
(3) 4
(4) 4.5

Sol. Answer (3)

Haemoglobin consists of four polypeptide chain (2α and 2β) having heme as prosthetic group. Heme is iron (Fe^{2+}) containing prophyrin ring. One haemoglobin binds four oxygen molecules, one per heme and form oxyhemoglobin.

$$Hb + 4O_2 \rightleftharpoons Hb(O_2)_4$$

28. To which part of Hb does CO_2 bind?

(1) Haem (2) Amino group of globin (3) Iron of haem group (4) Carboxy group of globin

Sol. Answer (2)

Haemoglobin = Heme + Globin

↓ ↓

Contain Fe^{2+} with porphyrin ring Include four polypeptide chain ($\alpha_2\beta_2$)

CO_2 bind to amino group of globin and form carbaminohaemoglobin.

$$\underset{\substack{\text{(Haemoglobin)}\\\text{(Amino group)}}}{Hb} + CO_2 \rightleftharpoons \underset{\text{(Carbamino haemoglobin)}}{HbCO_2}$$

29. Which of the following condition is **not** responsible for shifting the oxygen dissociation curve towards left?

(1) High pO_2 (2) Low pCO_2

(3) Low temperature (4) High H^+ ion concentration

Sol. Answer (4)

Following are the conditions responsible for shifting the curve towards left :

(a) High pO_2

(b) Low pCO_2

(c) Less H^+ concentration and high pH

(d) Low temperature

All above four conditions are favourable for the association of oxygen with hemoglobin, at alveoli.

30. Which factors favour the binding of CO_2 with Hb in tissues?

(1) High pCO_2 and high pO_2 (2) Low pCO_2 and high pO_2

(3) Low pCO_2 and low pO_2 (4) High pCO_2 and low pO_2

Sol. Answer (4)

Condition favourable for the binding of CO_2 with Hb or we can say dissociation of O_2 from Hb are :

(a) Low pO_2 (b) High pCO_2

(c) More H^+ concentration and low pH (d) High temperature

In these conditions, oxygen dissociation curve will shift to right.

31. In mature mammalian erythrocytes, respiration is

(1) Aerobic (2) Anaerobic

(3) Sometimes aerobic and sometimes anaerobic (4) Absent

Sol. Answer (2)

Mature RBCs do not have cell organelle (like mitochondria) and nucleus, so in mature RBC anaerobic respiration occurs.

32. The amount of oxygen delivered by one litre of blood under strenous condition is approximately

(1) 5 ml (2) 50 ml (3) 15 ml (4) 150 ml

Sol. Answer (4)

100 ml of blood contains about ~20 ml of O_2

In normal physiological condition	In strenous/exercise condition
5 ml goes to tissue +	15 ml goes to tissue +
15 ml → returned via venous blood	5 ml → returned via venous blood

So, 100 ml of blood transport → 15 ml of O_2 (strenous condition)

1000 ml of blood transport → 150 ml of O_2

(Regulation of respiration, Disorders of respiratory system)

33. 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

Sol. Answer (1)

Pneuomotaxic centre is present in the pons region of hind brain.

It is also known as "switch off point of inspiration" *i.e.* it reduces the duration of inspiration and alter the respiratory rate and depth of breathing.

34. A chronic disorder in which alveolar walls are damaged due to excessive cigarette smoking is

(1) Asthma (2) Emphysema

(3) Silicosis (4) Bronchitis

Sol. Answer (2)

Emphysema
- Due to excessive cigarette smoking
- Walls of alveoli get damaged and loss of elasticity of walls of bronchioles and alveoli
- ↓
- Due to which, surface area for exchange of gases is reduced

Asthma : Caused because of allergen and effects the respiratory tract.

Bronchitis : Inflammation of bronchi.

Silicosis : It is an occupational respiratory disorder caused due to continuous exposure of asbestos dust at place of work.

35. Which of the following is **not** a symptom of asthma?

(1) Difficulty in breathing (2) Breathing noisily / wheezing

(3) Alveolar walls are damaged (4) Inflammation of bronchi and bronchioles

Sol. Answer (3)

Wall of alveoli get damaged due to excessive smoking is a symptom of chronic disorder, emphysema.

SECTION - B

Previous Years Questions

1. Which of the following options correctly represents the lung conditions in asthma and emphysema, respectively?

[NEET-2018]

(1) Inflammation of bronchioles; Decreased respiratory surface

(2) Increased number of bronchioles; Increased respiratory surface

(3) Decreased respiratory surface; Inflammation of bronchioles

(4) Increased respiratory surface; Inflammation of bronchioles

Sol. Answer (1)

Asthma is a difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles. Emphysema is a chronic disorder in which alveolar walls are damaged due to which respiratory surface is decreased.

2. Match the items given in Column I with those in Column II and select the correct option given below:

[NEET-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	b	c	d
(1)	iii	ii	i	iv
(2)	iii	i	iv	ii
(3)	iv	iii	ii	i
(4)	i	iv	ii	iii

Sol. Answer (2)

Tidal volume is volume of air inspired or expired during normal respiration. It is approximately 500 mL. Inspiratory reserve volume is additional volume of air a person can inspire by a forceful inspiration. It is around 2500 – 3000 mL. Expiratory reserve volume is additional volume of air a person can be expired by a forceful expiration. This averages 1000 – 1100 mL.

Residual volume is volume of air remaining in lungs even after forceful expiration. This averages 1100 – 1200 mL.

3. Which of the following is an occupational respiratory disorder? **[NEET-2018]**

(1) Anthracis (2) Silicosis (3) Emphysema (4) Botulism

Sol. Answer (2)

Silicosis is due to excess inhalation of silica dust in the workers involved grinding or stone breaking industries.

Long exposure can give rise to inflammation leading to fibrosis and thus causing serious lung damage.

Anthrax is a serious infectious disease caused by *Bacillus anthracis*. It commonly affects domestic and wild animals. Emphysema is a chronic disorder in which alveolar walls are damaged due to which respiratory surface is decreased.

Botulism is a form of food poisoning caused by *Clostridium botulinum*.

4. Lungs are made up of air-filled sacs the alveoli. They do not collapse even after forceful expiration, because of **[NEET-2017]**

(1) Residual Volume (2) Inspiratory Reserve Volume

(3) Tidal Volume (4) Expiratory Reserve Volume

Sol. Answer (1)

Volume of air present in lungs after forceful expiration as residual volume which prevents the collapsing of alveoli even after forceful expiration.

5. The partial pressure of oxygen in the alveoli of the lungs is **[NEET(Phase-2) 2016]**

(1) Equal to that in the blood

(2) More than that in the blood

(3) Less than that in the blood

(4) Less than that of carbon dioxide

Sol. Answer (2)

Partial pressure of oxygen in alveoli of lungs is 104 mm of Hg that is more than that of blood in pulmonary artery (40 mm of Hg).

6. Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because **[NEET(Phase-2) 2016]**

(1) There is a negative pressure in the lungs

(2) There is a negative intrapleural pressure pulling at the lung walls

(3) There is a positive intrapleural pressure

(4) Pressure in the lungs is higher than the atmospheric pressure

Sol. Answer (2)

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

7. Name the chronic respiratory disorder caused mainly by cigarette smoking **[NEET-2016]**

(1) Respiratory alkalosis (2) Emphysema

(3) Asthma (4) Respiratory acidosis

Sol. Answer (2)

Emphysema is characterised by inflation of alveoli which is mainly due to chronic cigarette smoking.

8. Reduction in pH of blood will **[NEET-2016]**

(1) Release bicarbonate ions by the liver

(2) Reduce the rate of heart beat

(3) Reduce the blood supply to the brain

(4) Decrease the affinity of hemoglobin with oxygen

Sol. Answer (4)

Reduction in pH of blood favours the dissociation of oxyhemoglobin.

9. Asthma may be attributed to **[NEET-2016]**

(1) Accumulation of fluid in the lungs (2) Bacterial infection of the lungs

(3) Allergic reaction of the mast cells in the lungs (4) Inflammation of the trachea

Sol. Answer (3)

Asthma is an allergic reaction characterised by spasm of bronchi muscles because of effect of histamine released by mast cells.

10. When you hold your breath, which of the following gas changes in blood would first lead to the urge to breathe? **[AIPMT-2015]**

(1) Rising CO_2 and falling O_2 concentration

(2) Falling O_2 concentration

(3) Rising CO_2 concentration

(4) Falling CO_2 concentration

Sol. Answer (3)

11. Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs **[AIPMT-2014]**

(1) As bicarbonate ions

(2) In the form of dissolved gas molecules

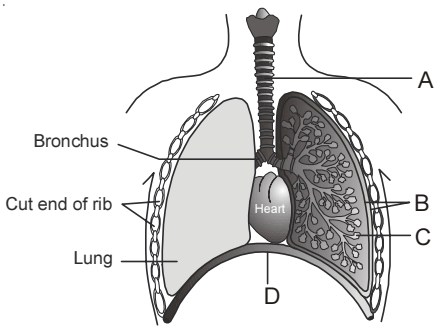
(3) By binding to R.B.C

(4) As carbamino - haemoglobin

Sol. Answer (1)

Nearly 20 – 25 percent of CO_2 is transported by RBCs, whereas, 70 percent of it is carried as bicarbonates. About 7 percent of CO_2 is carried as dissolved state in plasma.

12. The figure shows a diagrammatic view of human respiratory system with labels A, B, C, and D. Select the option which gives correct identification and main function and/or characteristic. **[NEET-2013]**



(1) B-pleural membrane-surround ribs on both sides to provide cushion against rubbing

(2) C-Alveoli-thin walled vascular bag like structures for exchange of gases

(3) D-lower end of lungs-diaphragm pulls it down during inspiration

(4) A-trachea-long tube supported by complete cartilaginous rings for conducting inspired air

Sol. Answer (2)

13. Which one of the following is the **correct** statement for respiration in humans? **[AIPMT (Prelims)-2012]**

(1) About 90% of carbon dioxide (CO_2) is carried by haemoglobin as carbamino-haemoglobin

(2) Cigarette smoking may lead to inflammation of bronchi

(3) Neural signals from pneumotoxic centre in pons region of brain can increase the duration of inspiration

(4) Workers in grinding and stone-breaking industries may suffer, from lung fibrosis

Sol. Answer (4)

Option (1) is wrong, because ~70% of CO_2 is carried by haemoglobin as carbaminohaemoglobin.

Option (2) is wrong, because cigarette smoking lead to damage of alveoli wall.

Option (3) is wrong, because pneumotaxic centre in pons region of brain decrease the duration of inspiration.

14. People who have migrated from the planes to an area adjoining Rohtang Pass about six months back **[AIPMT (Prelims)-2012]**

(1) Have the usual RBC count but their haemoglobin has very high binding affinity to O_2

(2) Have more RBCs and their haemoglobin has a lower binding affinity of O_2

(3) Are not physically fit to play games like football

(4) Suffer from altitude sickness with symptoms like nausea, fatigue, etc

Sol. Answer (2)

High altitude (pO_2 less) so more RBC production, which leads to polycythemia *i.e.,* increased RBC count.

15. A large proportion of oxygen is left unused in the human blood even after its uptake by the body tissues. This O_2 **[AIPMT (Prelims)-2011]**

(1) Helps in releasing more O_2 to the epithelial tissues

(2) Acts as a reserve during muscular exercise

(3) Raises the pCO_2 of blood to 75 mm of Hg.

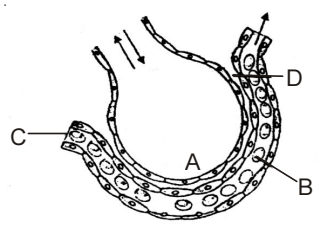
(4) Is enough to keep oxyhaemoglobin saturation at 96%

Sol. Answer (2)

During exercise, contraction of muscle occurs and for that more energy is required and for energy oxygen is required.

16. 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 function.

[AIPMT (Prelims)-2011]



Option:

(1) **B:** Red blood cell – transport of CO_2 mainly.

(2) **C:** Arterial capillary – passes oxygen to tissues

(3) **A:** Alveolar cavity – main site of exchange of respiratory gases

(4) **D:** Capillary wall – exchange of O_2 and CO_2 takes place here.

Sol. Answer (3)

Option (1) is wrong because RBCs are involved in transport of CO_2 and O_2 both

Option (2) is wrong because C is blood capillary.

Option (4) is wrong because D is basement membrane - substance

17. Bulk of carbon dioxide (CO_2) released from body tissues into the blood is present as **[AIPMT (Mains)-2011]**

(1) 70% carbamino-haemoglobin and 30% as bicarbonate

(2) Carbamino-haemoglobin in RBCs

(3) Bicarbonate in blood plasma and RBCs

(4) Free CO_2 in blood plasma

Sol. Answer (3)

CO_2 transport via plasma 7%

Bicarbonate = 70% (Major)

Haemoglobin = 20–25%

18. Which one of the following is a possibility for most of us in regard to breathing, by making a conscious effort?

[AIPMT (Mains)-2011]

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

(2) The lungs can be made fully empty by forcefully breathing out all air from them

(3) One can breathe out air totally without oxygen

(4) One can breathe out air through eustachian tubes by closing both the nose and the mouth

Sol. Answer (1)

If we push voluntarily abdominal contents towards diaphragm, it will lead to expiration without involvement of intercostal muscle.

19. Which two of the following changes (a–d) usually tend to occur in the plain dwellers when they move to high altitudes (3,500 m or more)?

(a) Increase in red blood cell size

(b) Increase in red blood cell production

(c) Increased breathing rate

(d) Increase in thrombocyte count

Changes occurring are

[AIPMT (Prelims)-2010]

(1) (a) and (b) (2) (b) and (c) (3) (c) and (d) (4) (a) and (d)

Sol. Answer (2)

20. Listed below are four respiratory capacities (a - d) and four jumbled respiratory volumes of a normal human adult: Respiratory capacities and volumes

(a) Residual volume 2500 mL
(b) Vital capacity 3500 mL
(c) Inspiratory reserve volume 1200 mL
(d) Inspiratory capacity 4500 mL

Which one of the following is the **correct** matching of two capacities and volumes? **[AIPMT (Prelims)-2010)]**

(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

Sol. Answer (4)

Residual volume	–	1200 ml
Vital capacity	–	4500 ml
Inspiratory reserve volume	–	2500 ml
Inspiratory capacity	–	3500 ml

21. What is vital capacity of our lungs? **[AIPMT (Prelims)-2008]**

(1) Total lungs capacity minus residual volume
(2) Inspiratory reserve volume plus tidal volume
(3) Total lungs capacity minus expiratory reserve volume
(4) Inspiratory reserve volume plus expiratory reserve volume

Sol. Answer (1)

Vital capacity is the maximum volume of air a person can breathe in after a forceful expiration.

Vital capacity (VC) = Total lung capacity – Residual volume

22. Increased asthamatic attacks in certain seasons are related to **[AIPMT (Prelims)-2007]**

(1) Low temperature
(2) Hot and humid environment
(3) Eating fruits preserved in tin containers
(4) Inhalation of seasonal pollen

Sol. Answer (4)

23. People living at sea level have around 5 million RBC per cubic millimeter of their blood whereas those living at an altitude of 5400 metres have around 8 million. This is because at high altitude **[AIPMT (Prelims)-2006]**

(1) People get pollution-free air to breathe and more oxygen is available
(2) Atmospheric O_2 level is less and hence more RBCs are needed to absorb the required amount of O_2 to survive
(3) There is more UV radiation which enhances RBC production
(4) People eat more nutritive food, therefore more RBCs are formed

Sol. Answer (2)

24. Which one of the following statements is **incorrect**? **[AIPMT (Prelims)-2006]**

(1) The residual air in lungs slightly decreases the efficiency of respiration in mammals
(2) The presence of non-respiratory air sacs, increases the efficiency of respiration in birds
(3) In insects, circulating body fluids serve to distribute oxygen to tissues
(4) The principle of countercurrent flow facilitates efficient respiration in gills of fishes

Sol. Answer (3)

In insects tracheal system serve to distribute oxygen to tissues. Openings of trachae are called spiracles and present for entry and exist of gases.

25. The majority of carbon dioxide produced by our body cells is transported to the lungs

[AIPMT (Prelims)-2006]

(1) Dissolved in the blood (2) As bicarbonates

(3) As carbonates (4) Attached to haemoglobin

Sol. Answer (2)

26. In man and other mammals, air passes from outside into the lungs through

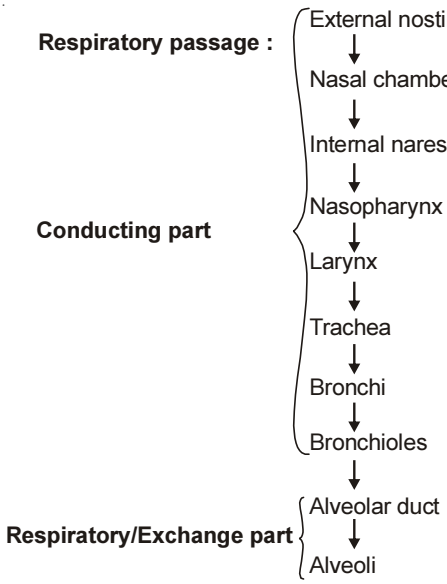
(1) Nasal cavity, larynx, pharynx, trachea, bronchi, alveoli

(2) Nasal cavity, larynx, pharynx, trachea, bronchioles, alveoli

(3) Nasal cavity, pharynx, larynx, trachea, bronchioles, bronchi, alveoli

(4) Nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles, alveoli

Sol. Answer (4)



27. Lungs are enclosed in

(1) Peritoneum (2) Perichondrium (3) Pericardium (4) Pleural membranes

Sol. Answer (4)

Lungs are enclosed in pleural membranes. *i.e.* external pleura and internal pleura and in between pleural fluid is present.

Pericardium → Membrane covers the heart Perichondrium → Outer covering of cartilage

Peritoneum → Covering of visceral organ

28. When a person breathes air through a tube directly into the trachea (tracheotomy) it may lead to serious lung crushing and infection due to

(1) Cooling effect (2) Drying effect (3) Non filtering effect (4) All of these

Sol. Answer (4)

Because upper respiratory tract helps in filtering the air, bringing air to body temperature and making it moist.

29. Pitch of the voice is lower in males than females as the vocal cords of man are

(1) Thicker and longer (2) Thinner and longer (3) Thicker and shorter (4) Thinner and shorter

Sol. Answer (1)

In males, vocal cord is thicker and longer than females and pitch is affected by this

Male → Low pitch and female → High pitch

30. Which of the following statement is **not** true for man?
(1) Forceful expiration is an active process
(2) Mammals have negative pressure breathing
(3) Internal intercostal and abdominal muscles are muscles of forceful inspiration
(4) Respiration excretes CO_2, water etc.

Sol. Answer (3)

Internal intercostal muscle, Abdominal muscle } Muscles of forceful expiration

31. The ventilation movements of the lungs in mammals are governed by
(1) Muscular walls of lung (2) Diaphragm (3) Costal muscles (4) Both (2) & (3)

Sol. Answer (4)

Inspiration and expiration both governed by diaphragm and costal muscles.

32. In lungs, the air is separated from the venous blood through
(1) Transitional epithelium of alveoli + squamous epithelium of blood vessel
(2) Squamous epithelium of alveoli + endothelium of blood vessel
(3) Squamous epithelium of alveoli + cubical epithelium of blood vessel
(4) Cubical epithelium of alveoli + columnar epithelium of blood vessel

Sol. Answer (2)

Alveolar-capillary membrane or respiratory membrane or diffusion membrane, made up of
(1) Thin squamous epithelium of alveoli
(2) Basement membrane
(3) Endothelial lining of alveolar capillary/blood vessel

33. Which of the following volume or capacity of lungs can't be measured directly by the spirometer?
(1) Residual volume (2) Functional residual capacity
(3) Total capacity (4) All of these

Sol. Answer (4)

Spirometer can measure the volume of air goes inside and outside the lungs. It does not measure the residual volume of air that remains inside the lungs. So, residual volume, functional residual capacity and total capacity cannot be measured by spirometer.

34. Amount of air left in the lung after normal expiration is
(1) Residual volume (2) Inspiratory reserve volume
(3) Expiratory reserve volume (4) Functional residual capacity

Sol. Answer (4)

It is the volume of air left in the lung after normal expiration.

FRC = ERV + RV = 2500 ml

35. Minute Volume of Respiration (MVR) in a person can be defined as
(1) Tidal volume × Breathing rate
(2) (Tidal volume – Anatomic dead space) × Breathing rate
(3) Vital capacity ÷ Breathing rate
(4) Vital capacity ÷ Tidal volume

Sol. Answer (1)

Minute volume is the volume of air a person can inhale per minute.

Minute volume = Tidal volume × Breathing rate

500 ml × 12–16/min

= 6000 - 8000 ml/min

36. When CO_2 concentration in blood increases, breathing becomes

(1) Shallower and slow
(2) There is no effect on breathing
(3) Slow and deep
(4) Faster and deeper

Sol. Answer (4)

Like exercise, when [CO_2] increases in blood and [O_2] decreases in blood, then breathing become faster and deeper.

37. The CO_2 content by volume, in the atmospheric air is about

(1) 3.34%
(2) 4%
(3) 0.0314%
(4) 0.34%

Sol. Answer (3)

Air composition :

Nitrogen = 78%

Oxygen = 21%

CO_2 = 0.03%

Argon = <1%

Other gases = <1%

38. Although much CO_2 is carried in blood, yet blood does **not** become acidic, because

(1) CO_2 is continuously diffused through the tissues and is not allowed to accumulate
(2) In CO_2 transport, blood buffers play an important role
(3) CO_2 is absorbed by the leucocytes
(4) CO_2 combines with water to form H_2CO_3 which is neutralized by $NaCO_3$

Sol. Answer (2)

Blood acts as a buffer, which resists the change in pH of blood, because of bicarbonate ions.

39. The carbon dioxide is transported via blood to lungs

(1) In combination with haemoglobin only
(2) Dissolved in blood plasma only
(3) In the form of carbonic acid only
(4) As carbaminohaemoglobin and as bicarbonates

Sol. Answer (4)

CO_2 transport via plasma = 7%; Bicarbonate = 70%; Haemoglobin = 20–25%

40. How does the transport of O_2 and CO_2 by blood occur?

(1) With the help of WBCs and blood serum
(2) With the help of platelets and corpuscles
(3) With the help of RBCs and blood plasma
(4) With the help of RBCs and WBCs

Sol. Answer (3)

Blood is the medium of transport for O_2 and CO_2.

41. Blood analysis of a patient reveals an unusually high quantity of carboxyhaemoglobin content. The patient has been inhaling polluted air containing unusually high content of

(1) Carbon disulphide
(2) Chloroform
(3) Carbon dioxide
(4) Carbon monoxide

Sol. Answer (4)

$$\underset{\text{(Carbon dioxide)}}{CO_2} + Hb \rightleftharpoons \underset{\text{(Carbaminohaemoglobin)}}{HbCO_2}$$

$$\underset{\text{(Carbon monoxide)}}{CO} + Hb \rightleftharpoons \underset{\text{(Carboxyhaemoglobin)}}{HbCO}$$

42. What is **true** about RBCs in humans?
(1) They do not carry CO_2 at all
(2) They carry both CO_2 and O_2
(3) They transport 99.5 percent of O_2
(4) They transport about 80 percent oxygen only and the rest 20 percent of it is transported in dissolved state in blood plasma

Sol. Answer (2)

RBCs carry 20-25% of CO_2 as carbaminohaemoglobin and 97% of O_2 as oxyhaemoglobin.

43. How carbon monoxide, emitted by automobiles, prevents transport of oxygen to the body tissues?
(1) By forming a stable compound with haemoglobin
(2) By inhibiting exchange of O_2 at alveoli
(3) By changing oxygen into carbon dioxide
(4) By destroying the haemoglobin

Sol. Answer (1)

Carbon monoxide has more affinity to bind with haeme group of haemoglobin, than oxygen

250 : 1

$CO : O_2$

44. The respiratory centre, which regulates respiration, is located in
(1) Cerebellum (2) Medulla oblongata (3) Cerebral peduncle (4) The vagus nerve

Sol. Answer (2)

Respiratory centre is located in medulla oblongata.

45. Mark the **incorrect** statement
(1) Hering Breuer's reflex prevents the over expansion of lungs
(2) Oxygen dissociation curve for foetal haemoglobin is on the left side with respect to maternal haemoglobin
(3) When pneumotaxic centre transmits strong signals then inspiration time becomes shorter
(4) Amount of air left in the lung after normal expiration is termed as residual volume only

Sol. Answer (4)

Amount of air left in the lung after forceful expiration is termed as **residual volume**.

46. Which of the following reflex is involved to prevent excessive inflation of the lungs?
(1) Stretch reflex (2) Hering-Breuer's reflex (3) Withdrawal reflex (4) Conditioned reflex

Sol. Answer (2)

Excessive inflation $\rightarrow$ Stretch receptors get activated $\rightarrow$ Cause expiration by sending signal through vagus nerve to inhibit inspiratory area.

47. Chemoreceptors present in carotid and aortic arch are very much sensitive to
(1) Increase in pCO_2 in arterial blood
(2) Increase in pO_2 in arterial blood
(3) Decrease in pO_2 in venous blood
(4) Both (2) & (3)

Sol. Answer (1)

Chemoreceptors present in carotid and aortic are sensitive to CO_2 and H^+.

48. A person remaining at high altitudes for years becomes more and more acclimatized to the low pO_2 by the following except
(1) Increased pulmonary ventilation
(2) Increased in RBCs and haemoglobin concentration
(3) Polycythemia
(4) Increased cardiac output permanently

Sol. Answer (4)

At high altitude (less pO_2) then more RBC production which leads to increase RBC count (polycythemia) in blood, due which viscosity of blood increases, hence cardiac output decreases.

49. If the blood does not deliver adequate O_2 to the tissues, it is called
(1) Anaemia (2) Anorexia (3) Hypoxia (4) Hypopnea

Sol. Answer (3)

Anorexia – Loss of apetite
Hypoxia – Low oxygen condition in tissue
Hypopnea – Slow breathing
Anaemia – Low hemoglobin, immature RBC

50. Less oxygen due to high levels of carbon dioxide is called
(1) Carbon monoxide poisoning (2) Asphyxia
(3) Dyspnea (4) Apnoea

Sol. Answer (2)

Dyspnea – Painful breathing
Apnoea – No breathing
Asphyxia – Combination of Hypoxia (low O_2) + Hypercapnia (more CO_2)

51. Which of the following is not pollution related disorder?
(1) Silicosis (2) Pneumoconiosis (3) Fluorosis (4) Leprosy

Sol. Answer (4)

Leprosy is caused by *Mycobacterium leprae*.

52. Hiccups can be best described as
(1) Forceful sudden expiration (2) Jerky incomplete inspiration
(3) Vibration of the soft palate during breathing (4) Sign of indigestion

Sol. Answer (2)

Because hiccups occur due to spasm of phrenic muscle which leads to jerky inspiration.

53. Number of alveoli in the human lungs has been estimated to be approximately
(1) 100 million (2) 300 million (3) 125 million (4) 300 billion

Sol. Answer (2)

54. Which of the following can be termed as opposite of Bohr's effect?
(1) Haldane's effect (2) Hamburger's phenomenon
(3) Hering - breuer reflex (4) None of these

Sol. Answer (1)

Haldane's effect and Bohr effect complement each other. In the tissue, addition of CO_2 to the blood facilitates unloading of O_2 by Bohr effect. In turn, O_2 unloading favours uptake of CO_2 by Haldane'e effect.

SECTION - C

Assertion-Reason Type Questions

1. A : Pneumotaxic centre controls rate of respiration.
R : Primarily it controls switch off point of inspiration.

Sol. Answer (1)

Pneumotaxic centre is called switch off centre of inspiration.

2. A : Asthmatic patients use bronchi odilator drugs as well as inhalers for symptomatic relief.
R : Asthma is characterized by the spasm of smooth muscles in the wall of bronchioles due to allergens.

Sol. Answer (1)

Asthma is response to an allergic reaction.

3. A : Major part of carbondioxide is transported in the form of sodium bicarbonate.

R : 0.3 ml of carbon dioxide is transported per 100 ml of blood in dissolved state in plasma of blood.

Sol. Answer (2)

Only 7% of CO_2 is transported in dissolved state in plasma of blood.

4. A : Diffusion of carbon dioxide is 20 times faster than oxygen.

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

Sol. Answer (1)

Solubility of CO_2 is 20 times higher than that of O_2.

5. A : The passage starting with the external nostrils upto the terminal bronchioles constitutes the respiratory part.

R : The respiratory part transports the air to the alveoli, where clears it from the foreign material, humidifies it and brings the air to body temperature.

Sol. Answer (4)

The passage starting with the external nostils upto the terminal bronchioles constitutes the conducting part. Alveoli are not part of conducting part.

6. A : Normal expiration during quiet breathing, unlike inspiration, is a passive process because no muscular contractions are involved.

R : Normal expiration results from the elastic recoil of the chest wall and lungs.

Sol. Answer (1)

Normal expiration in human is due to relaxation of muscles.

7. A : Human blood always contains more amount of CO_2 than blood oxygen.

R : Solubility coefficient of CO_2 is more than O_2.

Sol. Answer (1)

In 100 ml oxygenated blood, amount of O_2 is about 20 ml while of CO_2 is about 48 ml.

8. A : When a person starts doing exercise, rate of breathing increases due to changes in pCO_2 or H^+ concentration.

R : The main stimulus for these quick changes is due to input from the proprioreceptors, which monitor movements of joints and muscles.

Sol. Answer (1)

9. A : Emphysema is a chronic obstructive disease of lung, causing irreversible distension and loss of elasticity of alveoli.

R : Emphysema is preventable if chronic exposure to smoke (cigarette and others) and pollutants is avoided.

Sol. Answer (2)

Emphysema is due to inflation of alveoli.

10. A : 100 ml of venous blood has 14.4 ml of O_2 *i.e.*, it is still 75% saturated with oxygen under normal physiological condition.

R : About 4.6 ml of O_2, *i.e.* 25% diffuses from arterial blood into the tissue during exercise.

Sol. Answer (3)

During normal conditions, oxygen demand in tissue is low.

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