

DPP - Daily Practice Problems

Chapter-wise Sheets

Date :

Start Time :

End Time :

BIOLOGY

CB17

SYLLABUS : Breathing and Exchange of Gases

Max. Marks : 180

Marking Scheme : + 4 for correct & (-1) for incorrect

Time : 60 min.

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQs. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

- Bulk of carbon dioxide (CO_2) released from body tissues into the blood is present as
 - bicarbonate in blood plasma and RBCs
 - free CO_2 in blood plasma
 - 70% carbamino- haemoglobin and 30% as bicarbonate
 - carbamino-haemoglobin in RBCs
- A large proportion 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
 - raise the pCO_2 of blood to 75 mm of Hg.
 - is enough to keep oxyhaemoglobin saturation at 96%
 - helps in releasing more O_2 to the epithelial tissues.
- Oxygen dissociation curve of haemoglobin is
 - Sigmoid
 - Hyperbolic
 - Linear
 - Hypobolic
- Which one of the following organs in the human body is most affected due to shortage of oxygen?
 - Intestine
 - Skin
 - Kidney
 - Brain
- When CO_2 concentration in blood increases, breathing becomes
 - shallower and slow
 - there is no effect on breathing
 - slow and deep
 - faster and deeper
- Although much CO_2 is carried in blood, yet blood does not become acidic, because
 - it is absorbed by the leucocytes
 - blood buffers play an important role in CO_2 transport.
 - it combines with water to form carbonic acid (H_2CO_3) which is neutralized by Na_2CO_3 .
 - it is continuously diffused through tissues and is not allowed to accumulate.
- Which one of the following is the correct statement for respiration in humans?
 - Workers in grinding and stone-breaking industries may suffer from lung fibrosis.
 - About 90% of carbon dioxide (CO_2) is carried by haemoglobin as carbaminohaemoglobin.
 - Cigarette smoking may lead to inflammation of bronchi.
 - Neural signals from pneumotoxic centre in pons region of brain can increase the duration of inspiration.
- The largest quantity of air that can be expired after a maximal inspiratory effort is called
 - residual volume
 - tidal volume
 - vital capacity
 - total lung volume

**RESPONSE
GRID**

1. (a)(b)(c)(d)
6. (a)(b)(c)(d)

2. (a)(b)(c)(d)
7. (a)(b)(c)(d)

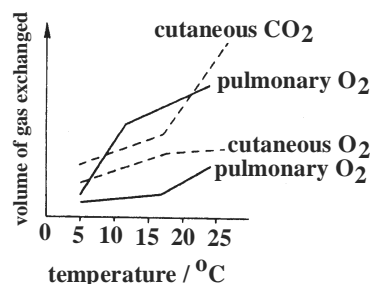
3. (a)(b)(c)(d)
8. (a)(b)(c)(d)

4. (a)(b)(c)(d)

5. (a)(b)(c)(d)

Space for Rough Work

9. Which one of the following statements is incorrect ?
 (a) The presence of non-respiratory air sacs, increases the efficiency of respiration in birds.
 (b) In insects, circulating body fluids serve to distribute oxygen to tissues.
 (c) The principle of countercurrent flow facilitates efficient respiration in gills of fishes.
 (d) The residual air in lungs slightly decreases the efficiency of respiration in mammals.
10. During oxygen transport the oxyhaemoglobin at the tissue level liberates oxygen to the cells because in tissue
 (a) O_2 concentration is high and CO_2 is low
 (b) O_2 concentration is low and CO_2 is high
 (c) O_2 tension is high and CO_2 tension is low
 (d) O_2 tension is low and CO_2 tension is high
11. Emphysema develops mainly because of
 (a) Allergy or hypersensitisation
 (b) Spasm of the smooth muscles of bronchioles
 (c) Cigarette smoking
 (d) Inflammation of the alveoli
12. During inspiration the diaphragm
 (a) relaxes to become dome-shaped
 (b) contracts and flattens
 (c) expands
 (d) shows no change
13. The volume of air breathed in and out during normal breathing is called
 (a) Vital capacity
 (b) Inspiratory reserve volume
 (c) Expiratory reserve volume
 (d) Tidal volume
14. What would happen if human blood becomes acidic (low pH)
 (a) Oxygen carrying capacity of haemoglobin increases
 (b) Oxygen carrying capacity of haemoglobin decreases
 (c) RBCs count increases
 (d) RBCs count decreases
15. The respiratory centre, which regulates respiration, is located in
 (a) Cerebral peduncle (b) Vagus nerve
 (c) Pons (d) Medulla oblongata
16. Even when there is no air in it, human trachea does not collapse due to presence of
 (a) Bony rings (b) Turgid pressure
 (c) Chitinous rings (d) Cartilaginous rings
17. The structure which does not contribute to the breathing movements in mammals is
 (a) Larynx (b) Ribs
 (c) Diaphragm (d) Intercostal muscles
18. In emphysema –
 (a) Gas exchange area of lungs is reduced
 (b) Gas exchange area of lungs is increased
 (c) Trachea gets narrowed
 (d) Larynx is permanently closed
19. Which of the following changes occur in diaphragm and intercostal muscles when expiration of air takes place?
 (a) External intercostal muscles relax and diaphragm contracts
 (b) External intercostal muscles contract and diaphragm relaxes
 (c) External intercostal muscles and diaphragm relax
 (d) External intercostal muscles and diaphragm contract
20. The graph below shows how gaseous exchange in an amphibian varies with temperature.



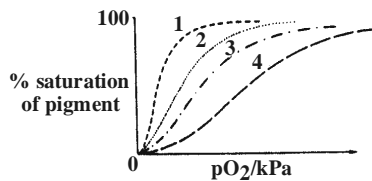
The graph shows that at all temperatures the lungs :

- (a) absorb more oxygen than the skin
 (b) absorb less oxygen than the skin
 (c) release more carbon dioxide than the skin
 (d) release less carbon dioxide than the skin
21. Which statement explains the significance of myoglobin in muscle tissue?
 (a) Myoglobin can associate with oxygen in conditions of high carbon dioxide tension
 (b) Myoglobin can dissociate from oxygen most readily under aerobic conditions
 (c) Myoglobin acts as an oxygen store delaying the onset of anaerobic respiration
 (d) Myoglobin acts as a buffer to hydrogen ions produced during anaerobic respiration
22. When you exhale, the diaphragm
 (a) relaxes and arches.
 (b) relaxes and flattens.
 (c) contracts and arches.
 (d) contracts and flattens.
23. Smoking destroys the cilia in the respiratory passageways. This
 (a) makes it harder to move air in and out of the lungs.
 (b) decreases the surface area for respiration.
 (c) slows blood flow through lung blood vessels.
 (d) makes it harder to keep the lungs clean.

RESPONSE GRID

9. (a)(b)(c)(d)	10. (a)(b)(c)(d)	11. (a)(b)(c)(d)	12. (a)(b)(c)(d)	13. (a)(b)(c)(d)
14. (a)(b)(c)(d)	15. (a)(b)(c)(d)	16. (a)(b)(c)(d)	17. (a)(b)(c)(d)	18. (a)(b)(c)(d)
19. (a)(b)(c)(d)	20. (a)(b)(c)(d)	21. (a)(b)(c)(d)	22. (a)(b)(c)(d)	23. (a)(b)(c)(d)

24. The graph shows dissociation curves for four respiratory pigments.



Which combination identifies the four curve?

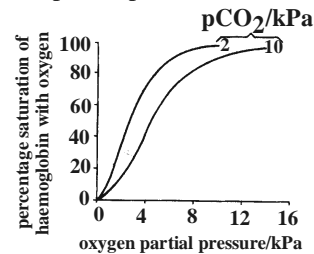
	adult haemoglobin with high CO_2	adult haemoglobin	myoglobin	foetal haemoglobin
(a)	1	2	3	4
(b)	2	1	4	3
(c)	3	2	1	4
(d)	3	4	2	1

25. Gas flows into the lungs of mammals during inspiration because
- The pressure in the lungs falls below atmospheric pressure.
 - The volume of the lungs decreases.
 - The pressure in the lungs rises above atmospheric pressure.
 - The diaphragm moves upward toward the lungs.
26. The Bohr shift describes
- The outward movement of Cl^- from the blood cell in exchange for HCO_3^- moving into the cell.
 - The leftward shift of the entire oxygen equilibrium curve when temperature rises.
 - The rightward shift of the entire oxygen equilibrium curve when pH rises.
 - The rightward shift of the entire oxygen equilibrium curve when pH falls.
27. The movement of O_2 and CO_2 between the blood in the tissue capillaries and the cells in tissues depends most directly upon
- active transport of O_2 and CO_2 .
 - total atmospheric (barometric) pressure differences across the cell membranes.
 - diffusion of O_2 and CO_2 down a concentration gradient.
 - diffusion of O_2 and CO_2 down a partial pressure gradient.
28. The function of the mucus elevator in the mammalian respiratory system is to
- move surfactant from the bronchi to the alveoli.
 - produce negative pressure during inhalation.
 - stimulate contraction of rib musculature during forcible exhalation.
 - trap and remove particulate matter that has entered the respiratory system.

29. The oxygen-binding curve for myoglobin is steep and shifted to the left of the same curve for hemoglobin. This indicates that

- people with myoglobin are acclimated for life at high altitudes.
- myoglobin occurs in high concentration in the human foetus.
- myoglobin does not function well at high percent saturation of oxygen.
- myoglobin picks up and releases O_2 at lower Po_2 values than does haemoglobin.

30. The graph shows haemoglobin-oxygen dissociation curves at two different partial pressures of carbon dioxide



What is the advantage to the organism of the difference between the curve?

- CO_2 is readily released into the alveoli
 - Haemoglobin removes more CO_2 from active tissues
 - Haemoglobin can release oxygen to myoglobin
 - Oxygen is readily released into active tissues
31. A person can hold his breath longer if he gradually exhales than if he keeps his lungs fully expanded. This phenomenon is due to the fact that :
- concentration of CO_2 in the blood decreases, lessening the excitatory input to the carotid bodies
 - he is then using less O_2 as his thoracic muscles are not working as hard
 - stretch receptors in his lungs are then not firing as much thus lessening the excitatory input to the expiratory centres
 - he is preventing the pressure in his lungs from increasing too much
32. The alveoli contain specialized cells that secrete a phospholipoprotein complex known as pulmonary surfactant. The function of pulmonary surfactant is :
- to provide some rigidity to the alveoli to prevent lung collapse
 - to decrease the surface tension of the alveoli, making it easier to expand them
 - to facilitate the diffusion of O_2 and CO_2 by providing protein channels through which these gases flow
 - to provide a sticky surface upon which dust and microbes are trapped and disposed of.

RESPONSE
GRID

24. (a)(b)(c)(d)
29. (a)(b)(c)(d)

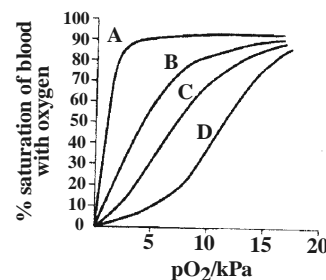
25. (a)(b)(c)(d)
30. (a)(b)(c)(d)

26. (a)(b)(c)(d)
31. (a)(b)(c)(d)

27. (a)(b)(c)(d)
32. (a)(b)(c)(d)

28. (a)(b)(c)(d)

33. During inspiration, the air is brought into the lungs by the working of the thoracoabdominal pump whereby the :
 (a) diaphragm contracts to lengthen the thoracic cavity
 (b) chest muscles pull the ribs up and out to widen the thoracic cavity
 (c) abdominal muscles relax
 (d) all of the above
34. The binding of an O_2 atom to the first iron atom of a haemoglobin molecule
 (a) occurs at a very low partial pressure of oxygen
 (b) produces a conformational change that lowers the other subunits' affinity for oxygen
 (c) is an example of cooperativity as O_2 readily binds to the other subunits.
 (d) occurs more readily at a lower pH value.
35. What is the function of the cilia in the trachea and bronchi?
 (a) movement of air into and out of the lungs
 (b) increase the surface area for gas exchange
 (c) filter the air that rushes through them
 (d) sweep mucus with its trapped particles up and out of the respiratory tract
36. A shift in the O_2 binding capacity of hemoglobin as a function of pH is known as
 (a) oxygen binding
 (b) the Hering-Breuer reflex
 (c) the Bohr effect.
 (d) respiratory ventilation
37. The most important function of diaphragm is
 (a) To divide body cavity into compartments
 (b) To protect lungs
 (c) To aid in digestion
 (d) To aid in ventilation
38. Which is not a structure of the respiratory system ?
 (a) the pharynx (b) the bronchus
 (c) the larynx (d) the hyoid
39. The alveoli of the lungs do not contain "air" because
 (a) we normally do not ventilate our lungs at a high enough rate.
 (b) the lungs have too many alveoli to ventilate.
 (c) there is "dead space" in the trachea and bronchi.
 (d) the trachea and bronchi are too small in volume.
40. Which of the following is not a reason that breathing air is easier than breathing water?
 (a) A given volume of air is easier to move across the respiratory organs than the same volume of water.
 (b) Air holds more oxygen per unit volume than water.
 (c) Water breathers have a difficult time ridding themselves of CO_2 because CO_2 does not dissolve well in water.
 (d) Temperature increases affect the O_2 content of water more than they do that of air.
41. Which of the following represents a larger volume of air than is normally found in the resting tidal volume of a human lung ?
 (a) Residual volume
 (b) Inspiratory reserve volume
 (c) Expiratory reserve volume
 (d) All of the above
42. The graph shows four dissociation curves.



Which curve represents the oxygen dissociation curve for myoglobin?

- (a) At A (b) At B (c) At C (d) At D
43. Functional residual capacity can be represented as
 (a) $TV + ERV$ (b) $ERV + RV$
 (c) $RV + IRV$ (d) $ERV + TV + IRV$
44. The process of migration of chloride ions from plasma to RBC and carbonate ions from RBC to plasma is
 (a) chloride shift (b) ionic shift
 (c) atomic shift (d) Na^+ pump
45. The quantity 1500 ml in the respiratory volumes of a normal human adult refers to
 (a) maximum air that can be breathed in and breathed out
 (b) residual volume
 (c) expiratory reserve volume
 (d) total lung capacity

**RESPONSE
GRID**

33. (a)(b)(c)(d) 34. (a)(b)(c)(d) 35. (a)(b)(c)(d) 36. (a)(b)(c)(d) 37. (a)(b)(c)(d)
 38. (a)(b)(c)(d) 39. (a)(b)(c)(d) 40. (a)(b)(c)(d) 41. (a)(b)(c)(d) 42. (a)(b)(c)(d)
 43. (a)(b)(c)(d) 44. (a)(b)(c)(d) 45. (a)(b)(c)(d)

Space for Rough Work

DAILY PRACTICE PROBLEM DPP CHAPTERWISE 17 - BIOLOGY

Total Questions	45	Total Marks	180
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	50	Qualifying Score	65
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

HINTS & SOLUTIONS

DPP/CB17

1. (a) 70% to 75% CO_2 is transported as primary buffer of the blood bicarbonate ion (HCO_3^-) in blood plasma. When CO_2 diffuses from tissues into blood then it is acted upon by the enzyme carbonic anhydrase.
2. (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.
3. (a) It is the relationship between the percentage saturation of haemoglobin (by volume) in the blood and the oxygen tension (in partial tension) pO_2 of the blood.
It is usually a sigmoid plot. Haemoglobin molecules can bind up to four oxygen molecules in a reversible way. The shape of the curve results from the interaction of bound oxygen molecules with incoming molecules. The binding of the first molecule is difficult. However, this facilitates the binding of the second and third molecules, and it is only when the fourth molecule is to be bound that the difficulty increases, partly as a result of crowding of the haemoglobin molecule, partly as a natural tendency of oxygen to dissociate.
4. (d) Brain is the most vital organ. It stops functioning in the absence of O_2 .
5. (d) When the CO_2 concentration in blood increases, breathing becomes faster and deeper. As CO_2 levels increase, patients exhibit a reduction in overall level of consciousness as well as respiratory effort. Severe increase in CO_2 levels can lead to respiratory arrest.
6. (c) CO_2 enters RBC and reacts with water to form carbonic acid. Carbonic acid dissociates to form bicarbonate and hydrogen ions. Some bicarbonate ions are transported in erythrocytes while some diffuse into the blood plasma. Exit of bicarbonate ions change the ionic balance between the plasma and erythrocytes. To restore this balance chloride ions diffuse from plasma into erythrocytes. Due to this, the pH of blood is maintained.
7. (a)
8. (c) 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 is called vital capacity (VC). This includes tidal volume, inspiratory reserve volume and expiratory reserve volume. ($\text{TV} + \text{IRV} + \text{ERV}$). VC varies from 3400 ml – 4800 mL, depending upon age, sex and height of the individual.
9. (b)
10. (d)
11. (c) Emphysema is lung condition that causes shortness of breath due to damage of air sacs in the lungs (alveoli). The main cause of emphysema is a long-term exposure to air-borne irritants including tobacco smoke, air pollution, dust.
12. (b)
13. (d)
14. (b)
15. (d)
16. (d)
17. (a)
18. (a)
19. (c) When the external intercostal muscles and diaphragm relax, the ribs move downward and inward and diaphragm becomes convex (dome shaped), thus decreasing the volume of thoracic cavity and increasing the pressure inside as compared to the atmospheric pressure outside. This will cause the air to move out (expiration).
20. (d) Pulmonary, CO_2 is found to be lower than cutaneous O_2 at all temperatures. Statement A is a wrong answer. This is because at 5°C , pulmonary O_2 is lower than cutaneous O_2 , although as the temperature increases, the reverse becomes true.
21. (c) Myoglobin has an affinity for oxygen. It is present in the muscles. As oxygen levels reduce, myoglobin would release the stored oxygen to keep the muscles working.
22. (a) This decreases the size of the thoracic cavity, which increases the pressure within the thoracic cavity, forcing air out of the lungs.
23. (d) Debris normally gets trapped in mucus lining the respiratory passage ways. This mucus is then swept up and away from the lungs by the action of cilia.
24. (d) Myoglobin has the greatest affinity for oxygen and does not unload the oxygen until very low partial pressures of oxygen (below 20 mmHg). Foetal haemoglobin has a higher affinity for oxygen than adult haemoglobin, thus facilitating the transfer of oxygen from maternal haemoglobin to fetal, haemoglobin at the placenta. When respiration is occurring a fast rate, more oxygen is needed. High levels of respiration are associated with high levels of carbon dioxide, hence the affinity of haemoglobin for oxygen decreases at higher carbon dioxide partial pressures so that oxygen can be released to respiring tissues.
25. (a) Inspiration in the mammalian lung occurs by means of negative pressure produced by contraction of the diaphragm. Thus, the pressure in the lungs falls below atmospheric pressure.
26. (d) The Bohr effect describes the action of pH on the oxygen-binding curve. Decreases in pH result in a net right shift of the entire oxygen equilibrium curve.
27. (d) Movement of O_2 and CO_2 from the blood to the tissues always occurs by diffusion of O_2 and CO_2 down their partial pressure gradients.
28. (d) This mechanism serves a very important cleansing role for the mammalian respiratory system.
29. (d) A left shift in the oxygen-binding curve means that the pigment operates at lower PO_2 values.
30. (d) Actively respiring tissues require more oxygen. They are also associated with high partial pressures of carbon dioxide since it is a product of respiration. The curves show that oxygen would be more readily released at higher partial pressures of carbon dioxide, i.e. at active tissues.
31. (c) When the chest expands, stretch receptors in the lungs reflexly excite the expiratory center in the medulla which tends to produce expiration. Partial exhalation lessens the intensity of this reflex, allowing breath to be held for a longer time. Exhalation does not change the blood CO_2 concentration unless fresh air (low in CO_2) is brought into the lungs, allowing more CO_2 to diffuse out of the blood.
32. (b) Thin layer of water on the inner surface of alveoli serves to contract the alveoli and makes them behave like unfilled balloons that resist inflation. This would mean tremendous effort to inhale and expand the alveoli and therefore to overcome this, cells of the alveoli secrete pulmonary surfactant to decrease the surface tension of water lining the alveoli.

33. (d) Gas is brought into the lungs when the negative pressure exists between the lungs and the rest of the chest. This negative intrapleural pressure is aided to occur by all the choices mentioned.
34. (c)
35. (d)
36. (c) Changes in pH due to the accumulation of acidic metabolites resulting from increased cell activity are the basis of the Bohr effect.
37. (d)
38. (d) The hyoid is a bone of the skeletal system that supports the larynx and tongue.
39. (c) The alveoli do not contain "air" with 20.9% O₂ because incoming air is mixed with air left in the "dead space" of the trachea and bronchi that has had some of the O₂ removed by the lungs.
40. (c) Water breathing is more difficult than air breathing because the higher density of water makes it more expensive to move across the respiratory surfaces than air, it has less oxygen than air, and the oxygen content is very dependent on the temperature of the water. CO₂ however, dissolves easily into water and is easy to get rid of.
41. (d) All of the listed choices have larger volume than the resting tidal volume.
42. (a) Myoglobin has only one haem group and there can be no co-operative binding, hence the shape of the dissociation curve is hyperbolic rather than sigmoidal. Also, myoglobin has a very high affinity for oxygen and does not release oxygen until a very low oxygen tension.
43. (b)
44. (a) During the transport of CO₂ through the blood, bicarbonate ions diffuse out of RBCs while chloride ions from plasma enter the RBCs to maintain ionic equilibrium. This is called chloride shift.
45. (b) The total volume of air that can be expelled from the lungs after maximum inspiration and then expiring to the maximum is known as the vital capacity. The volume of air that remains inside lungs at the end of maximum forceful expiration is the residual volume. Expiratory reserve volume is the maximum extra volume of air that can be expired by forceful expiration after a normal tidal expiration. Total lung capacity is the maximum volume of air that can be contained in the lungs after maximum inspiration.