

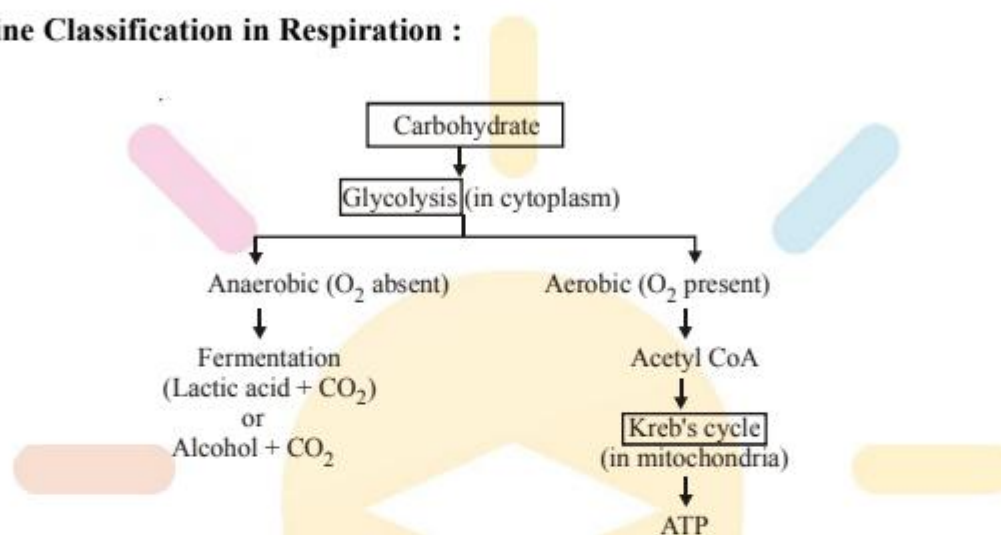
RESPIRATION

1. INTRODUCTION ::

Definition :

Respiration is a multistep, enzymatically controlled catabolic process in which organic molecules are broken down to liberate energy.

(A) Outline Classification in Respiration :



(B) Common Pathway of respiration :

2. GLYCOLYSIS ::

- Glycolysis was discovered by **Embden, Meyerhoff** and **Parnas** and hence it is called as **EMP pathway**.
- Glycolysis is **independent of O₂**, hence it is common in both **aerobic** and **anaerobic** conditions.
- Glycolysis is completed in **cytoplasm**.
- **Glucose** is most common substrate in glycolysis.
- Glycolysis is a **reductive process** in which 1 molecule of glucose is reduced to **pyruvic acid**.

2.1 Kreb's Cycle :

- Krebs cycle was discovered by **Sir Hans Krebs** in 1937 in **pigeon muscles**.
- It is also called **citric acid cycle**, citric acid being the **first** product of krebs cycle.
- Krebs cycle **occurs in matrix of mitochondria** as its enzymes are present in the matrix.
- Kreb's cycle is **amphibolic in nature** because it is **central metabolic pathway** playing an important role in both **catabolism** and **anabolism**.

3. RESPIRATION IN PLANTS ::

- It takes place in all parts of a plant like root, stem and leaf.

- Stomata performs the main role.

4. RESPIRATORY ORGAN IN ANIMALS ::

- ❑ **Gills** — Fish, some arthropod and molluscas
- ❑ **Lungs** — Tetrapods
- ❑ **Skin** — Earthworm
- ❑ **Trachea** — Cockroach.
- ❑ **Body surface** — Protozoans.

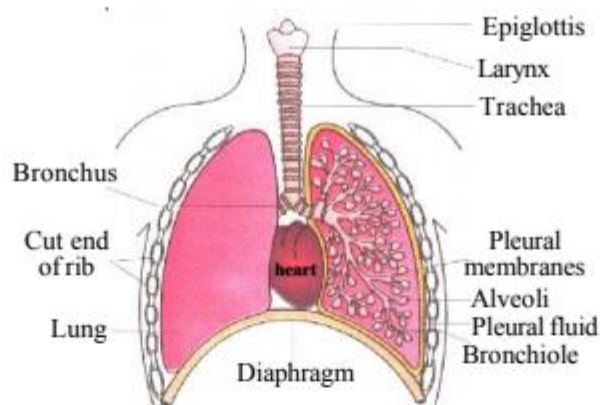
4.1. Respiration in Frog :

- Amphibian respire by means of -
 - (a) Branchial (gills) in tadpole
 - (b) Cutaneous respiration (skin)
 - (c) Buccopharyngeal respiration (buccal cavity)
 - (d) Pulmonary respiration (lungs)

5. MAMMALIAN RESPIRATORY SYSTEM ::

- The mammalian respiratory system consists of nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles and alveoli.
- **Nostril** - It is also called external nares.
- **Nasal chamber** - Nasal septum divides nasal cavity into two nasal chamber by the nasal septum.
- **Internal nares** - There are posterior opening of nasal chambers that leads into pharynx.
- **Pharynx** - The pharynx provides passage to both air and food.
- **Laryngopharynx** - It is the lower part of pharynx and has a slit like aperature called **glottis**, which can be closed by a leaf like bilobed cartilage **epiglottis**, during swallowing of food bolus.
- **Larynx** - It is also called **voice box** or **adam's apple** or **pomas adami**.
- **Vocal cord** - In larynx, 2 pairs of vocal cord is found outer pair is **false vocal cord** whereas, inner pair is **true vocal cord** when air is forced through the larynx it cause vibration of true vocal cords and sound is produced.
- **Trachea (Wind pipe)** - It is long, tubular structure which runs downward through the neck in front of oesophagus. It is supported by eartilage to prevent collapse.
- **Primary bronchi** - These are one pair of small thin walled tubular structure formed by the division of trachea. It further divides and end at alveoli.
- **Lungs** - lungs are present in thoracic cavity on either side of heart. covered by pleural membrane.

5.1 Respiratory System :



HUMAN RESPIRATORY SYSTEM

5.1.1 Mechanism of Breathing :

Respiratory centre is in **Medulla Obongata**.

Mechanism of breathing involves Two Phases.

(A) Inspiration

(B) Expiration

(A) Inspiration :

- Intercostal and phrenic muscles of diaphragm contract to increase thoracic cavity, therefore outside rushes inside.

(B) Expiration :

- Intercostal & phrenic relax muscles.
- Due to decrease of thoracic cavity air pressure within lungs increase, the greater pressure within lungs force foul air from lungs to outside of body.
- **Cavities of the respiratory centre is -**

❑ Gaseous Exchange :

- Gaseous exchange occur in Alveoli following pressure gradient O_2 from high pressure in alveoli diffuse into blood & CO_2 from blood in alveoli.

❑ Gaseous Transport :

- O_2 is carried by haemoglobin (in RBC). 100 ml of blood can carry ~20 ml of O_2 max, CO_2 is transported in form of bicarbonates in plasma.

5.2 Respiratory Volumes and Capacities :

❑ Tidal Volume (TV) :

- Volume of air inspired or expired during a normal respiration. It is approx. 500 mL.

❑ Inspiratory Reserve Volume (IRV) :

- Additional volume of air, a person can inspire by a forcible inspiration. This averages 2500 mL to 3000 mL.

❑ Expiratory Reserve Volume (ERV) :

- Additional volume of air, a person can expire by a forcible expiration. This averages 1000 mL to

1100 mL.

❑ **Residual Volume (RV) :**

- Volume of air remaining in the lungs even after a forcible expiration. This averages 1100 mL to 1200 mL.

❑ **Inspiratory Capacity (IC) :**

- Total volume of air a person can inspire after a normal expiration. This includes tidal volume and inspiratory reserve volume (TV + IRV). Value - 3000 ml.

❑ **Expiratory Capacity (EC) :**

- Total volume of air a person can expire after a normal inspiration. This includes tidal volume and expiratory reserve volume (TV + ERV). Value - 2000 ml.

❑ **Vital Capacity (VC) :**

- The maximum volume of air a person can breathe in after a forced expiration. This includes ERV, TV and IRV or the maximum volume of air a person can breathe out after a forced inspiration. (VC = IRV + ERV + TV). It is 4500 ml.

❑ **Total Lung Capacity :**

- Total volume of air accommodated in the lungs at the end of a forced inspiration. This includes RV, ERV, TV and IRV or vital capacity + residual volume. It is 6000 ml

5.3 Respiratory Quotient :

- The ratio of volume of CO₂ released to the volume of O₂ absorbed in respiration is called **respiratory quotient (RQ)** or **respiratory ratio**.

$$RQ = \frac{\text{Volume of CO}_2 \text{ released}}{\text{Volume of O}_2 \text{ absorbed}}$$

- Value of RQ can be measured with the help of **Ganong's respirometer**.
- Value of RQ varies from one substrate to another.
- RQ gives the idea of nature of substrate being respired in a particular tissue.

5.4 Common Respiratory Diseases :

(A) Bronchitis :

It is inflammation of the bronchi.

(B) Pneumonia :

In pneumonia fluid and white blood corpuscles accumulate in the lung tissue. It is caused by diplococcus pneumoniae.

(C) Emphysema :

The air pollutants that cause chronic bronchitis may breakdown the alveoli of lungs reducing the surface area of gaseous exchange. So years of smoking may suffocate the patient to death.

(D) Asthma :

It is an allergic attack of breathlessness associated with bronchial spasm.

(E) Occupational-Lung Diseases :

It is caused because of the exposure of potentially harmful substances, such as gas, fumes or dust present in the environment where a person works. Silicosis and asbestosis are the common examples, which occur due to the chronic exposure of silica and asbestos dust in the mining industry.

(F) Lung Cancer :

Polycyclic hydrocarbons present in cigarette smoke acts as carcinogen causing lung cancer.

	Aerobic Respiration	Anaerobic Respiration
(i)	Organic food is oxidised in presence of O ₂ .	Organic or inorganic food is oxidized or commonly called decomposition in absent of O ₂ .
(ii)	As byproduct release CO ₂ , H ₂ O and heat.	As byproduct release lactic acid.
(iii)	Complete oxidation process occur $C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O + \text{energy}$.	Incomplete oxidation process occur $C_6H_{12}O_6 \rightarrow 2C_3H_6O_3 + \text{energy}$.
(iv)	38 ATP molecules are formed.	2 ATP molecules are formed.
(v)	In this type of respiration more energy is released.	In this type of respiration less energy is released.
(vi)	In this type of respiration mainly occurs in most of higher organism and human beings.	This type of respiration less occurs like germinating seeds, parasites, RBC and skeletal muscles.

EXERCISE - 1

A. VERY SHORT ANSWER TYPES QUESTIONS

- Q.1 Write the names of the respiratory organ present in fish and earthworm ?
- Q.2 Write down the term used for respiratory organs of insects ?
- Q.3 What is R.Q. ?
- Q.4 Define total lung capacity ?
- Q.5 Define Respiration ?
- Q.6 What do ATP and ADP stands for ?
- Q.7 What is Tidal volume ?

B. SHORT ANSWER TYPES QUESTIONS

(About 30–40 words)

- Q.8 Define the following terms :
(a) I.R.V. (b) E.R.V
- Q.9 Describe the mechanism of breathing ?
- Q.10 What is Glycolysis ?
- Q.11 What is Krebs' cycle ?

C. LONG ANSWER TYPES QUESTIONS

(More than 60–70 words)

- Q.12 Why is respiration a catabolic process ?
- Q.13 Give an account of disease related to respiratory system ?
- Q.14 List the parts of respiratory tract ?
- Q.15 Explain the terms : Vital capacity and Total lung capacity in relation to respiration.

Q.16 Give the average values of the following in normal adult humans :

- (a) Residual volume
- (b) E.R.V

D. FILL IN THE BLANKS

Q.17 Nasal chambers are separated from the oral cavity by

Q.18 Larynx communicates with the by glottis.

Q.19 Lungs lie in the thoracic cavity separated by from the abdominal cavity.

Q.20 Wall of alveoli consists of simple epithelium.

Q.21 The blood corpuscles have respiratory pigment names in humans.

Q.22 Volume of air normally inspired or expired in one breath is termed

Q.23 Prawn respire with and insects with

E. TRUE OR FALSE

Q.24 Fishes respire with the lungs.

Q.25 A water breather expends much more energy in ventilating its respiratory surface than an air-breathing one.

Q.26 Lungs become empty after forceful expiration.

Q.27 Lactic acid is produced in anaerobic respiration.

Q.28 Exchange of gases in the lungs is interrupted during expiration.

Q.29 100 ml of blood can carry 20 ml oxygen.

Q.30 Maximum contraction of diaphragm causes maximum expiration.

Q.31 Tidal volume is equal to the vital capacity of the lungs.

F. SINGLE CHOICE QUESTIONS

- Q.32** Which of the following has no blood but respire -
(A) Earthworm (B) Hydra
(C) Cockroach (D) Fish
- Q.33** Common feature of human and insect tracheae is -
(A) Non collapsible wall
(B) Supporting rings
(C) Ectodermal origin
(D) Endodermal origin
- Q.34** Which one of the following can respire in total absence of air -
(A) Amoeba (B) Bed bug
(C) Hydra (D) Tapeworm
- Q.35** Vocal cords occur in -
(A) Pharynx (B) Glottis
(C) Bronchial tube (D) Larynx
- Q.36** The covering of lungs is called -
(A) Pericardium (B) Pleural membrane
(C) Perichondrium (D) Peritoneum
- Q.37** The exchange of gases in a mammal takes place in -
(A) Trachea (B) Bronchioles
(C) Bronchi (D) Alveoli
- Q.38** Volume of air inspired or expired with each normal breath is called -
(A) Tidal volume
(B) Inspiratory capacity
(C) Total lung capacity
(D) Residual volume

G. MATCH THE COLUMNS

- Q.39** Match the column -

Column - I

1. Trachea
2. Respiratory centres
3. Yeast

Column - II

- a. Alveolar air
- b. ATP
- c. Cartilaginous rings

- | | |
|----------------------------------|-------------------------|
| 4. Insects | d. Medulla oblongata |
| 5. Branchial
respiration | e. Larynx |
| 6. Biologically
useful energy | f. Tracheal respiration |
| 7. Vocal cords | g. Ethanol |
| | h. Fish |

H. FILL THE BOX WITH APPROPRIATE WORD

Q.40 Volume of air expired forcefully-

Q.41 Krebs cycle also called -

Q.42 Kreb's cycle occur in -

EXERCISE - 2

A. SINGLE CHOICE QUESTIONS

- Q.1** It is formed in respiration -
(A) ATP (B) TPP
(C) CTP (D) All the above
- Q.2** Where the reactions of glycolysis occur -
(A) Cytoplasm
(B) Mitochondrial matrix
(C) Either A and B
(D) None of these
- Q.3** End product of glycolysis is -
(A) Glucose-1-phosphate
(B) Fructose 1-phosphate
(C) Pyruvic acid
(D) Acetyl CoA
- Q.4** The apparatus used to measure rate of respiration -
(A) Auxanometer (B) Potometer
(C) Respirometer (D) Manometer
- Q.5** Alcohol is produced in -
(A) Aerobic respiration
(B) Anaerobic respiration
(C) Photosynthesis
(D) None of these

B. MULTIPLE CHOICE QUESTIONS

- Q.6** The two waste products of oxidation in cells are -
(A) C and O (B) Water
(C) Water and N₂ (D) CO₂
- Q.7** What are other names of Kreb's cycle -
(A) TCA cycle (B) Citric acid cycle
(C) EMP pathway (D) None of above

C. PASSAGE BASED QUESTIONS**PASSAGE 1 (Q.8 TO Q.12)**

Respiration is a process of energy liberation. It begins in cytoplom of cell and completes in mitochondria. This is different from breathing which involves gaseous exchange.

- Q.8** Name the cycles in cytoplasm and mitochondria ?
- Q.9** Name Inspiratory museles ?
- Q.10** Cavities of respiratory centre ?
- Q.11** What amount of air is inspired and expired normally ?
- Q.12** What is TLC ?

ANSWER EXERCISE -1

A. VERY SHORT ANSWER TYPES QUESTION

1. Gills and Skin.
2. Trachea.
3. $R.Q. = \frac{\text{Volume of CO}_2 \text{ released}}{\text{Volume of O}_2 \text{ absorbed}}$
4. Total volume of air accommodated in the lungs at the end of a forced inspiration.
5. Fermentation is an anerobic breakdown of carbohydrates and organic compounds into CO₂, alcohols and organic acids with the help of microorganisms and their enzymes.
6. Adenosine triphosphate, Adenosine diphosphate.
7. Air inspired and expired during normal breathing value ~500 ml.

D. FILL IN THE BLANKS

17. Palate
18. Laryngopharynx
19. Diaphragm
20. Squamous
21. Red, haemoglobin
22. Tidal volume
23. Gills, tracheae

E. TRUE OR FALSE

24. False
25. True
26. False
27. True
28. False
29. True
30. False
31. False

F. SINGLE CHOICE QUESTIONS

32. A
33. A
34. C
35. A
36. C
37. B
38. A

G. MATCH THE COLUMNS

39. 1-c, 2-d, 3-g, 4-f, 5-h, 6-b, 7-e

H. FILL THE BOX WITH APPROPRIATE WORD

40. ERV = 1500 ml
41. TCA cycle or Citric acid cycle
42. Mitochondric

EXERCISE -2

A. SINGLE CHOICE QUESTIONS

1. A 2. A 3. C
4. C 5. B

B. MULTIPLE CHOICE QUESTIONS

6. B, D 7. A, B

C. PASSAGE BASED QUESTIONS

8. Glycolysis & kreb's cycle.
9. Intercostal & Phrenic muscles.
10. Alveoli
11. 500 ml
12. Total lung capacity equal to vital capacity and residual volume value - 6000 ml.