Breathing and Exchange of Gases

Question1

Match List-I with List-II:

	List-I		List-II
A.	Residual Volume	I	Maximum volume of air that can be breathed in after forced expiration
B.	Vital Capacity	II	Volume of air inspired or expired during normal respiration
C.	Expiratory Capacity	III	Volume of air remaining in lungs after forcible expiration
D.	Tidal Volume	IV	Total volume of air expired after normal inspiration

Choose the correct answer from the options given below:

[NEET 2024 Re]

Options:

A.

A-IV, B-III, C-II, D-I

B.

A-II, B-IV, C-I, D-III

C.

A-III, B-I, C-IV, D-II

D.

A-I, B-II, C-III, D-IV

Answer: C

Solution:

Option (3) is the answer of this question because correct match is A-III, B-I, C-IV, D-II.

Option (1), (2) and (4) are incorrect because they are not correctly matched.

Residual volume - Volume of air remaining in lungs after forcible expiration.

Vital capacity - Maximum volume of air that can be breathed in after forced expiration.

Expiratory Capacity - Total volume of air expired after normal inspiration.

Tidal volume - Volume of air inspired or expired during normal respiration.

Question2

Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: During the transportation of gases, about 20 − 25 percent of CO_2 is carried by Haemoglobin as carbamino-haemoglobin.

Reason R : This binding is related to high pCO_2 and low pO_2 in tissues.

In the light of the above statements, choose the correct answer from the options given below.

[NEET 2024 Re]

Options:

A.

A is true but R is false.

B.

A is false but R is true.

C.

Both A and R are true and R is the correct explanation of A .

D.

Both A and R are true but R is NOT the correct explanation of A.

Answer: C

Solution:

The correct answer is option (3) as nearly 20 − 25 precent of CO_2 is transported by RBCs whereas 70 percent of it is carried as bicarbonate. About 7 percent of CO2 is carried in a dissolved state through plasma.

The binding of CO_2 with haemoglobin is related to the partial pressure of CO_2. pO_2 is a major factor which could affect this binding. When pCO2 is high and pO2 is low as in the tissues, more binding of CO_2 occurs. Percentage of a gas transported depends upon its partial pressure. If partial pressure decreases, the transportation of gases also decrease with haemoglobin. So, Reason is the correct explanation of Assertion.

Question3

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 :

[NEET 2024]

Options:

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

Answer: A

Solution:

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

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Question4

Which of the following factors are favourable for the formation of oxyhaemoglobin in alveoli?

[NEET 2024]

Options:

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

Answer: B

Solution:

The correct answer is option (2) as

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

Option (1), (3) and (4) are not correct as they do not favour the formation of oxyhaemoglobin.

Question5

Vital capacity of lung is

[NEET 2023]

Options:

A.

IRV + ERV + TV + RV

B.

IRV + ERV + TV − RV

C.

IRV + ERV + TV

D.

IRV + ERV

Answer: C

Solution:

Solution:

Option (3) is the correct answer because vital capacity is the maximum volume of air a person can breathe in after forced expiration. This includes ERV, TV and IRV.

Question6

Select the sequence of steps in Respiration.
(A) Diffusion of gases (O_2. and CO_2) across alveolar membrane.
(B) Diffusion of O_2 and CO_2 between blood and tissues.
(C) Transport of gases by the blood
(D) Pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out.
(E) Utilisation of O_2 by the cells for catabolic reactions are resultant release of CO_2

Choose the correct answer from the options given below :

[NEET 2023 mpr]

Options:

A.

(D), (A), (C), (B), (E)

B.

(C),(B),(A),(E),(D)

C.

(B),(C),(E),(D),(A)

D.

(A), (C), (B), (E), (D)

Answer: A

Solution:

Here's the reasoning behind this order:

(D) Pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out.
Respiration begins with pulmonary ventilation (breathing), which allows the atmospheric air to enter the lungs and CO_2-rich air to be exhaled.

(A) Diffusion of gases (O_2. and CO_2) across the alveolar membrane.
Inside the lungs, oxygen diffuses from the alveoli into the blood, and carbon dioxide diffuses from the blood into the alveoli across the alveolar membrane.

(C) Transport of gases by the blood.
Once in the bloodstream, oxygen and carbon dioxide are transported to and from the body's tissues.

(B) Diffusion of O_2 and CO_2 between blood and tissues.
Oxygen diffuses from the blood into the body's tissues, and carbon dioxide diffuses from the tissues into the blood.

(E) Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2.
Finally, oxygen is used by cells for metabolic processes, creating carbon dioxide as a byproduct.

Question7

Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) :
A person goes to high altitude and experiences "Altitude Sickness" with symptoms like breathing difficulty and heart palpitations.

Reason (R) :
Due to low atmospheric pressure at high altitude, the body does not get sufficient oxygen.
In the light of the above statements, choose the correct answer from the

options given below :

[NEET 2023 mpr]

Options:

A.

(A) is true but (R) is false

B.

(A) is false but (R) is true

C.

Both (A) and (R) are true and (R) is the correct explanation of (A).

D.

Both (A) and (R) are true but (R) is not the correct explanation of (A).

Answer: C

Solution:

Option C : Both (A) and (R) are true and (R) is the correct explanation of (A).

Explanation :
At higher altitudes, the air pressure is lower than at sea level. This means there is less atmospheric pressure to push oxygen into the lungs, which can make it more difficult for the body to get the oxygen it needs. This condition can lead to altitude sickness, which can cause symptoms such as difficulty breathing and heart palpitations, among others. This is the basis for the statement (A) and the reason given in statement (R) accurately explains this situation.

Question8

Which of the following statements are correct with respect to vital capacity?
(a) It includes ERV, TV and IRV.
(b) Total volume of air a person can inspire after a normal expiration.
(c) The maximum volume of air a person can breathe in after forced expiration.
(d) It includes ERV, RV and IRV.
(e) The maximum volume of air a person can breathe out after a forced inspiration. Choose the most appropriate answer from the options given below.
[NEET Re-2022]

Options:

A. (a) and (e)

B. (b), (d) and (e)

C. (a), (c) and (d)

D. (a), (c) and (e)

Answer: D

Solution:

Solution:

Vital capacity (VC): The maximum volume of air a person can breathe in after a forced expiration or the maximum volume of air a person can breathe out after a forced inspiration. This includes ERV, TV and IRV.

Question9

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

Options:

A. It clears inhaled air from foreign particles

B. Inhaled air is humidified

C. Temperature of inhaled air is brought to body temperature

D. Provides surface for diffusion of O_2 and CO_2

Answer: D

Solution:

Solution:

Option (4) is correct because the part starting with the external nostrils upto the terminal bronchioles constitute the conducting part; whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system.

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

Question10

The partial pressures (in mmH g) of oxygen (O_2) and carbon dioxide (CO_2) at alveoli (the site of diffusion) are:
[NEET 2021]

Options:

A. pO_2 = 104 and pCO_2 = 40

B. pO_2 = 40 and pCO_2 = 45

C. pO_2 = 95 and pCO_2 = 40

D. pO_2 = 159 and pCO_2 = 0.3

Answer: A

Solution:

• Option (1) is correct because pO_2 in alveoli is 104mmH g and pCO_2 in alveoli is 40mmH g.
• In atmosphere, pO_2 is 159mmH g and pCO_2 is 0.3mmH g
• In deoxygenated blood, pO_2 is 40mmH g and pCO_2 is 45mmH g.
• In oxygenated blood, pO_2 is 95mmH g and pCO_2 is 40mmH g.

Question11

Select the favourable conditions required for the formation of oxyhaemoglobin at the alveoli.
[NEET 2021]

Options:

A. High pO_2, low pCO_2, less H^+, lower termperature

B. Low pO_2, high pCO_2, more H^+, higher temperature

C. High pO_2, high pCO_{22}, less H^+, higher temperature

D. Low pO_2, low pCO_2, more H^+, higher temperature

Answer: A

Solution:

Solution:
● 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.

Question12

Assertion (A): A person goes to high altitude and experiences 'altitude sickness' with symptoms like breathing difficulty and heart palpitations.
Reason (R): Due to low atmospheric pressure at high altitude, the body does not get sufficient oxygen.
In the light of the above statements, choose the correct answer from the options given below .

[NEET 2021]

Options:

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true but (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

Solution:

Solution:
Altitude sickness can be experienced at high altitude where body does not get enough oxygen due to low atmospheric pressure and causes nausea, fatigue and heart palpitations.
Hence correct option is (1) as [R] is correct explanation of [A].

Question13

Select the correct events that occur during inspiration.(i) Contraction of diaphragm
(ii) Contraction of external inter-costal muscles
(iii) Pulmonary volume decreases
(iv) Intra pulmonary pressure increases
[2020]

Options:

A. (iii) and (iv)

B. (i), (ii) and (iv)

C. Only (iv)

D. (i) and (ii)

Answer: D

Solution:

Solution:
(d) Inspiration is initiated by the contraction of diaphragm, which increases the volume of thoracic chamber in the anterio-posterior axis. 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.

Question14

Identify the wrong statement with reference totransport of oxygen. [2020]

Options:

A. Partial pressure of CO_2 can interfere with O_2 binding with haemoglobin

B. Higher H^+ conc. in alveoli favours the formation of oxyhaemoglobin

C. Low pC_{O2} in alveoli favours the formation of oxyhaemoglobin

D. Binding of oxygen with haemoglobin ismainly related to partial pressure of O_2

Answer: B

Solution:

Solution:
The correct option is (b) because higher H^+ concentration favours the dissociation of oxygen from oxyhaemoglobin in tissues. In the alveoli, high pO2, low pCO2, lesser H + concentration and lower temperature favour formation of oxyhaemoglobin.

Question15

Select the correct statement. [2019, Odisha]

Options:

A. Expiration is initiated due to contraction of diaphragm.

B. Expiration occurs due to external intercostal muscles.

C. Intrapulmonary pressure is lower than the atmospheric pressure during inspiration.

D. Inspiration occurs when atmospheric pressure is less than intrapulmonarypressure.

Answer: C

Solution:

Solution:
(c) During inspiration, diaphragm and external intercostal muscles contract causing increase in volume of thoracic cage. As a result intrapulmonary pressure decreases to a level less than atmospheric pressure, thus causing inspiration. Expiration is initiated due to relaxation of diaphragm.

Question16

The maximum volume of air a person can breathe in after a forced expiration is known as :
[2019, Odisha]

Options:

A. Total lung capacity

B. Expiratory capacity

C. Vital capacity

D. Inspiratory capacity

Answer: C

Solution:

Solution:
(c) Vital capacity is the maximum amount of air expired by a person after forceful inspiration or inspired after forceful expiration.
It represents the changes in volume from completely emptied lungs to completely filled lungs. It is about 4800 ml. The value varies according to age and body size.

Question17

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?
[2019]

Options:

A. 1500 mL

B. 1700 mL

C. 2200 mL

D. 2700 mL

Answer: A

Solution:

Solution:
(a) Expiratory capacity is the total volume of air that a person can expire after a normal inspiration. this includes tidal volume and expirtory reserve volume (TV + ERV).
Tidal volume of an athelete = 500 ml Expiratory reserve volume of an athelete
= 1000 ml Expiratory capacity = TV + ERV

= 500 + 1000
= 1500 ml

Question18

Due to increasing air-borne allergens and pollutants, many people in urban areas are suffering from respiratory disorder causing wheezing due to:
[2019]

Options:

A. benign growth on mucous lining of nasal cavity.

B. inflammation of bronchi and bronchioles.

C. proliferation of fibrous tissues and damage of the alveolar walls.

D. reduction in the secretion of surfactants by pneumocytes.

Answer: B

Solution:

Solution:
The respiratory disorders are caused by the small minute particles when they enter the bronchioles. When unwanted foreign particles enter the body's mechanism, they cause irritation and inflammation. This makes breathing tough and painful.

When there is difficulty inbreathing, the condition is called asthma. It causes wheezing due to the inflammation of bronchioles. The allergens and pollutants enter the nasal cavity and cause allergic reactions. Due to more pollution in the urban areas, respiratory disorders are more common there.
Option A: Benign growth on mucosa lining of the nasal cavity: This causes the sinonasal hemangiomas and paranasal sinuses. This occurs in the nasal cavity rather than the lungs.
Option B: Inflammation of bronchi and bronchioles: The entry of allergens and pollutants cause inflammation of bronchi and bronchioles. The allergic reaction causes inflammation.
Option C: Proliferation of fibrous tissues and damage of the alveolar walls: The alveoli are the extreme vessels in the lungs. The damage to them causes serious problems and the proliferation of fibrous tissues causes pulmonary fibrosis. This occurs usually due to tobacco smoke.
Option D: Reduction in the secretion of surfactants by pneumocytes: Pnuemocytes prevent collapsing of the alveoli by maintaining the surface tension, thus various surfactants are released for this purpose. If the surfactant secretion will decrease, the alveoli will collapse and expire.

Question19

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	B	C	D
(a)	iii	ii	i	iv
(b)	iii	i	iv	ii
(c)	iv	iii	ii	i
(d)	i	iv	ii	iii

(2018)

Options:

A. (a)

B. (b)

C. (c)

D. (d)

Answer: B

Solution:

(b) Tidal volume (TV) is volume of air inspired or expired during normal respiration.
It is approximately 500 mL. Inspiratory reserve volume (IRV) is additional volume of air a person can inspire by a forceful inspiration. It is around 2500 - 3000 mL. Expiratory reserve volume (ERV) is additional volume of air a person can be expired by a forceful expiration.
This averages 1000 - 1100 mL. Residual volume (RV) is volume of air remaining in lungs even after forceful expiration.
This averages 1100 - 1200 mL.

Question20

Which part of poppy plant is used to obtain the drug “Smack”? [2018]

Options:

A. Flowers

B. Latex

C. Leaves

D. Roots

Answer: B

Solution:

Solution:
(b) 'Smack' also called as brown sugar/Heroin is formed by acetylation of morphine. It is obtained from the latex of unripe capsule of Poppy plant (Papaver somniferum).

Question21

Which of the following is an occupational respiratory disorder? [2018]

Options:

A. Anthracis

B. Silicosis

C. Emphysema

D. Botulism

Answer: B

Solution:

Solution:
(b) Silicosis is an occupational disease caused due to excess inhalation of silica dust in the workers involved grinding or stone breaking industries.

Question22

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

Options:

A. inspiratory reserve volume

B. tidal volume

C. expiratory reserve volume

D. residual volume.

Answer: D

Solution:

Solution:
(d) : Residual volume is the volume of air which remains in the lungs after the most forceful expiration. This residual air enables the lungs to continue exchange of gases even after maximum exhalation. Due to this, lungs do not collapse even after forceful expiration.

Question23

The partial pressure of oxygen in the alveoli of the lungs is (NEET II 2016)

Options:

A. equal to that in the blood

B. more than that in the blood

C. less than that in the blood

D. less than that of carbon dioxide.

Answer: B

Solution:

Solution:
(b) : The partial pressure of oxygen in alveolar air is 104 mmHg whereas it is 40 mmHg in deoxygenated blood and 95 mmHg in oxygenated blood.

Question24

Lungs do not collapse between breaths and some air always remains in the lungs which can never be expelled because (NEET II 2016)

Options:

A. there is a negative pressure in the lungs

B. there is a negative intrapleural pressure pulling at the lung walls

C. there is a positive intrapleural pressure

D. pressure in the lungs is higher than the atmospheric pressure

Answer: B

Solution:

Solution:
(b) : Intrapleural pressure is the pressure of air within the pleural cavity. Intrapleural pressure is always negative, which acts like a suction to keep the lungs inflated and prevent them from collapsing. The negative intrapleural pressure is due to three main factors: surface tension of the alveolar fluid; elasticity of lungs; elasticity of thoracic wall. Normally, there is a difference between intrapleural and intrapulmonary pressure, which is called transpulmonary pressure. This transpulmonary pressure creates the suction to keep the lungs inflated. If there is no pressure difference, there is no suction and lungs will collapse.

Question25

Reduction in pH of blood will (NEET I 2016)

Options:

A. decrease the affinity of haemoglobin with oxygen

B. release bicarbonate ions by the liver

C. reduce the rate of heart beat

D. reduce the blood supply to the brain.

Answer: A

Solution:

Solution:
(a) : Reduction in pH of blood causes oxygen haemoglobin dissociation curve to shift to right which indicates dissociation of oxygen from haemoglobin. This decreases affinity of haemoglobin for oxygen.

Question26

Name the chronic respiratory disorder caused mainly by cigarette smoking. (NEET I 2016)

Options:

A. Respiratory acidosis

B. Respiratory alkalosis

C. Emphysema

D. Asthma

Answer: C

Solution:

Solution:
(c) : Emphysema is a chronic obstructive pulmonary disease (COPD) caused due to cigarette smoking. It is an inflation or abnormal distention of the bronchioles or alveolar sacs of the lungs which causes irreversible distension and loss of elasticity of alveoli of the lungs.

Question27

Asthma may be attributed to (NEET I 2016)

Options:

A. inflammation of the trachea

B. accumulation of fluid in the lungs

C. bacterial infection of the lungs

D. allergic reaction of the mast cells in the lungs

Answer: D

Solution:

Solution:
(d) : Asthma is an allergic condition in which the tissue surrounding the bronchioles of the lungs swell up and compress the bronchioles thus causing difficulty in breathing. This allergy mainly involves IgE antibodies and chemicals like histamine and serotonin from the mast cells.

Question28

Name the pulmonary disease in which alveolar surface area involved in gas exchange is drastically reduced due to damage in the alveolar walls. (2015)

Options:

A. Pneumonia

B. Asthma

C. Pleurisy

D. Emphysema

Answer: D

Solution:

Solution:
(d) : Emphysema is an inflation or abnormal distension of the bronchioles or alveolar sacs of the lungs. Many of the septa between the alveoli are destroyed and much of the elastic tissue of the lungs is replaced by connective tissue. As the alveolar septa collapse, the surface area for gas exchange is greatly reduced. There is loss of elasticity in the walls of bronchioles or alveolar sacs. As a result the alveolar sacs remain filled with air even after expiration. The exhalation becomes more difficult. The lungs remain inflated. Major causes of emphysema are cigarette smoking and the inhalation of smoke or other toxic substances over a period of time.

Question29

When you hold your breath, which of the following gas changes in blood would first lead to the urge to breathe?
(2015 Cancelled)

Options:

A. Falling CO_2 concentration

B. Rising CO_2 and falling O_2 concentration

C. Falling O_2 concentration

D. Rising CO_2 concentration

Answer: D

Solution:

Solution:
(d) : Excess CO_2 mainly stimulates the respiratory centre of the brain and increases the inspiratory and expiratory signals to the respiratory muscles. O_2 does not have a significant direct effect on the respiratory centre of the brain in controlling respiration.

Question30

Approximately seventy percent of carbondioxide absorbed by the blood will be transported to the lungs
(2014)

Options:

A. as bicarbonate ions

B. in the form of dissolved gas molecules

C. by binding to R.B.C

D. as carbamino - haemoglobin.

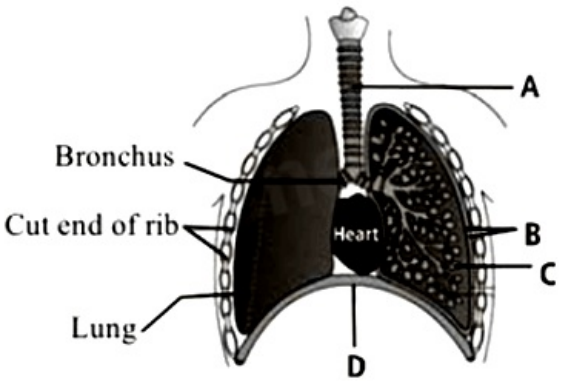
Answer: A

Solution:

Solution:
(a) : About 70% of CO_2 (about 2.5ml per 100 ml. of blood), received by blood from the tissues, enters the RBCs where it reacts with water to form carbonic acid (H_2CO_3) Carbonic anhydrase, exclusively found in RBCs speeds up the formation of H_2CO_3 and rapidly converts it back to carbon dioxide and water when blood reaches th lungs. Almost as rapidly as formed, all carbonic acid of RBCs dissociates into hydrogen (H^+) and bicarbonate ions (HCO_3^-)

Question31

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)



Options:

A. C - Alveoli - Thin walled vascular bag like structures for exchange of gases.

B. D - Lower end of lungs - Diaphragm pulls it down during inspiration.

C. A - Trachea - Long tube supported by complete cartilaginous rings for conducting inspired air.

D. B - Pleural membrane - Surround ribs on both sides to provide cushion against rubbing.

Answer: A

Solution:

Solution:
(a) : In the given figure A is trachea. It is supported by incomplete cartilaginous rings which prevent its collapse during inspiration. B is pleural membrane. It encloses lungs. C are alveoli. They are thin walled sacs having extensive network of

capillaries for gaseous exchange. D is diaphragm.

Question32

Which one of the following is the correct statement for respiration in humans?
(2012)

Options:

A. Cigarette smoking may lead to inflammation of bronchi.

B. Neural signals from pneumotoxic centre in pons region of brain can increase the duration of inspiration.

C. Workers in grinding and stone-breaking industries may suffer, from lung fibrosis.

D. About 90% of carbon dioxide (CO_2) is carried by haemoglobin as carbaminohaemoglobin

Answer: C

Solution:

Solution:
(c) : In certain industries, especially those involving grinding or stone breaking so much dust is produced that the defense mechanism of the body cannot fully cope with the situation. Long exposure can give rise to inflammation leading to fibrosis (proliferation of fibrous tissues) and thus causing serious lung damage. Workers in such industries should wear protective masks.

Question33

People who have migrated from the planes to an area adjoining Rohtang Pass about six months back
(2012)

Options:

A. have more RBCs and their haemoglobin has a lower binding affinity to O_2

B. are not physically fit to play games like football

C. suffer from altitude sickness with symptoms like nausea, fatigue, etc.

D. have the usual RBC count but their haemoglobin has very high binding affinity to O_2

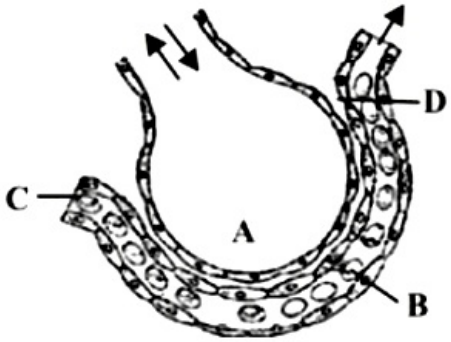
Answer: A

Solution:

(a) : Tourists visiting high altitude areas such as Rohtang Pass or Mansarovar, experience altitude sickness. Its symptoms include nausea, fatigue and heart palpitations. This is because in the low atmospheric pressure of high altitudes, the body does not get enough oxygen. But, gradually we get acclimatized and stop experiencing altitude sickness. The body compensates low oxygen availability by increasing red blood cell production, decreasing the binding affinity of haemoglobin and by increasing breathing rate.

Question34

The figure given below shows a small part of human lung where exchange of gases takes place. Select the option which represents labelled part (A, B, C or D) correctly identified along with its function.



(2011)

Options:

A. C: arterial capillary - passes oxygen to tissues

B. A : alveolar cavity - main site of exchange of respiratory gases

C. D : capillary wall - exchange of O_2 and CO_2 takes place here

D. B: red blood cells - transport of CO_2 mainly

Answer: B

Solution:

Solution:
(b) In the given figure the exchange of respiratory gases occurs in alveolar cavity. The thickness of the alveolar-capillary barrier varies from 0.2 to 2.5 µm. The wall of the capillary endothelial cell is fused to that of the alveolar cell with only a very thin basement membrane between these two cells. This produces a very narrow gap across which oxygen and carbon dioxide can rapidly diffuse

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Question35

A large proportion of oxygen remains unused in the human blood even after its uptake by the body tissues. This O_2

(2011)

Options:

A. acts as a reserve during muscular exercise

B. raises the pCO_2 of blood to 75mm of Hg.

C. is enough to keep oxyhaemoglobin saturation at 96%

D. helps in releasing more O_2 to the epithelial tissues

Answer: A

Solution:

Solution:
(a) A large portion of oxygen is left unused in the human blood even after its uptake by the body tissues. This O_2 acts as a reserve during muscular exercise.

Question36

Which one of the following is a possibility for most of us in regard to breathing, by making a conscious effort? (Mains 2011)

Options:

A. One can breathe out air totally without oxygen.

B. One can breathe out air through Eustachian tube by closing both nose and mouth.

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

D. The lungs can be made fully empty by forcefully breathing out all air from them

Answer: C

Solution:

Solution:
The process of breathing involves the pathway of the human respiratory system and includes the nasal cavities, oral cavities, pharynx, trachea, primary bronchi, secondary bronchi and lungs with bronchioles and alveoli present. Breathing is a 2-fold process which includes breathing in and breathing out. During this process, the diaphragm which is the dome-shaped sheet of muscle located below the lungs contracts and expands along with the intercostal muscles to force air in and out of the lungs. Since intercostal muscles are also involved in the process of respiration, deeper respiration results in the movement of ribs too. Hence most of us can consciously breathe in and breathe out by moving the diaphragm alone.

Question37

Bulk of carbon dioxide (CO_2) released from body tissues into the blood is present as (Mains 2011)

Options:

A. bicarbonate in blood plasma and RBCs

B. free CO_2 in blood plasma

C. 70% carbamino-haemoglobin and 30% as bicarbonate

D. carbamino-haemoglobin in RBCs

Answer: A

Solution:

Solution:
(a) : At the tissue site where partial pressure of CO_2 is high due to catabolism, CO_2 diffuses into blood (RBCs and plasma) and forms HCO_2^- and H^+. At the alveolar site where pCO_2 is low, the reaction proceeds in the opposite direction leading to the formation of CO_2 and H_2O. Thus, CO_2 trapped as bicarbonate at the tissue level and transported to the alveoli is released out as CO_2.

Question38

Listed below are four respiratory capacities (i − iv) and four jumbled respiratory volumes of a normal human adult.

	Respiratory capacities	Respiratory volumes
(i)	Residual volume	$2500mL$
(ii)	Vital capacity	$3500mL$
(iii)	Inspiratory reserve volume	$1200mL$
(iv)	Inspiratoy capacity	$4500mL$

Which one of the following is the correct matching of two capacities and volumes?
(2010)

Options:

A. (ii) 2500mL (iii) 4500mL

B. (iii) 1200mL (iv) 2500mL

C. (iv) 3500mL (i) 1200mL

D. (i) 4500mL (ii) 3500mL

Answer: C

Solution:

Respiratory capacities	Respiratory volumes
Residual volume	1200 mL
Vital capacity	4500 mL
Inspiratory reserve volume	2500 mL
Inspiratoy capacity	3500 mL

Question39

What is true about RBCs in humans? (2010)

Options:

A. They carry about $20-25$ percent of CO_2.

B. They transport 99.5 percent of O_2

C. They transport about 80 percent oxygen only and the rest 20 percent of it is transported in dissolved state in blood plasma.

D. They do not carry CO_2 at all.

Answer: A

Solution:

Solution:
(a) : Blood is the medium of transport for O_2 and CO_2. About 97 percent of O_2 is transported by RBCs in the blood. The remaining 3 percent of O_2 is carried in a dissolved state through the plasma. Nearly $20-25$ percent of CO_2 is transported by RBCs whereas 70 percent of it is carried as bicarbonate. About 7 percent of CO_2 is carried in a dissolved state through plasma.

Question40

What is vital capacity of our lungs? (2009)

Options:

A. Inspiratory reserve volume plus expiratory reserve volume

B. Total lung capacity minus residual volume

C. Inspiratory reserve volume plus tidal volume

D. Total lung capacity minus expiratory reserve volume

Answer: B

Solution:

Solution:
(b) : Vital capacity is the amount of air which one can inhale or exhale with maximum effort. It is the sum of tidal volume, inspiratory reserve volume and expiratory reserve volume, while total lung capacity is the total amount of air present in the lungs and the respiratory passage after a maximum inspiration. It is the sum of the vital capacity and the residual volume. TLC = VC + RV. So, vital capacity is also total lung capacity (TLC) - residual volume (RV).

Question41

The haemoglobin of a human foetus (2009)

Options:

A. has only 2 protein subunits instead of 4

B. has a higher affinity for oxygen that that of an adult

C. has a lower affinity for oxygen than that of the adult

D. its affinity for oxygen is the same as that of an adult.

Answer: B

Solution:

(b) : Oxygen is needed for aerobic respiration and diffuses from a region of high to low concentration from the mother's blood to the blood of the foetus. The haemoglobin of the foetus has a higher affinity for oxygen than that of adult haemoglobin and so the efficiency of exchange is increased. Carbon dioxide, a waste product of aerobic respiration diffuses in the opposite direction.

Question42

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

(2006)

Options:

A. attached to haemoglobin

B. dissolved in the blood

C. as bicarbonates

D. as carbonates.

Answer: C

Solution:

Solution:
(c) : When systemic arterial blood flows through capillaries, carbon dioxide diffuses from the tissues into the blood. Some carbon dioxide is dissolved in the blood. Some carbon dioxide reacts with haemoglobin to form carbaminohaemoglobin. The remaining carbon dioxide is converted to bicarbonate and hydrogen ions. Most carbon dioxide is transported through the blood in the form of bicarbonate ions.

Question43

Which one of the following statements is incorrect? (2006)

Options:

A. The principle of countercurrent flow facilitates efficient respiration in gills of fishes.

B. The residual air in lungs slightly decreases the efficiency of respiration in mammals.

C. The presence of non-respiratory air sacs, increases the efficiency of respiration in birds.

D. In insects, circulating body fluids serve to distribute oxygen to tissues.

Answer: D

Solution:

Solution:
(d) : The circulatory system of insects is open, whereby blood (haemolymph), flows freely through the body cavity (haemocoel). There is a dorsal vessel which is closed at the posterior end of the abdomen, and runs forward along the dorsal midline and opens in the head at the anterior portion (aorta). There are several chambers and openings (ostia), along the dorsal vessel where blood enters it through valves. The blood is then pumped forward to the aorta and into the body cavity.Blood contains: water - about 90%; inorganic ions - dissolved salts of Na, K, Ca Mg; organic molecules - amino acids, sugars for muscle use; blood cells. Haemolymph does not contain an oxygen carrying pigment like Hb, hence, does not assist in respiration.

Question44

People living at sea level have around 5 million RBC per cubic millimeter of their blood whereas those living at an altitude to 5400 metres have around 8 million. This is because at high altitude (2006)

Options:

A. people eat more nutritive food, therefore more RBCs are formed

B. people get pollution-free air to breath and more oxygen is available

C. atmospheric O_2 level is less and hence more RBCs are needed to absorb the required amount of O_2 to survive

D. there is more UV radiation which enhances RBC production.

Answer: C

Solution:

Solution:
(c) : At high altitudes composition of air remains almost same as at sea level, but density (barometric pressure) of air gradually decreases due to which arterial pO_2 is also decreased (hypoxemia). High altitudes presents with complex conditions to which human body has to acclimatize. Number of red blood cells per unit volume of blood is likely to be higher in a person living at high altitudes. This is in response to the air being less dense at high altitude. More number of red blood cells are needed to trap O_2, from rarefied air having low pO_2 (partial pressure of oxygen).

Question45

Blood analysis of a patient reveals an unusually high quantity of carboxyhaemoglobin content. Which of the following conclusions is most likely to be correct? The patient has been inhaling polluted air containing unusually high content of (2004)

Options:

A. carbon disulphide

B. chloroform

C. carbon dioxide

D. carbon monoxide.

Answer: D

Solution:

Solution:
(d) : Carboxyhaemoglobin, a stable compound, is formed when haemoglobin readily combines with carbon monoxide.

Carbon monoxide converts iron (II) to iron (III) in its reaction with haemoglobin. In this form haemoglobin does not carry oxygen resulting in its (oxygen) starvation and leads to asphyxiation and in extreme cases to death. The affinity of haemoglobin for CO is 250 times its affinity for O_2 and $COHb$ liberates CO very slowly and also due to that compound the dissociation curve of the remaining HbO_2, shifts to the left, decreasing the amount of O_2 released.

Question46

When CO_2 concentration in blood increases breathing becomes (2004)

Options:

A. shallower and slow

B. there is no effect on breathing

C. slow and deep

D. faster and deeper.

Answer: D

Solution:

Solution:
(d) : The effect of rising CO_2 tension is to decrease the affinity of Hb for O_2. Thus, when CO_2 concentration in blood increases, breathing becomes faster and deeper.

Question47

An average person not doing hard work requires energy per day about (1999)

Options:

A. 2000kcal

B. 1000kcal

C. 750kcal

D. 2800 kcal

Answer: D

Solution:

(d) : An average person, not doing hard labour i.e., leading a rather sedentary life, needs about 2800 kcal of energy per day. This is called routine metabolic rate (RMR).

Question48

Haemoglobin is a type of
(1999)

Options:

A. carbohydrate

B. respiratory pigment

C. vitamin

D. skin pigment

Answer: B

Solution:

Solution:
(b) : Haemoglobin (Hb) is a conjugated protein. It consists of a basic protein globin joined to a nonprotein group heme. Heme is an iron-porphyrin ring. A mammalian Hb molecule is a complex of 4 heme molecules joined with 4 globin molecules. It is present in RBC, and carries O_2 from the lungs to the tissues and transports CO_2 from the tissues to the lungs.

Question49

The respiratory centres, which control inspiration and expiration, are located in
(1999)

Options:

A. diencephalon

B. medulla oblongata

C. cerebellum

D. spinal cord

Answer: B

Solution:

Solution:
(b) : The respiratory centre is the medulla oblongata, that regulates the rate and depth of breathing. The dorsal group of neurons located in the dorsal portion of medulla oblongata regulates inspiration and ventral group of neurons located in the ventrolateral part of medulla oblongata regulates both inspiration and expiration.

Question50

The exchange of gases in the alveoli of the lungs takes place by (1998)

Options:

A. passive transport

B. active transport

C. osmosis

D. simple diffusion

Answer: D

Solution:

Solution:
(d) : Diffusion is the net flow of a substance from a region of higher concentration to a region of lower concentration. The exchange of gases between the alveoli and blood in the lung is the result of difference in partial pressure of respiratory gases. The partial pressure of oxygen (pO_2) of the alveolar air is higher than the pO_2 of blood in alveolar capillaries, thus O_2 diffuses rapidly from the alveolar air into the blood of alveolar capillaries. The pCO_2 of blood reaching the alveolar capillaries is higher than the pCO_2 of alveolar air. Therefore, CO_2 into the alveolar air.

Question51

The CO_2 content by volume, in the atmospheric air is about (1997)

Options:

A. 3.34%

B. 4%

C. 0.0314%

D. 0.34%

Answer: C

Solution:

Solution:
(c) : The atmosphere (air) is a mixture of several gases. Near the earth's surface it consists of 78% nitrogen, 21% oxygen, 0.93% argon, 0.03% carbon dioxide and small quantities of hydrogen, helium, neon, krypton and traces of many other gases.

Question52

In lungs, the air is separated from the venous blood through (1997)

Options:

A. transitional epithelium + tunica externa of blood vessel

B. squamous epithelium + endothelium of blood vessel

C. squamous epithelium + tunica media of blood vessel

D. none of the above

Answer: B

Solution:

Solution:
(b) : In lungs, the air is separated from the venous blood through squamous epithelium and endothelium of blood vessel. As a result, the barriers between the air in an alveolus and the blood in its capillaries is only about 0.5 mm

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Question53

Which vertebrate organ receives only oxygenated blood? (1996)

Options:

A. Spleen

B. Liver

C. Gill

D. Lung

Answer: A

Solution:

Solution:
(a) : Spleen receives only oxygenated blood from the heart through splenic artery. The liver receives a blood supply from two sources. The first is the hepatic artery which delivers oxygenated blood from the general circulation. The second is the hepatic portal vein delivering deoxygenated blood from the small intestine containing nutrients. The blood flows through the liver tissue to the hepatic cells where many metabolic functions take place. The blood drains out of the liver via the hepatic vein. Gill and Lung receive deoxygenated blood as these are the organs where oxygenation of blood takes place.

Question54

How the transport of O_2 and CO_2 by blood happens? (1996)

Options:

A. With the help of WBCs and blood serum

B. With the help of platelets and corpuscles

C. With the help of RBCs and blood plasma

D. With the help of RBCs and W BCs

Answer: C

Solution:

Solution:
(c) : The transport of O_2 and CO_2 occurs with the help of RBCs and blood plasma. 97% of O_2 is transported by RBCs and 3% of O_2 is carried by plasma. About 7% of CO_2 is transported in plasma and rest by RBCs(23%) by binding with Hb and 70% reacts with water to form carbonic acid in RBCs.

Question55

When 1500ml air is in the lungs, it is called (1996)

Options:

A. residual volume

B. inspiratory reserve volume

C. vital capacity

D. tidal volume

Answer: A

Solution:

Solution:
(a) : Residual volume is the amount of air that remains in the lungs after forcible expiration. It is about $1500ml$. It enables the lungs to continue exchange of gases even after maximum exhalation or holding the breath. Inspiratory reserve volume is the extra amount of air which can be inhaled forcibly after a normal inspiration. It is about 2000 to $2500ml$. Vital capacity is the amount of air which one can inhale and also exhale with maximum effort. It is about $3.5 - 4.5$ litres. Tidal volume ($500ml$) is the volume of air normally inspired or expired in one breath without any effort.

Question56

Lungs are enclosed in (1996)

Options:

A. periosteum

B. perichondrium

C. pericardium

D. pleural membrane

Answer: D

Solution:

Solution:
(d) : Each lung is enclosed in two membranes, the pleura. The inner membrane is called the visceral pleuron and the outer membrane is called parietal pleuron. A very narrow space exists between the two pleura. It is called the pleural cavity and contains a watery fluid called the pleural fluid that lubricates the pleura. Periosteum is the outer membrane of the bone.
Perichondrium is a layer that surrounds the cartilage and pericardium is the membrane that encloses the pericardial cavity, containing the vertebrate heart.

Question57

At high altitude, the RBCs in the human blood will (1995)

Options:

A. increase in number

B. decrease in number

C. increase in size

D. decrease in size

Answer: A

Solution:

Solution:
(a) : At high altitudes, arterial pO_2 decreases as density of air decreases. Number of RBCs per unit volume of blood is likely to be higher in a person living at high altitudes. More number of RBCs are needed to trap O_2 from air having less O_2.

Question58

Although much CO_2 is carried in blood, yet blood does not become acidic, because
(1995)

Options:

A. CO_2 is continuously diffused through the tissues and is not allowed to accumulate

B. in CO_2 transport, blood buffers play an important role

C. CO_2 is absorbed by the leucocytes

D. CO_2 combines with water to form H_2CO_3 which is neutralized by $NaCO_3$

Answer: B

Solution:

Solution:
(b) : Buffer is a solution that resists change in pH when an acid or alkali is added or when the solution is diluted. Acidic buffers consists of a weak acid with a salt of the acid. The salt provides the negative ion A, which is the conjugate base of the acid HA. An example is carbonic acid and sodium hydrogen carbonate in which molecules H_2CO_3 and ions HCO_3^- are present. About 70% of CO_2, released combines with water in the RBCs to form carbonic acid. Carbonic acid dissociates into bicarbonate and hydrogen ions. Addition of H^+ ions would make the blood acidic. However, most of the hydrogen ions are neutralized by combination with Hb, forming acid haemoglobin. This reduces the acidity of the blood and also releases additional O_2.

$HbO_2^- + H^+ \rightleftharpoons HHb + O_2$

Question59

The carbon dioxide is transported via blood to lungs mostly
(1995)

Options:

A. in combination with haemoglobin only

B. dissolved in blood plasma

C. in the form of bicarbonate ions

D. as carbaminohaemoglobin and as carbonic acid

Answer: C

Solution:

(c) : About 70% of CO_2 released diffuses into the plasma and then into the RBCs. Here, it combines with water to form carbonic acid. Carbonic acid dissociates into bicarbonate and hydrogen ions. Hydrogen ions are picked up by proteins and a small amount of bicarbonate ions is transported in the RBCs, whereas most of them diffuse into the plasma to be carried by it. About 7% of CO_2 is transported as dissolved in plasma and 23% of CO_2 combines with Hb to form carbaminohaemoglobin.

$$CO_2 + H_2O \underset{\text{anhydrase}}{\overset{\text{carbonic}}{\rightleftharpoons}} \underset{\text{carbonic acid}}{H_2CO_3}$$

$$H_2CO_3 \rightleftharpoons H^+ + \underset{\text{bicarbonate ion}}{HCO_3^-}$$

Question60

The ventilation movements of the lungs in mammals are governed by (1995)

Options:

A. muscular walls of lung

B. diaphragm

C. costal muscles

D. both (b) and (c)

Answer: D

Solution:

Solution:
(d) : The ventilation movements of the lungs in mammals are governed by diaphragm and intercostal muscles (between the ribs). The method is as follows:.

Question61

The respiratory centre which regulates respiration is located in (1994)

Options:

A. cerebellum

B. medulla oblongata

C. cerebral peduncle

D. the vagus nerve

Answer: B

Solution:

(b) : The respiratory centre is the medulla oblongata, that regulates the rate and depth of breathing. The dorsal group of neurons located in the dorsal portion of medulla oblongata regulates inspiration and ventral group of neurons located in the ventrolateral part of medulla oblongata regulates both inspiration and expiration.

Question62

Carbon dioxide is transported from tissues to respiratory surface by only (1993)

Options:

A. plasma and erythrocytes

B. plasma

C. erythrocytes

D. erythrocytes and leucocytes

Answer: A

Solution:

Solution:
(a) : Carbon dioxide is carried by the blood in three forms : physical solution, bicarbonate ions and carbamino-haemoglobin. A very small amount of carbon dioxide dissolves in the plasma and is carried as a physical solution. About 70% of carbon dioxide released by respiring tissue cells diffuses into the plasma and then into the red blood corpuscles. Here, CO_2 combines with water to form carbonic acid. Carbonic acid dissociates into bicarbonate and hydrogen ions.

Question63

The alveolar epithelium in the lung is (1990)

Options:

A. nonciliated columnar

B. nonciliated squamous

C. ciliated columnar

D. ciliated squamous

Answer: B

Solution:

(b) : In the lung, each alveolar duet opens into a blind chamber, the alveolar sac, or infundibulum. The latter consists of a central passage giving off several small pouches, the alyeoli, or air sacs on all sides.The air sacs give the infundibulum the appearance of a small bunch of grapes. The alveoli have a very thin (0.0001 mm thick) wall composed of simple moist, nonciliated, squamous epithelium. The number of alveoli is countless and their surface area enormous. This further accelerates the gaseous exchange in the alveoli.

Question64

Skin is an accessory organ of respiration in (1990)

Options:

A. humans

B. frog

C. rabbit

D. lizard

Answer: B

Solution:

(b) : In addition to lungs, skin is also an organ of respiration in frog. It is practically the only mode of respiration when the frog is under water or hibernating. Skin is richly supplied with blood and is permeable to gases. That is why frogs always stay near water to keep their skin moist. It is further kept moist by secretion of mucus from its glands, and does not become dry out of water.
