



BREATHING AND GAS EXCHANGE

BQ17Q384

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

NEET - 2015

- (A) Falling O_2 concentration
- ☒ (B) Rising CO_2 concentration
- (C) Falling CO_2 concentration
- (D) Rising CO_2 and falling O_2 concentration

• Respiratory centre is very less sensitive to O_2

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Ans [B]

When you hold your breath the ongoing accumulation of carbon dioxide in your cells, in your blood and lungs will eventually irritate and trigger impulses from the respiratory center part of your brain. Rising levels of carbon dioxide signal the body to breathe and ensure our unconscious and autonomous respiration.

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

NEET - 2017

- ☒ (A) Residual Volume (RV)
- (B) Inspiratory Reserve Volume (IRV)
- (C) Tidal Volume (TV)
- (D) Expiratory Reserve Volume (ERV)

vol. of air inspired
or expired
with each
normal breath

volume of air present in lungs even
after most forceful expiration

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Ans [A]

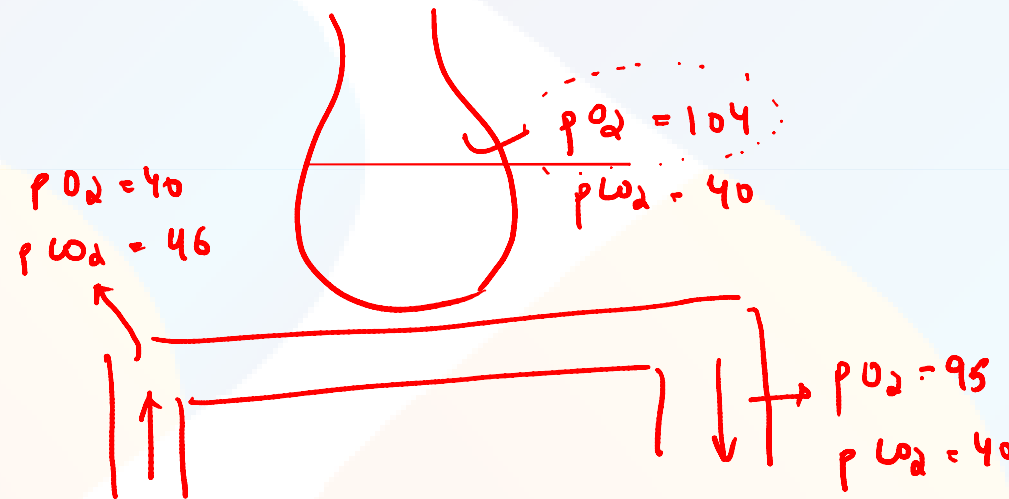
In lungs, even after the most forceful expiration, some of the volume of air remains. This volume is termed Residual Volume (RV). Due to this, lungs do not collapse even after the most forceful expiration. RV is about 1100 mL to 1200 mL.

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The partial pressure of oxygen in the alveoli of the lungs is

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- (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



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Ans [B]

The partial pressure of oxygen (pO_2) in alveoli of lungs is 104 mm Hg, which is more than that of blood in the blood capillaries of lung alveoli (40 mm Hg). This difference allows passive diffusion of O_2 from air filled in the lungs to the blood vessels of lung alveoli.

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Reduction in pH of blood will

- (A) Reduce the blood supply to the brain
- ☒ (B) Decrease the affinity of hemoglobin with oxygen
- (C) Release bicarbonate ions by the liver
- (D) Reduce the rate of heart beat

→ High H^+ concentration → dissociation of oxyhaemoglobin

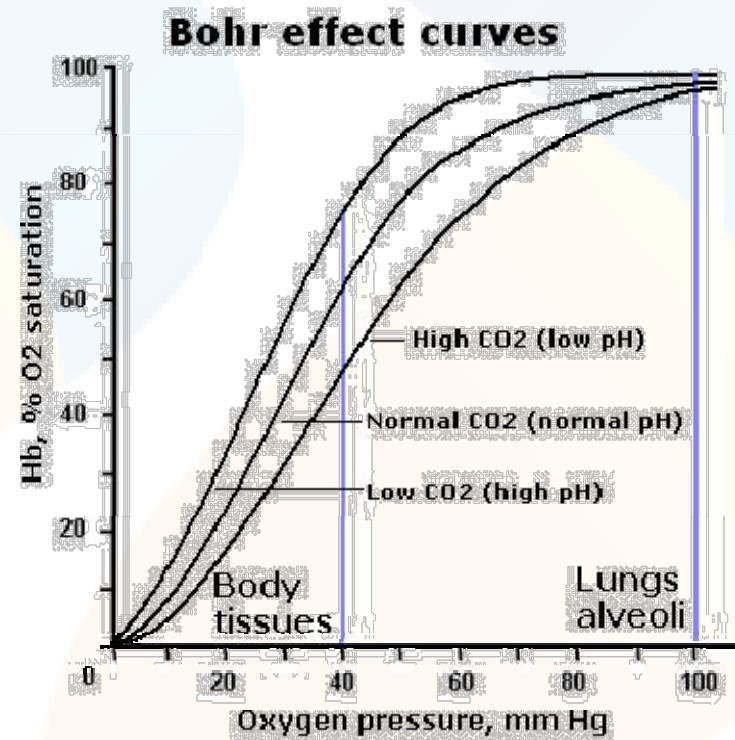
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↓
affinity between Hb & O_2 is reduced

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Ans [B]

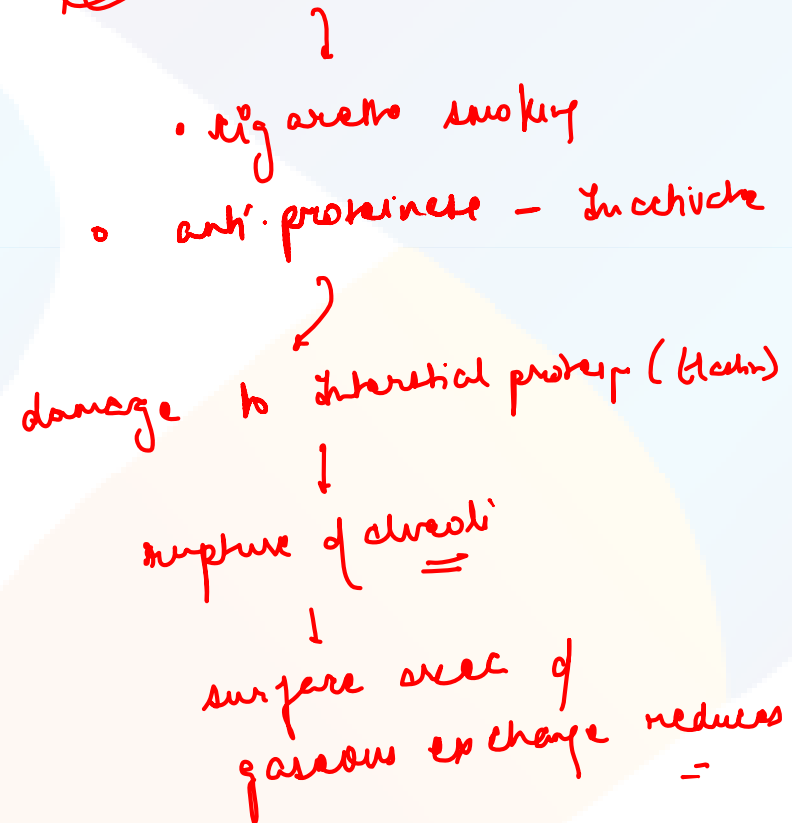
Reduction in pH of blood i.e., increase in acidity favours the dissociation of oxyhemoglobin thereby giving up more O_2 . When this phenomenon occurs due to increase in CO_2 concentration then it is called Bohr effect.



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Name the chronic respiratory disorder caused mainly by cigarette smoking **NEET - 2016**

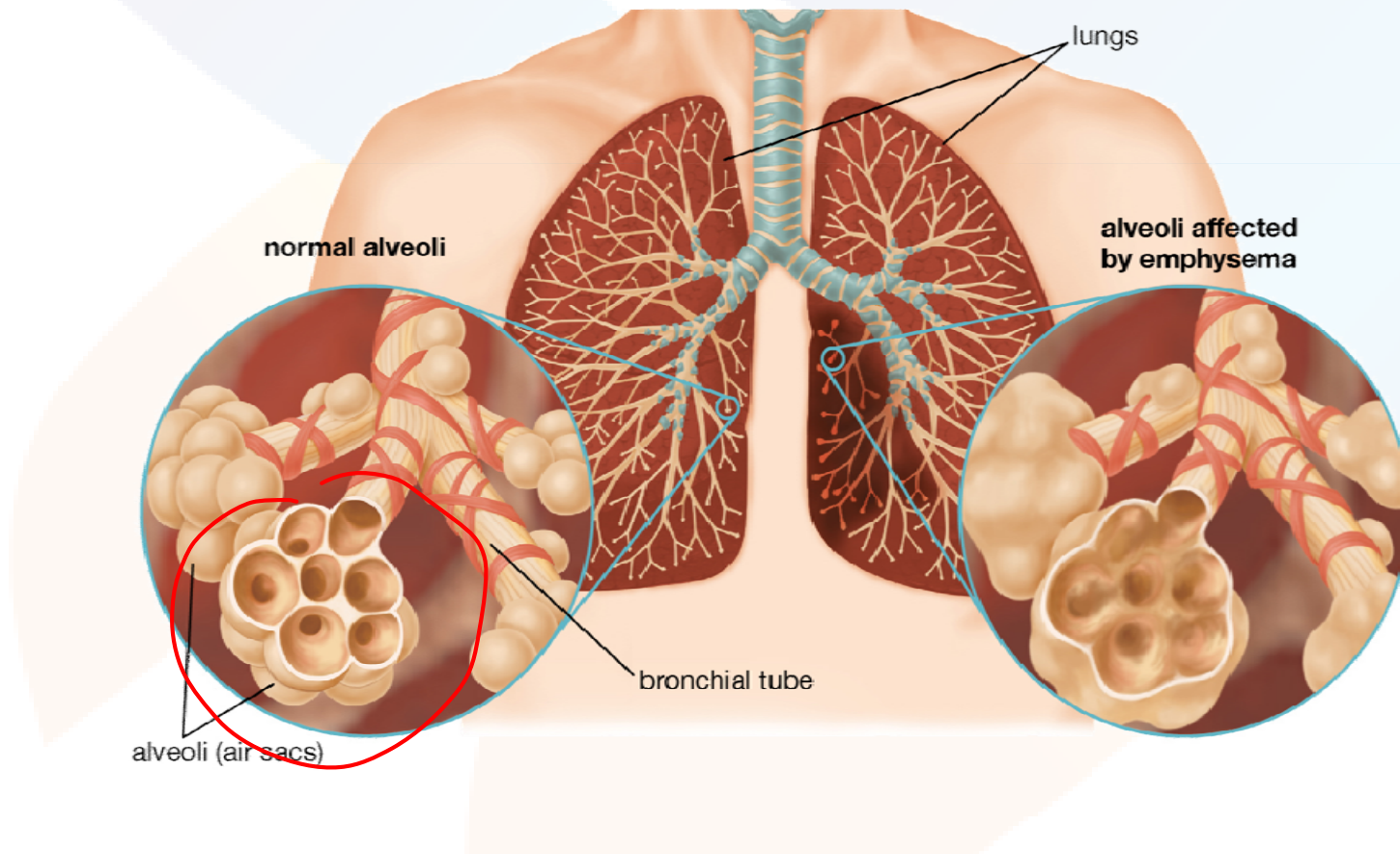
- (A) Asthma
(B) Respiratory acidosis
(C) Respiratory alkalosis
(D) Emphysema



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Ans [D]

Emphysema is characterised by inflation or distension of alveoli by dissolution of wall of the two adjacent lung alveoli. It generally occurs due to chronic cigarette smoking.



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

(A) Pleurisy

(B) Pneumonia

~~(C)~~ Emphysema

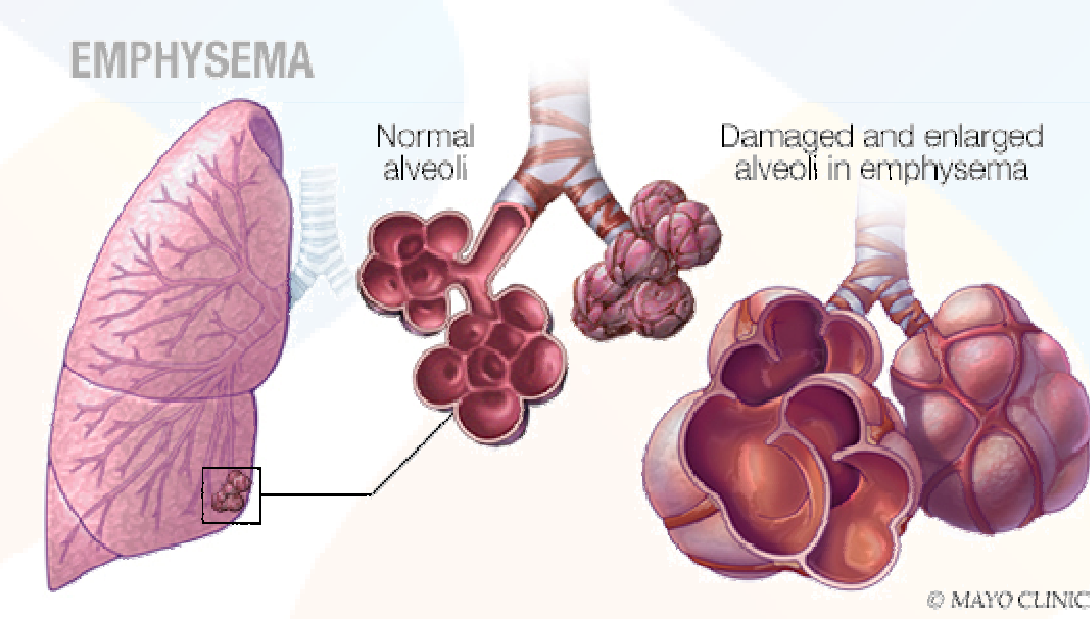
(D) Asthma

?

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Ans [C]

Emphysema is a chronic respiratory disease where there is over-inflation of the air sacs (alveoli) in the lung, causing a decrease in lung function and often, breathlessness. In this disease, the alveolar walls are damaged leading to drastic reduction in gas exchange.



BQ17Q391

Approximately seventy percent of carbon dioxide absorbed by the blood will be transported to the lungs

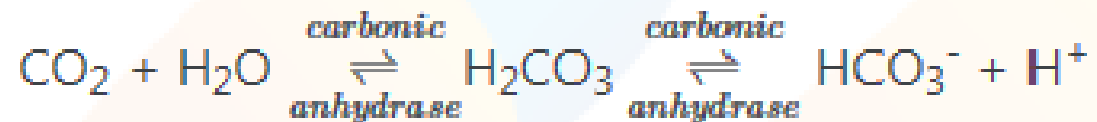
NEET - 2014

- ~~(A)~~ As bicarbonate ions
- (B) In the form of dissolved gas molecules
- (C) By binding to RBC
- (D) As carbamino-haemoglobin (20-25%)

BQ17S391

Ans [A]

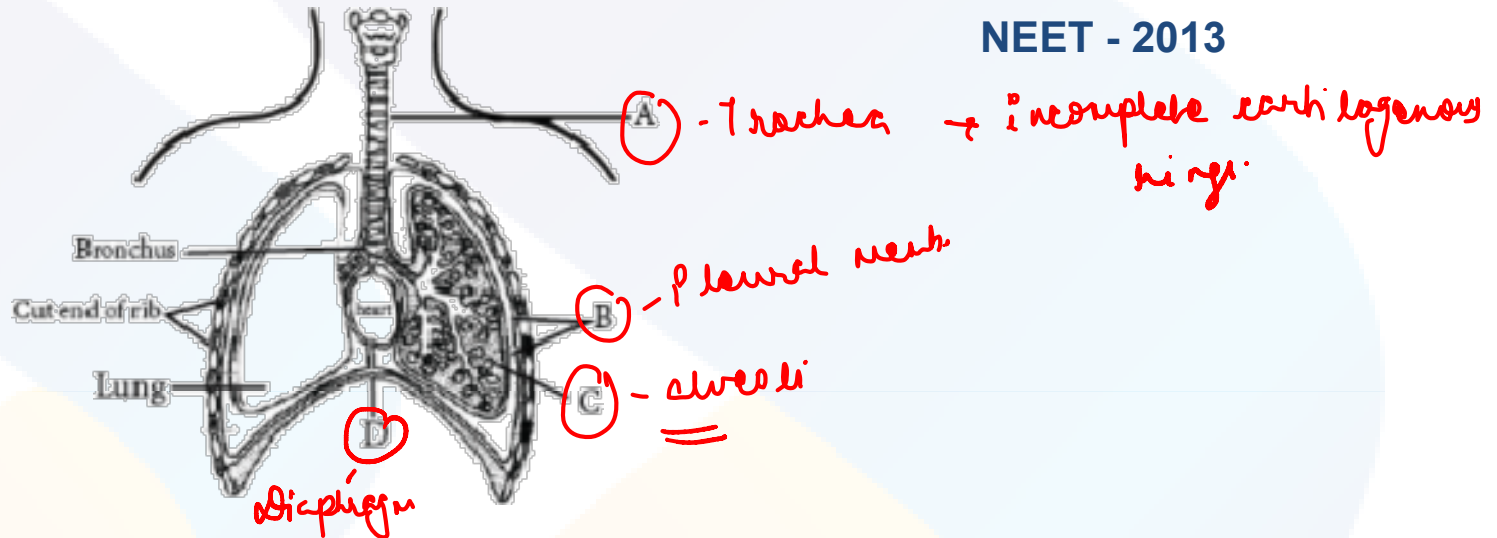
Q.
Because of its high solubility, about 7% of carbon dioxide gets dissolved in the blood plasma and is carried to the wings in the same way. The largest fraction of carbon dioxide, i.e. (about 70%) is converted to bicarbonates (HCO₃) and transported in the plasma.
About (-23% of CO₂ is carried by haemoglobin as carbominohaemoglobin
CO₂ + Hb (haemoglobin) HbCO₃ (carboamino haemoglobin)



BQ17Q392

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



- (A) A-trachea-long tube supported by complete cartilaginous rings for conducting inspired air ~~x~~
- (B) B-pleural membrane-surround ribs on both sides to provide cushion against rubbing ~~x~~
- ~~A~~ (C) C-alveoli-thin walled vascular bag-like structures for exchange of gases
- (D) D-lower end of lungs-diaphragm pulls it down during inspiration ~~x~~

BQ17S392

Ans [C]

C-Alveoli are thin-walled vascular bag-like structures for exchange of gases.

A-trachea or wind pipe is an air conducting tube through, which transport of gases takes place.

B-pleural membrane is double layered, which reduces friction on the lung surface.

D-diaphragm is involved in the inspiration and expiration process of breathing.

BQ17Q393

Which one of the following is the correct statement for respiration in humans? **NEET - 2012**

- (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 (CO₂) is carried by haemoglobin as carbamino haemoglobin ✗

BQ17S393

~~Ans~~ [C]

Irritating gases, fumes, dusts, etc., present in the work place result in lung disorders. Pneumoconiosis is a condition of permanent deposition of particulate matter in the lungs. Tissue reaction to these irritating substances causes proliferation of fibrous connective tissue called fibrosis.

It is common in flour mill workers, iron mill workers, coalminers, stone grinders, etc. A strong pneumotoxic signal from pons varoli reduces the inspiration duration to only 0.5 second while weak signal may prolong the inspiration duration to five seconds.

BQ17Q394

People who have migrated from the plains to an area adjoining Rohtang Pass about six months back

NEET - 2012

- (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 ✗

BQ17S394

Ans [A]

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.

BQ17Q396

What is true about RBCs in humans?

NEET - 2010

- (A) They carry about 20-25 per cent of CO₂
- (B) They transport 99.5 per cent of O₂ ✗
- (C) They transport about 80 per cent oxygen only and the rest 20 per cent of it is transported in dissolved state in blood plasma ✗
- (D) They do not carry CO₂ at all ✗

97.1% - oxyHb

3% - plasma

BQ17S396

Ans [A]

Nearly 20-25 per cent of CO_2 is transported by RBCs. It is caused by haemoglobin as carbamino haemoglobin. 70 per cent of CO_2 is carried as bicarbonates.

About 97 per cent of O_2 is transported by RBCs in the blood. The remaining 3 per cent of O_2 is carried in dissolved state through the plasma.

BQ17Q397

Which two of the following changes (1-4) usually tend to occur in the plain **NEET - 2010** dwellers when they move to high altitudes (3,500 m or more)?

- (1) Increase in red blood cell size
 - (2) Increase in red blood cell production ✓
 - (3) Increased breathing rate ✓
 - (4) Increase in thrombocyte count ✓
- Changes occurring are

☒ (A) (2) and (3)

(B) (3) and (4)

(C) (1) and (4)

(D) (1) and (2)

BQ17S397

Ans [A]

When a person moves to higher altitudes, the PO₂ and total atmospheric pressure decrease. Hypoxia stimulates the JG-cells of the kidney to release erythropoietin hormone, which stimulates erythropoiesis in bone marrow causing polycythemia. Hypoxia will also increase breathing rate. Initially the size of RBCs will also increase but with increase in number of RBCs, the size of RBCs becomes normal.

BQ17Q398

What is vital capacity of our lungs?

NEET - 2008

- (A) Inspiratory reserve volume plus tidal volume ✗
- (B) Total lung capacity minus expiratory reserve volume ✗
- (C) Inspiratory reserve volume plus expiratory reserve volume ✗
- ☒ (D) Total lung capacity minus residual volume

$$\text{vital capacity} = \text{TV} + \text{IRV} + \text{ERV}$$

$$\text{ TLC} = \text{VC} + \text{RV}$$

BQ17S398

Ans [D]

Vital capacity is the sum of inspiratory reserve volume, tidal volume and expiratory reserve volume. It is about 4800 mL.

BQ17Q399

The haemoglobin of a human foetus

NEET - 2008

- (A) Has a lower affinity for oxygen than that of the adult
- (B) Its affinity for oxygen is the same as that of an adult
- (C) Has only 2 protein subunits instead of 4
- ☒ (D) Has a higher affinity for oxygen than that of an adult

— =

BQ17S399

Ans [D]

Haemoglobin is the protein that makes red blood corpuscles red and binds easily and reversibly with oxygen. Hemoglobin is made up of protein globin bound to the red haem pigment. The globin consists of four polypeptide chains-2 alpha and 2 beta. Foetal haemoglobin does not sickle even in those destined to have sickle cell anaemia, i.e, haemoglobin of foetus has higher affinity of oxygen than that an adult.

BQ17Q400

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:

NEET - 2006

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

BQ17S400

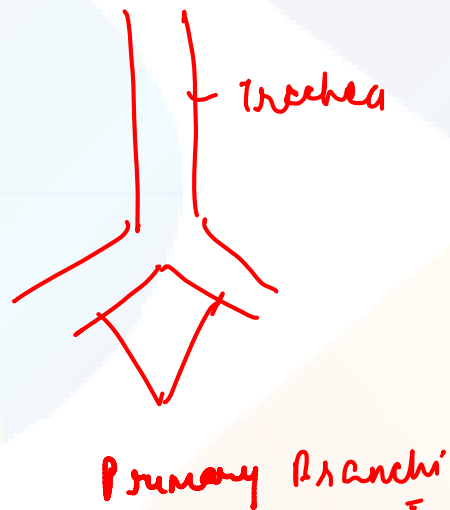
Ans [B]

At high altitudes, the atmospheric O_2 level is less and hence, more RBCs are needed to absorb the required amount of O_2 to survive. That is why, the people living at sea level have around 5 million RBC/mm³ of their blood whereas those living at an altitude of 5400 meters have around 8 million RBC/mm³ of their blood.

Which one of the following has the smallest diameter

[NCERT; Kerala CET 2003]

- (a) Right primary bronchus (b) Left primary bronchus
(c) Trachea (d) Respiratory bronchiole



Arrange the following in the order of increasing volume

(1) Tidal volume =

(2) Residual volume = ~~1100-1200~~

(3) Expiratory reserve volume 1000-1100

(4) Vital capacity

[NCERT; AIIMS 2007]

(a) $1 < 2 < 3 < 4$

☒ (b) $1 < 3 < 2 < 4$

(c) $1 < 4 < 3 < 2$ ✓

(d) $1 < 4 < 2 < 3$ ✓

Match the items in Column – I with Column – II and choose the correct option

Column – I		Column – II	
A.	Tidal volume	1.	2500 to 3000 ml of air
B.	Inspiratory reserve volume	2.	1000 ml of air
C.	Expiratory reserve volume	3.	500 ml of air
D.	Residual volume	4.	3400 to 4800 ml of air
E.	Vital capacity	5.	1200 ml of air

[NCERT; CBSE PMT 1996; Pb PMT 2004;
Kerala PMT 2007; AFMC 2012]

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

(b) A – 3, B – 1, C – 2, D – 5, E – 4

(c) A – 3, B – 1, C – 4, D – 5, E – 4 ✗

(d) A – 5, B – 4, C – 2, D – 1, E – 2 ✗

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

Ans : B



Oxy-haemoglobin dissociates into oxygen and deoxy-haemoglobin at **[DPMT 1992; MP PMT 1995; JIPMER 2002]**

- ☒ (a) Low O_2 pressure in tissue
- (b) High O_2 pressure in tissue
- (c) Equal O_2 pressure inside and outside tissue
- (d) All times irrespective of O_2 pressure

If concentration of CO_2 is more the curve of oxygen will shift towards **[MP PMT 2002]**

Or

Increase in body temperature makes oxygen haemoglobin dissociation curve shift to **[BHU 2012]**

- ☒ (a) Right (b) Left
(c) Central (d) None of these

low PO_2
high PCO_2
high H^+
high temp

} → dissociation of oxy_h

Choose the right sequential phenomena among the following during the delivery of O_2 from blood to tissue

- ✓ P. Absorption of CO_2 by the blood ✓
- ✓ Q. Reaction of absorbed CO_2 with H_2O to form H_2CO_3 within RBC and its conversion into H^+ and HCO_3^- ions ✓
- R. Reaction of absorbed CO_2 with H_2O in plasma to form H_2CO_3 and its conversion into H^+ and HCO_3^- ions ✗
- ✓ S. Combination of H^+ with haem portion of HbO_2 to release O_2 ✓
- T. Combination of HCO_3^- with haem portion HbO_2 to form reduced haemoglobin and release of O_2 ✗

[WB JEE 2012]

(a) P, Q, T

(b) P, R, S

✓ (c) P, Q, S

(d) P, R, T

And : C



The major fraction of CO_2 released during cellular respiration is transported by the blood to the lung capillaries

[NCERT; CPMT 1998; MP PMT 1998, 2002;
AIEEE Pharmacy 2003; Odisha JEE 2010]

Or

Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs

[CBSE PMT 2014]

- (a) In combination with haemoglobin
- (b) As free CO_2
- (c) As carbonic acid or H_2CO_3
- ☒ (d) In the form of bicarbonate ions

Chloride shift occurs in response to

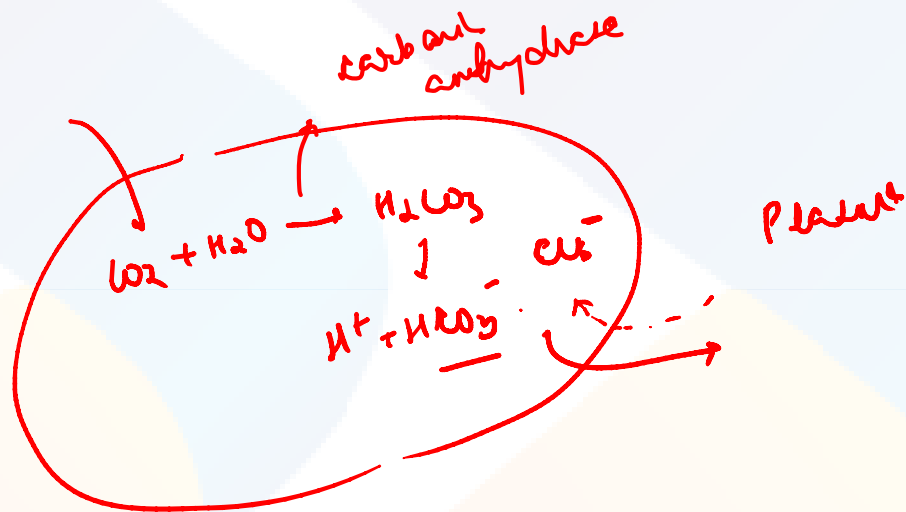
or Hamburger shift

(a) H^+

(b) K^+

~~(c) HCO_3^-~~

(d) Na^+



Identify the correct statement with reference to transport of respiratory gases by blood [KCET 2006]

- (a) Haemoglobin is necessary for transport of carbon dioxide and carbonic anhydrase for transport of oxygen
- ✓ (b) Haemoglobin is necessary for transport of oxygen and carbonic anhydrase for transport of carbon dioxide
- (c) Only oxygen is transported by blood ✗
- (d) Only carbon dioxide is transported by blood ✗

Under a given concentration in blood, dissociation of oxyhaemoglobin will increase if

- (a) pH of blood falls
- (b) pH of blood rises
- (c) CO_2 concentration in blood falls
- (d) Free fatty acid concentration in blood falls

↳ Low PO_2
high PO_2
high H^+

Oxygen binding to haemoglobin in blood is [AIIMS 2012]

- (a) Directly proportional to the concentration of CO_2 in the medium
- ☒ (b) Inversely proportional to the concentration of CO_2 in the medium
- (c) Directly proportional to the concentration of CO in the medium x
- (d) Independent of the concentration of CO in the medium x

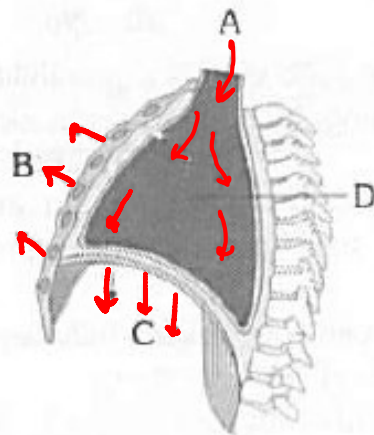
high PCO_2 \rightarrow disproportion of oxy Hb
=

The process by which chloride ions pass into R.B.C. and bicarbonate ions pass out is called

[DPMT 1992; RPMT 1999; Kerala CET 2003]

- (a) Bicarbonate shift
- (b) ☒ Chloride shift
- (c) Buffer system
- (d) Enzyme shift

Following diagram indicates the mechanism of breathing. Identify all the parts A, B, C and D correctly [NCERT]



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