Progress Check

Page: 137

1. **Given below is the definition of respiration with a few blanks to be filled in. Write suitable words in the blanks:**
   Respiration is a process of releasing _____ by breaking down _____ for carrying out _____ processes.
   Solution:
   Energy, glucose, life.

2. **Write the overall chemical equation representing the above definition of respiration.**
   Solution:
   The chemical equation is as follows:

   $$C_6H_{12}O_6 + 6\ O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy}$$

3. **In what form is the energy liberated in respiration?**
   Solution:
   A large part of the energy liberated is in the form of ATP (adenosine triphosphate).

4. **Give two examples of life activities which need energy.**
   Solution:
   We need energy because:
   - We require to synthesize proteins from amino acids
   - Production of new cells and enzymes
   - To keep the body warm

Progress Check

Page: 137

1. **State whether the following statementsare true(T) or false(F):**
   - **(i)** **Strenuous physical exercise may cause fatigue due to accumulation of CO_2 in the blood. T/F**
   - **(ii)** **No CO_2 is produced in anaerobic respiration in the human body. T/F**
   - **(iii)** **Breathing and gaseoustransport are and the same thing. T/F**
   - **(iv)** **CO_2 is transported to the lungs by the blood in two forms: as bicarbonates and as carbamino-haemoglobin. T/F**
   - **(v)** **Tissue respiration means chemical changesoccurring inside the cell. T/F**

   Solution:

   (i) The statement is false. Strenuous physical exercise may cause fatigue due to accumulation of lactic acid in the blood.

   (ii) The statement is true.

   (iii) The statement is false. Breathing and gaseous transport are two separate processes.

   (iv) The statement is true.

   (v) The statement is true.

Progress Check

Page: 144

1. Match the items in Column I with those in Column II.

Column I	Column I
A. Nasal chamber	**(i) Production of voice**
B. Epiglottis	**(ii) C-shaped rings**
C. Air-sacs	**(iii) Warms air**
D. Lungs	**(iv) Drives mucus**
E. Larynx	**(v) Closes wind-pipe during swallowing**
F. Trachea	**(vi) Network of capillaries**
G. Cilia	**(vii) Spongy and elastic**

Solution:

Column I	Column I
A. Nasal chamber	Warms air
B. Epiglottis	Closes wind-pipe during swallowing
C. Air-sacs	Network of capillaries
D. Lungs	Spongy and elastic
E. Larynx	Production of voice
F. Trachea	C-shaped rings
G. Cilia	Drives mucus

2. How do the following contribute in inspiration during breathing?
(i) Ribs (ii) Diaphragm

Solution:

The following is the contribution of these structures during breathing:
(i) Ribs – they move upwards and outwards
(ii) Diaphragm – contracts and flattens downwards

3. Match the lung capacities in Column I with the quantities given in Column II.

Column I	Column II
A. Residual air	**4500 mL**
B. Vital capacity	**6000 mL**
C. Total lung capacity	**1500 mL**
D. Dead air space	**150 mL**

Solution:

Column I	Column II
A. Residual air	1500 mL
B. Vital capacity	4500 mL
C. Total lung capacity	6000 mL
D. Dead air space	150 mL

Progress Check

1. Mention any two points of difference in the quality of inspired and expired air.

Solution:

Listed below are the differences:

Inspired air	Expired air
Amount of oxygen absorbed at the alveolar surface is 20.96%	Amount of oxygen absorbed at the surface is 16.4%
Amount of carbon dioxide released at the alveolar surface is 0.04%	Amount of carbon dioxide released at alveolar surface is 4%

2. Give reasons for:

(i) People climbing to high altitudes may suffer from dizziness and unsteady vision.

(ii) Use of lime water in most experiments on respiration

(iii) Respiration rate is higher in animals than in plants.

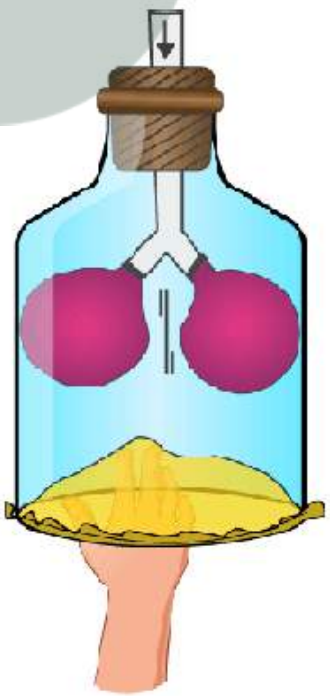
Solution:

(i) As we go up higher, the air we breathe decreases in pressure along with a gradual decrease in oxygen content. Lack of oxygen leads to dizziness and unsteady vision.

(ii) Lime water is used in most of the experiments on respiration as lime water turns milky in the presence of carbon dioxide.

3. Given alongside is an experiment intended to demonstrate the action of diaphragm, but something has gone wrong.

(i) What is the mistake in the diagram? Explain.



Solution:

(i) The mistake in the diagram is that when the sheet is pushed upwards, the volume of the rubber balloons inside the bell jar does not increase as shown in the diagram, instead it decreases. The pressure increases and the balloons should collapse as the air rushes out. The balloon represents the two lungs.

Review Questions

Page: 147

A. Multiple Choice Type

1. During inspiration, the diaphragm
(a) Relaxes
(b) Contracts
(c) Expands
(d) Gets folded
Solution:
(b) Contracts
The diaphragm contracts and flattens downwards during inspiration.

2. The ultimate end parts of the respiratory system in humans is known as
(a) Alveoli
(b) Bronchioles
(c) Tracheoles
(d) Bronchi
Solution:
(a) Alveoli
The bronchioles ultimately end in a cluster of tiny air chambers known as air sacs or alveoli.

3. During respiration there is
(a) Gain in dry weight
(b) Loss in dry weight
(c) No change in dry weight
(d) Increase in the overall weight
Solution:
(b) Loss in dry weight.
Respiration causes loss in dry weight.

B. Very short answer type

1. Choose the odd one out in each of the following groups of four items each:
(a) Trachea, Bronchus, Alveolus, Diaphragm
(b) Ethyl alcohol, Carbon dioxide, Starch, Oxygen absence
(c) Diffusion, Respiratory gases, Alveoli, Capillary network
(d) Trachea, ciliated epithelium, mucus, diffusion
(e) Oxyhaemoglobin, carbaminohaemoglobin, Hypoxia, Carboxyheamoglobin
(f) Hairy, Moist, Nostril, Vocal cord
Solution:
(a) Diaphragm
(b) Ethyl alcohol
(c) Diffusion

(d) Diffusion
(e) Hypoxia
(f) Vocal cord

2. Name the body structure concerned with the given functional activity:
(a) Prevents food from entering the trachea during swallowing
(b) Transports oxygen to the body cells
(c) Helps to increase the volume of the chest activity lengthwise
(d) Combines with the oxygen in the lungs
(e) Protects the lungs from mechanical injuries
(f) Provides actual diffusion of respiratory gases in lungs.

Solution:
(a) Prevents food from entering the trachea during swallowing - Epiglottis
(b) Transports oxygen to the body cells - Capillaries
(c) Helps to increase the volume of the chest activity lengthwise - Diaphragm
(d) Combines with the oxygen in the lungs - Bronchioles
(e) Protects the lungs from mechanical injuries - Ribs
(f) Provides actual diffusion of respiratory gases in lungs – Air sacs/alveoli

3. What is the normal percentage composition of gases in inspired air and expired air respectively?

Solution:
The following table depicts the gas composition in percentage:

Name of the gas	Inspiration	Expiration
Oxygen	20.96%	16.4%
Carbon dioxide	0.04%	4%
Nitrogen	79.00%	79.6%

4. Which chemical compound inside a cell can be termed "Currency of Energy".

Solution:
ATP – adenosine triphosphate

5. Match the items in Column I with the ones most appropriate in Column II. Rewrite the matching pairs:

Column I	Column II
(a) Alveoli	(i) where aerobic respiration takes place
(b) Bronchioles	(ii) Lined with hair
(c) Nasal chamber	(iii) Diffusion of gases
(d) Bronchi	(iv) small air tubes
	(v) An inverted Y-shaped tube
	(vi) A common passage for food and air

Solution:

Column I	Column II
(a) Alveoli	Diffusion of gases
(b) Bronchioles	small air tubes
(c) Nasal chamber	Lined with hair
(d) Bronchi	An inverted Y-shaped tube

C. Short Answer Type

1. Given below is an example of a certain structure and its special functional activity:
"Kidney and excretion"
Fill in the blanks on a similar pattern.
(a) Alveoli and _____
(b) Mitochondria and _____
(c) Epiglottis and _____
(d) Pleura and _____
(e) Diaphragm and _____
(f) „C" shaped cartilage rings and _____

Solution:
(a) Alveoli and gaseous diffusion
(b) Mitochondria and power house
(c) Epiglottis and Trachea(guard of entrance)
(d) Pleura and Lung covering
(e) Diaphragm and Distinguishes abdominal cavity and thoracic cavity
(f) 'C' shaped cartilage rings and support

2. State one function of each of the following:
(a) Ciliated epithelium lining the respiratory tract
(b) Mitochondria
(c) Diaphragm
(d) Intercostal muscles
(e) Pleural fluid

Solution:
(a) Ciliated epithelium lining the respiratory tract – it forms the protective inner thing of the respiratory passage and assists in motion, driving any fluid that is on them
(b) Mitochondria – In the presence of oxygen, pyruvic acid is disintegrated step wise in a cyclic manner.
(c) Diaphragm – It causes the enlargement of the chest cavity in length.
(d) Intercostal muscles – it facilitates the downward and upward rib movement causing the enlargement of the chest cavity all around.
(e) Pleural fluid – It renders lubrication for free movement of the contracting and expanding lungs.

3. Match the items in Column A with those in Column B.

Column A	Column B
Cartilaginous	Epiglottis
Large surface area	Diaphragm
Breathing movements	Bronchi
Voice	Alveoli
Complemented air	larynx
Swallowing	Extra inhalation

Solution:

Column A	Column B
Cartilaginous	Bronchi
Large surface area	Alveoli
Breathing movements	Diaphragm
Voice	Larynx
Complemented air	Extra inhalation
Swallowing	Epiglottis

4. Under what conditions would the breathing rate increase?

Solution:

Breathing rate can increase under the following circumstances:

- Accumulation of carbon dioxide in blood
- Vigorous physical exercise

5. How would you prove that the air you breathe out is warmer?

Solution:

The air that we breathe out is warmer or as per the temperature of the body as it can be felt when breathing out the air on your hands. We can feel the warmth of the air that is exhaled during breathing.

6. How is the respiratory passage kept free of dust particles?

Solution:

The respiratory passage is kept free of dust particles as the nasal cavity is lined by ciliated epithelium and mucous glands which secretes mucus. This ciliated epithelium is present through the lining of the trachea, larynx, bronchioles and bronchi. The constant motion of mucous and cilia traps micro-organisms, dust, pollen and other tiny particles existing in the air.

7. What is wrong in the statement "We breathe in oxygen and breathe out carbon dioxide"?

Solution:

The statement is wrong. The air we inhale has more of oxygen and less of carbon dioxide. The air we exhale has higher concentration of carbon dioxide and lesser concentration of oxygen.

D. Long Answer Type

1. Differentiate between the following pairs on the basis of the aspect given in the brackets.
(a) Aerobic and anaerobic respiration (end products of the process)
(b) Respiration and photosynthesis (gas released)
(c) Photosynthesis and respiration (reactants)
(d) Inspired air and alveolar air (carbon dioxide content)
(e) Respiration and breathing (organs involved)
(f) Tidal volume and residual volume (quantity of air)

Solution:

(a) Aerobic and anaerobic respiration (end products of the process)

Aerobic respiration	Anaerobic respiration
Carbon dioxide, water, ATP, Heat energy	Lactic acid, ATP, heat energy

(b) Respiration and photosynthesis (gas released)

Respiration	Photosynthesis
Carbon dioxide	Oxygen

(c) Photosynthesis and respiration (reactants)

Photosynthesis	Respiration
Water, carbon dioxide, sunlight	Glucose (with/without oxygen)

(d) Inspired air and alveolar air (carbon dioxide content)

Inspired air	Alveolar air
0.04%	4%

(e) Respiration and breathing(organs involved)

Respiration	Breathing
Lungs, bronchi, alveoli	Nasal cavity, trachea, diaphragm

(f) Tidal volume and residual volume (quantity of air)

Tidal volume	Residual volume
500mL	1500mL

2. Give suitable explanations for the following:
(a) Breathing through the nose is said to be healthier than through the mouth.
(b) Why does gaseous exchange continue in the lungs even during expiration?
(c) Why does a person feel breathlessness at higher altitudes?
(d) Why do you shiver and why do your teeth chatter when it is very cold in winter?

Solution:

(a) It is because the hair in the nostrils checks and prevents the large/tiny dust particles from entering the respiratory system.

(b) It is because expiration is the outcome of reverse movements of the diaphragms and ribs. As a result of the movements of the diaphragm and the ribs, the thoracic cavity shrinks and the lungs compress causing the air to be forced out of the body into the environment.

(c) A person feels breathlessness at higher altitudes because as we go up higher, the content of oxygen is lower in the air.

(d) We shiver and our teeth chatter when it is very cold in order to increase the heat production in the body. To maintain the temperature of the body constant in extremely cold conditions, the production of heat is increased through heightened metabolic rate and greater muscular activity and shivering and teeth chattering involves a lot of muscular activity.

3. With regard to the respiratory system and the process of respiration in man, answer the following questions:

(a) Name any two muscles that help in breathing.

(b) Briefly describe how the above mentioned muscles help in the inspiration of air.

(c) Give the overall chemical equation to represent the process of respiration in humans.

(d) What is meant by:

1. Residual air 2. Dead air space

Solution:

(a) The two muscles that help in breathing are: intercostal muscles and abdominal muscles

(b) When the intercostal muscles stretch between the ribs, they move outwards and inwards causing them to enlarge the chest cavity.

(c) The overall chemical equation for the process of respiration in humans is as given below:

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 38ATP + 420Kcal$$

(d) 1. Residual Air – Even after forcibly breathing out, some air always remains in the lungs. This air is referred to as residual air. The volume of this air is 1500mL.

2. Dead air space – Some tidal air is remaining in the respiratory passages such as bronchi and trachea. Here no gas diffusion takes place. This volume is referred to as dead air space and its volume is 150mL.

4. Starting from the nostrils, trace the path in sequence which the transpired air takes until it reaches the air sacs.

Solution:

The path taken by the transpired air through the nostrils until it reaches the air sacs is as follows:

Nose → Pharynx → Larynx → Trachea → Bronchi

5. What are the functions of the following in breathing?

(a) Ribs

(b) Diaphragm
(c) Abdominal muscles

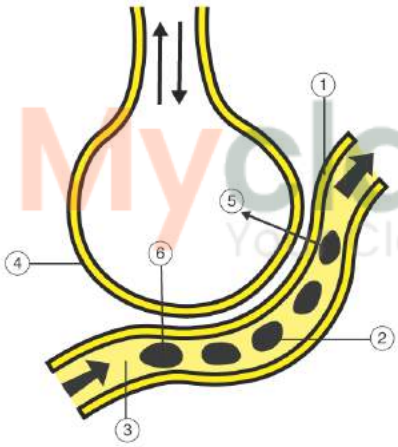
Solution:

The functions of the respective structures are as follows:

(a) Ribs – The intercostal muscles stretch between the ribs which causes its outward and inward movement which enlarges the chest cavity all around.
(b) Diaphragm – The diaphragm flattens from the dome-shaped outline to an almost horizontal plane upon contraction
(c) Abdominal muscles – it helps to increase the size of the thoracic cavity through the motion of the diaphragm which assists in inspiration.

E. Structured/Application/Skill Type

1. Given alongside is a diagrammatic sketch of a part in human lungs
(i) Name the parts numbered 1-4
(ii) What do the arrows 5 and 6 indicate?



Solution:

(i) The parts numbered 1-4 are:
1- thin walls of capillary
2- Red blood corpuscles
3 – Plasma
4 – Thin wall of alveoli

(ii) Arrows at 5 & 6 indicate diffusion of carbon dioxide outside and diffusing of oxygen inside respectively.

2. Given below is an overall chemical reaction of a certain process:

$C_6H_{12}O_6$ + lactic acid ⟶ 2ATP+ heat energy

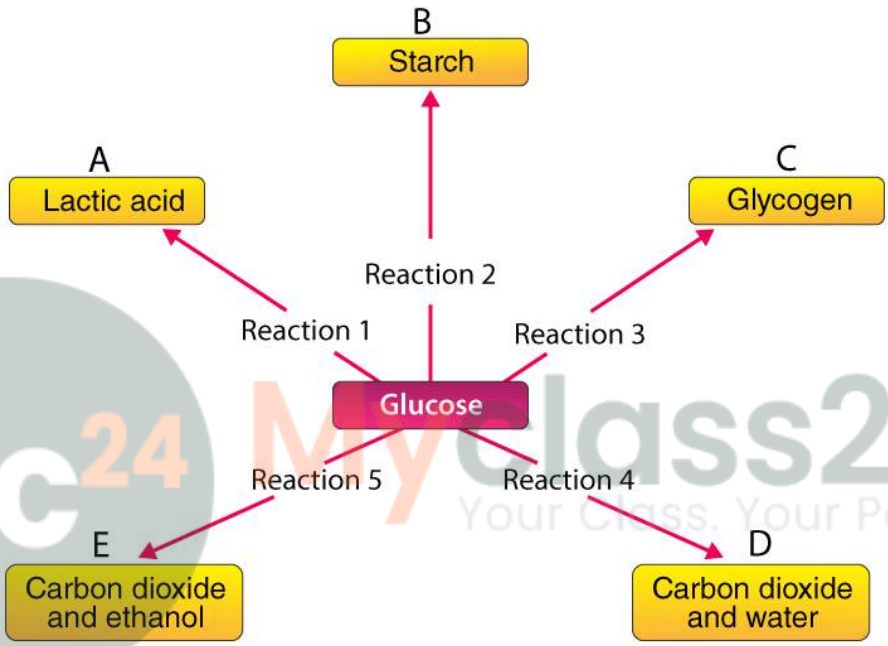
(a) Name the process.

(b) Is this reaction applicable to animals or to plants or to both animals and plants?
(c) Name one tissue in which this reaction may occur.

Solution:

(a) The process is anaerobic respiration
(b) The reaction is applicable to animals only.
(c) The reaction may occur in muscular tissues

3. Given below are chemical reactions (1 to 5) involving glucose and five other chemical products (A-E).



(a) Write the reaction number of the following:
- **(i) Anaerobic respiration in plants _____**
- **(ii) End-products in aerobic respiration _____**
- **(iii) Reaction occurring in liver _____**
- **(iv) Anaerobic respiration in animals _____**
- **(v) Storage in the liver _____**

(b) Which reactions (1-5) in the above correspond to the following (write the corresponding number of reaction next to them).
- **(i) Aerobic respiration**
- **(ii) Change taking place in the liver**
- **(iii) Anaerobic respiration in yeast**
- **(iv) Change taking place in a plant storage organ – e.g. potato.**
- **(v) Anaerobic respiration in animals**

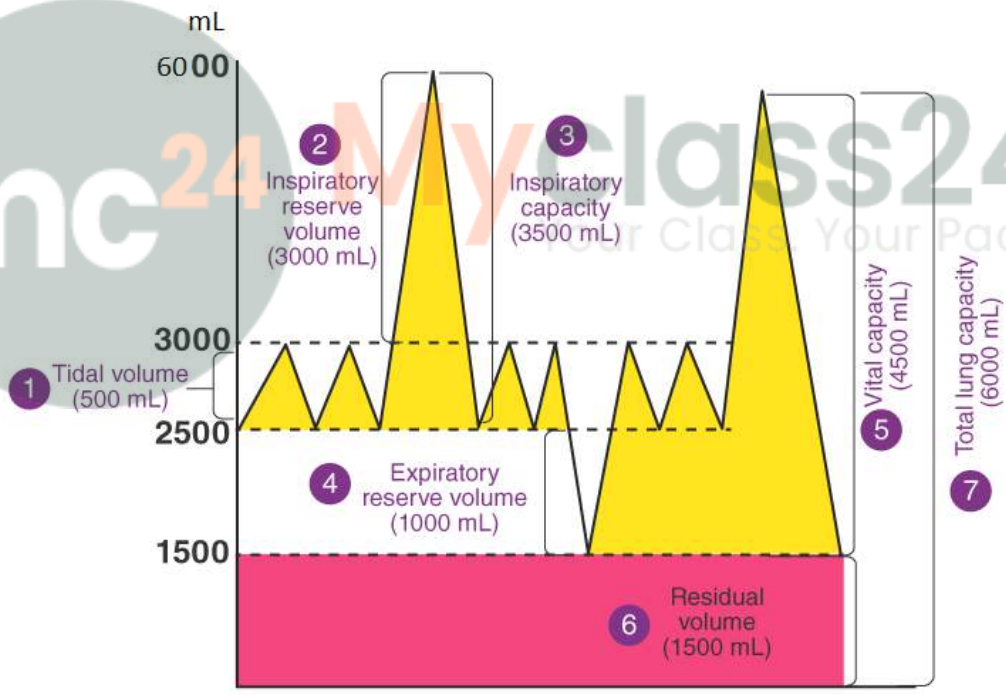
Solution:

(a) The reaction number of the following are:

(i) Anaerobic respiration in plants - 5
(ii) End-products in aerobic respiration - 4
(iii) Reaction occurring in liver - 2
(iv) Anaerobic respiration in animals - 1
(v) Storage in the liver – 3

(b) The corresponding reaction number is as follows:
(i) Aerobic respiration - 4
(ii) Change taking place in the liver - 3
(iii) Anaerobic respiration in yeast - 5
(iv) Change taking place in a plant storage organ – e.g. potato - 2
(v) Anaerobic respiration in animals - 1

4. The volume of air in the lungs and the rate at which it is exchangedduring inspiration and expiration was measured.
The following diagram showsa group of the lung volumes and capacities:



Study the diagram carefully and explain briefly the following:
(a) Tidal volume
(b) Inspiratory reservevolume
(c) Expiratory reservevolume
(d) Vital capacity
(e) Residual volume

Solution:

(a) Tidal volume – it is the air breathed in and out in a normal quiet breathing is known as tidal volume. The tidal volume(TV) is 500mL
(b) Inspiratory reserve volume – air that can be drawn in forcibly over and above the tidal air is known as inspiratory reserve volume. It is referred to as IRV or complemental air and is 3000mL.
(c) Expiratory reserve volume – it is the air that can be expelled out forcibly after a normal expiration. It is referred to as ERV or supplemental air and is 1000mL.
(d) Vital capacity (VC) – it is the volume of air that can be inhaled and exhaled by maximum inspiration and expiration respectively and is about 4500mL.
(e) Residual volume (RV) - Even after forcible expiration, there is some air left in the lungs and is referred to as residual volume. It is about 1500mL.