

## X State.Biology.Lesson-2.Study Material

### RESPIRATION-2 THE ENERGY RELEASING SYSTEM

1. **What are the basic essential needs for a human being to survive?**  
A. Food, Water, Air, Shelter.
  2. **What is Air?**  
A. Air is a mixture of gases.
  3. **Name some gases which are present in the atmosphere?**  
A. Oxygen, Carbondioxide, Nitrogen, Argon, Helium, etc.,.
  4. **Among the gases present in the atmosphere which gas is important for human beings for survival?**  
A. Oxygen.
  5. **Do plants also require oxygen for photosynthesis?**  
A. No, plants require CO<sub>2</sub> for photosynthesis.
  6. **From where do we derive energy?**  
A. Food.
  7. **What are the components that are present in food?**  
A. Carbohydrates, fats, proteins, vitamins and minerals.
  8. **How oxygen plays an important role in releasing energy from macromolecules.**  
A. By oxidation of glucose (breakdown) Eg: C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>+Oxygen → ATP.
  9. **In which part of the cell do energy is released?**  
A. Mitochondria.
  10. **How energy is useful?**  
A. For growth, repair, to carry on all metabolic activities .
  11. **What is vitated air and chalky acid gas?**  
A. 1) Vitiated air is in which an essential component required for burning, O<sub>2</sub> is removed.  
2) Chalky acid gas is air with more percent of CO<sub>2</sub>.
  12. **Can vitated air burns charcoal? Explain?**  
A. No, as it doesn't contain a component for burning. It cannot burn charcoal.  
Respiration: It is derived from a latin word 'respire'- 'to breathe'  
It refers to a process of oxidative breakdown of respiratory substrates (Carbohydrates, Proteins, Fats etc.,) with in the cell.
- Q **Write about discovery of gases and respiration?**
- 1) In 14<sup>th</sup> century, people didn't know much about gases and respiration,
  - 2) They know air is the mixture of gases
  - 3) Respiration (Medicdal term) involves passage of air and production of body heat.
- Lavoisier and priestly did a comprehensive work on the properties of gases and their exchange. Lavoisier carried several experiments, on discovery of gases..
- Heated powdered charcoal in a bell jar, kept over water trough, it released a gas CO<sub>2</sub> (fixed Air)
- During combustion of phosphorous in a bell jar lavoisier concluded that atmospheric air which combined with '**Phosphorus**' was not water vapour.

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- The substance which helped in the combustion of ‘**Phosphorus**’ was either air itself or an “elastic fluid” present in the air which we breathe.
- He also confirm that the gas liberated in respiration (Humans) that precipitated water to Milky white while the metal did not is carbondioxide.
- In an another experiment .He took  $1/6^{\text{th}}$  of the volume of vitated air (The essential component required for burning is removed) consist of chalky acid gas (fixed air), To recreate vitated air into common air, merely it is not possible to add the respirable air and also the chalkey acid gas has to be removed.

### 1. In those days fixed air means? ( $\text{CO}_2$ )

A. According to lavoisier which gas is produced on burning charcoal-carbondioxide.

### 2. During lavoisier experiment which gas turned the lime water to milky white?

A. The gas liberated on respiration turned lime water to milky white.

### 3. What is eminently respirable Air?

A. The oxygen rich air combines with blood (Haemoglobin) and forms dark red in colour (Blood)

→ Logical conclusion:

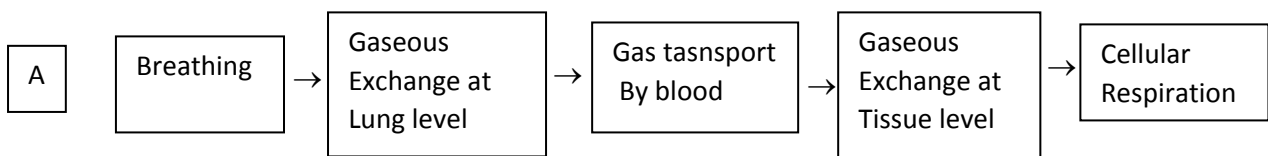
Respirable air is changed into chalky acid in lungs as an exchange might have taken place.

→ The red colour of the blood is due to eminently respirble air.

### Q. What did John Daper told in mid 19<sup>th</sup> century about respiration?

→ John Daper around Mid 19<sup>th</sup> century told ,by the oxidation of food particles, the body expels out is water and oxide of carbon, phosphorous ,sulphur and others”.

### Q Write events/steps in respiration in the form of flow chart?



### Q. How exchange of gases occurs at lung level

A. Alveoli by diffusion process.

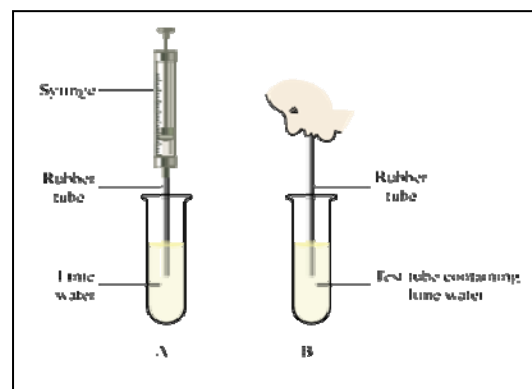
### Q. Who transport of gases takes from lungs to kidney?

A. By blood .

### Q. Name the carrier molecule in blood?

A. Haemoglobin.

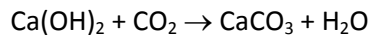
### Q. Show breathing or respiration experimentally?



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Test tube-1 → Containing Water → Breathing out Air (CO<sub>2</sub>) → passed No change.

Test tube-2 → Containing Lime water → Breathing out Air (CO<sub>2</sub>) Passed- Milky white.

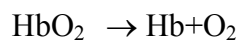
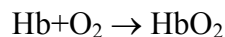


Lime water

Milky white

### Q. Explain the process of exchange of gases that occurs in lungs (Alveoli)

- A.
- 1) The process of exchange of respiratory gases like oxygen and carbon dioxide between blood and alveoli (Microscopic air sacs of lungs)
  - 2) The relative amount of gases and their combining capacity with haemoglobin and other substances in blood determine their transport via blood in the body.
  - 3) When oxygen present in the air is within normal limits (around 21%) then almost all of it is carried in the blood by binding to hemoglobin, a protein present in the red blood cells.
  - 4) As oxygen is diffused in the blood, it rapidly combines with the hemoglobin to form oxyhaemoglobin.
  - 5) Not only hemoglobin combine with oxygen, but the reverse also happens to yield a molecule of hemoglobin and oxygen.
  - 6) Carbon dioxide is usually transported as bicarbonate, while some amount of it combines with hemoglobin and rest is dissolved in blood plasma.



#### 1. Where are Alveoli present?

A. In the lungs.

#### 2. Write down the products of respiration?

A. CO<sub>2</sub>, water and energy.

#### 3. How is air filtered in the nose?

A. By mucous and hair lining the nasal cavity that prevents entry of dust and also humidifies air.

#### 4. What happens if respiratory tract is not moist?

A. The gaseous exchange occurs at very low level, microbes are not eliminated and leads to pulmonary diseases.

#### 5. How does O<sub>2</sub> enter into the cell?

A. By diffusion process.

#### 6. Why O<sub>2</sub> is needed (or) should enter into the cell?

A. To carry out cellular respiration.

#### 7. What are the functions of epiglottis?

A. Epiglottis arrests the entry of food into the lung pipe.

#### 8. When does the epiglottis close at the time of swallowing?

A. Epiglottis is partly closed and allows the food to enter into the food pipe.

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### 9. Show by flow chart the pathway of air and function of each part in respiratory system? (O<sub>2</sub> rich air)

**Nostrils** : → Air is drawn through nose (Nostrils)

↓↑

**Nasal cavity** : → Lined with mucus, filters air and traps all the pathogen, acts as an air conditioner, (Brings the air to the body temperature)

↓↑

**Pharynx** : → Common passage for both respiratory and digestive tract.

↓↑

**Larynx (Voicebox)** : → Contains vocal cords, due to vibration of vocal cord sound is produced as air passes out of lungs.  
epiglottis-Flap like muscular valve, prevents the entry of food in to wind pipe.

↓↑

**Trachea (Wind pipe)** : → Walls are having 'C' shaped cartilagenous rings, wind pipe channeling air into lungs

↓↑

**Bronchi** : → Trachea divides into two bronchi-one leading to each lung.

↓↑

**Broncholes** : → Bronchi further divides in to small branches called bronchioles.

↓↑

**Alveolus** : → Structural and functional units of lungs.microscopic air sacs of lungs, gaseous exchange occur and supplied with blood capillaries.  
alveoli cover an area of about 160m<sup>2</sup>

↓↑

**Blood** : → Carries O<sub>2</sub> from lungs to tissuesand collects CO<sub>2</sub> from tissues to lungs.

Q. What happens if epiglottis is absent (or) doesn't function properly?

A. The food which we eat enters in to the lung pipe and blocks the lungs if decayed may cause pneumonia.

Q. **Describe mechanism of respiration in human beings.**

A. Two floating rib muscles called "diaphragm" plays an important role in the process of respiration.

Probably two events occur during the process of respiration they are

1. **INSPIRATION (INHALATION)** : The events are when air is drawn from outside in to the body.

Chest wall moves up and expands.

Diaphragm (Floor) contracts and becomes flattened.

Internal pressure decreases and air rushes from outside in to lungs.

2. **EXPIRATION (EXHALATION)**

When air moves from lungs to outside.

Chest wall cavity is lowered and moves inward.

Diaphragm relaxes and becomes dome shape (convex side)

Internal pressure increases making the air to rush out from lungs.

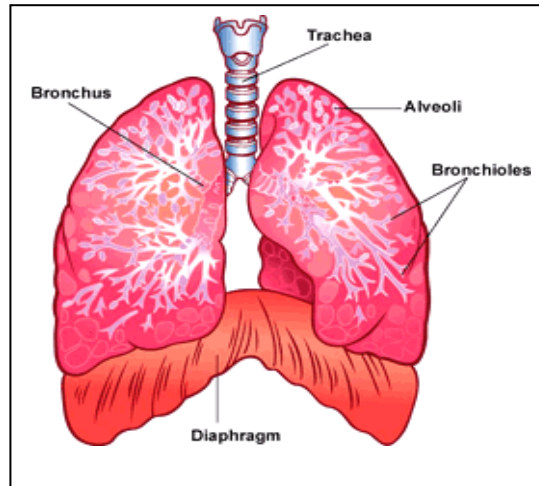
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**Q. What happens if Diaphragm doesn't function?**

If contraction and relaxation of the chest wall muscles.

doesn't take place inspiration and expiration becomes difficult and leads to death of a person.

**Q. How lungs are protected?**



Lungs are covered by 2-membranes- 'Pleura; A fluid filled.

Sac called pleural sac-protects lungs from shocks and injuries.

**Q. What happens if chest wall muscles (or) diaphragm doesn't work properly chest wall.**

A. Ribs and diaphragm are the important parts in the process of respiration if they don't function properly the respiration/breathing doesn't occurs and leads to death.

**Q Why right lung is larger than the left lung?**

**Q. Which lung is larger?**

Right lung (3 lobes) is larger, than left lung ( 2 lobes) because left lung is pressed by heart

**Q. What is the percentage of gases in inhaled and exhaled air during respiration?**

A.

Gas	% in Inhaled Air	% in Exhaled Air
Oxygen	21	16
Carbondioxide	0.04	4
Nitrogen	79	79

**Q. What happens if the Haemoglobin levels decreases in our body cells?**

A. If Haemoglobin (A protein) is deficient it results in deficiency of oxygen in our body cells. It lead to breathelessness and anaemia.

**Q. Why percentage of O<sub>2</sub> in inhaled air is more than exhaled air?**

A. Oxygen is used up by the cells in the breakdown of respiratory substrates to release energy.

**Q. Why does a Person exhale more CO<sub>2</sub> during Respiration?**

A. During metabolism in the living cells oxidative breakdown of respiratory substrates takes place during cellular respiration and more amount of CO<sub>2</sub> is liberated and send out.

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**Q. Write about capacity of lungs?**

A. Total lung capacity - 5800ml Air

→ At rest, inhale/exhale-500 ml air

→ After complete exhalation-120ml air still remains in lungs.

**Q. Food sometimes enters the wind pipe and causes choking. How does it happen?**

A. 1. The trachea is commonly called the wind pipe.

2. It is covered by the epiglottis so when a person swallows food, it does not go into the trachea..

3. If food enters the trachea, it may block it completely and cause a person difficult in breathing and may lead to death.

4. If the food goes down the trachea, it can lodge in the trachea and cause suffocation.

5. If the food enters the trachea, it generally causes a person to cough forcefully enough to remove the food.

**Q. Air leaves the tiny sacs in the lungs to pass into capillaries. What modification is needed in the statement?**

A. The modification needed in this statement. It is not the air that leaves the tiny sacs in the lungs to pass into capillaries but it is the oxygen that is binded by haemoglobin and leaves the tiny sacs in the lungs to pass into capillaries.

**Q. How are alveoli designed to maximize the exchange of gases?**

A. The human lungs are spongy and elastic such that they have been designed to maximize the exchange of gases as follows.

1) There are millions of alveoli in the lungs.

2) The presence of millions of alveoli in the lungs provide a very large surface area for the exchange of gases.

3) Availability of large surface area maximizes the exchange of gases.

**Q. Where will the release of energy from the glucose in respiration takes place? Mala writes lungs, while Jiya writes muscles. Who is correct and why?**

A. 1) Respiration is the process of releasing energy from the breakdown of glucose.

2) Respiration takes place in every living cell, all of the time and all cells need to respire in order to produce the energy that they require.

3) The release of energy from the glucose in respiration takes place in muscles cells but not in lungs called as cellular respiration.

4) So Jiya is correct. The energy is released from the muscle cells during respiration.

Only gaseous exchange takes place in lungs.

**Q. How does gaseous exchange takes place at blood level?**

A. 1) Within the alveoli, exchange of gases takes place between the gases inside the alveoli and blood.

2) Blood arriving in the alveoli has a higher CO<sub>2</sub> concentration which is produced during respiration by the body's cells.

3) At the same time air in the alveoli has a much lower concentration of CO<sub>2</sub> and this allows the diffusion of CO<sub>2</sub> out of the blood and oxygen rich air in to alveoli .

4) Similarly blood arriving in the alveoli has a lower oxygen concentration while air in the alveoli has a higher oxygen concentration.

5) Therefore oxygen moves into the blood by diffusion.

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**Q. Explain the mechanism of gaseous exchange at bronchiole level.**

- A.
- 1) Each bronchus divide in the lungs to form a large number of still smaller tubes called bronchioles.
  - 2) The smallest bronchioles have tiny air sacs at their ends.
  - 3) The pouch-like air sacs at the ends of the smallest bronchioles are called alveoli.
  - 4) The walls of the alveoli are very thin and they are surrounded by very thin blood capillaries.
  - 5) Since the concentration of the gases in the blood and the alveoli are not equal, there is a concentration of gradient which causes the diffusion of carbon dioxide from the blood to the alveolar air and of oxygen from the alveolar air into blood.

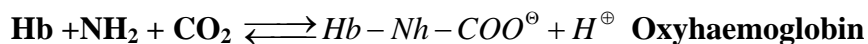
**Q. Write about process involved in TRANSPORTATION OF GASES:**

- It determines the binding capacity of gases present in the environment with the 'Hb' in the blood.
- As oxygen diffuses in to the blood. It combines with a carrier molecule (Protein) called haemoglobin present in the blood
- 'Hb' has  $Fe^{+2}$  is its central atom.



**Q Then How CO<sub>2</sub> is transported out of the body?**

- A. 'CO<sub>2</sub> is transported as bicarbonates, some amount dissolved in blood plasma and also transported by 'Hb'



**Q. Why do mountaineers deep sea divers carry oxygen cylinders with them?**

**Q. How do people in air crafts travel for longtime? Do they get / ufficient oxygen evels?**

**Q. Do levels of oxygen vary at different attitude? What happens if a person move to 13 km bove sea level.**

- A. When a person moves to a higher altitude of about 13km (8 miles) from sea-level, the oxygen levels decreases.
- As a result sufficient number of oxygen molecules donot combine with 'Hb' foming oxyHb'.
- As a result oxygen is not carried to Tissues. Life is not possible at such attitudes. So ountaineers, deep sea divers Carry Oxygen cylanders with them.  
Modern Air Crafts also have preserved Cabins which provide Oxygenated Air.

**Q. How O<sub>2</sub> is delivered & carried CO<sub>2</sub> is removed?**

**Q. By which process the exchange of Gases Occur?**

- A. As the Tissues use up O<sub>2</sub> continuously the levels of O<sub>2</sub> decreases in the Tissues, So as to deliver the O<sub>2</sub>, the Oxy Haemoglobin molecule dissociates & then the O<sub>2</sub> is delivered in to the Tissues (Diffusion process)

**Q. Define Cellular Respiration.**

- A. The substances which are oxidised during respiration to produce energyat cellular level are called respiratory substrates and process is called cellular respiration.

**Ex:** Carbohydrates, proteins , fats.

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**Q What are Sites of cellular Respiration in Bacteria and Eukaryotes.**

- A. In Bacteria –Cytoplasm  
In Eukaryotes- Cytoplasm & Mitochondria.

**Q Write the difference between aerobic and anaerobic respiration.**

<b>Aerobic</b>	<b>Anaerobic</b>
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 686K.C$	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2 + 56$ Kcal. (Lactic acid)
Oxygen is required	Oxygen is not required
More amount of $CO_2$ is produced	Less amount of $CO_2$ is produced.
Water is formed.	Lactic acid or ethyl alcohol is formed.
More amount of energy is released	Less amount of energy is released.

Q. Write about fermentation.

In the Absence of Oxygen yeast converts sugars into Ethyl alcohol it is called Fermentation

- A.  $C_6H_{12}O_6$  k/cal.  $\xrightarrow[\text{fermen lotion}]{\text{yeast}}$   $2C_2H_5OH + 2CO_2 + 56$  k/cal

**Q Which cell Organelle is known as power house of a cell & Why?**

- A. Mitochondria.

**Q. State two similarities between aerobic and anaerobic respiration**

- A. Two similarities between aerobic and anaerobic respiration.

- 1) Both aerobic and anaerobic respiration release energy by breaking down glucose molecule.
- 2) The energy produced by these two processes will be used to carry out various functions of the body
- 3) Both aerobic and anaerobic respiration take place in a cell.

**4. Why does the rate of breathing increases while walking uphill at a normal pace in the mountains? Give two reasons.**

- A. The rate of breathing increases while walking uphill at a normal pace in the mountains.

- 1) It is because as we go up the hill above sea level the concentration of oxygen is greatly reduced. So we have to breathe more to get required amount of oxygen.
- 2) While walking uphill a lot of oxygen is used by our body to release energy from glucose.
- 3) This leads to lack of oxygen in the cells.
- 4) We take in oxygen when we breathe.
- 5) Hence to increase the amount of oxygen intake there is an increase in breathing rate during walking uphill.

**13. If you have a chance to meet pulmonologist, what questions you are going to ask about pulmonary respiration?.**

- A. If I have a chance to meet pulmonologist , I Would like to ask the following questions.

- 1) What is the cause for lung cancer.
- 2) What type of diagnostic tests will be performed to assess the function of lungs.



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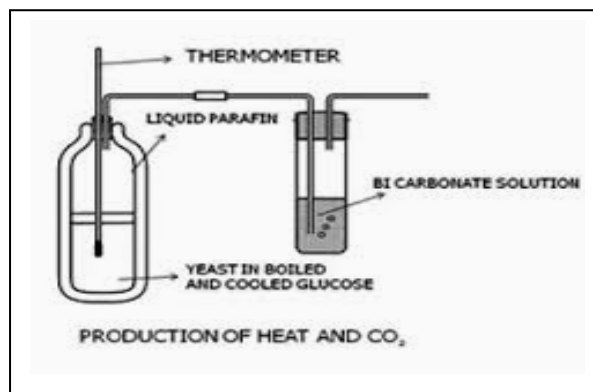
- 3) What is asthma.
- 4) How can asthma be cured?
- 5) What is chronic obstructive pulmonary disease.
- 6) What is pneumonia? How is it caused?
- 7) What is tuberculosis? Can it be cured permanently.
- 8) What is pulmonary edema? How is it caused.
- 9) What is the organism that causes acute bronchitis.
- 10) Can all the diseases of lungs be cured permanently.
- 11) How can we protect from lung diseases.
- 12) What are the reasons for different kinds of lung diseases.

**15. Collect information about respiratory diseases (because of pollution, tobacco) and discuss with your classmates.**

A. Respiratory diseases because of pollution:

- 1) Irritation of eyes, nose, mouth and throat.
- 2) Headaches, nausea and dizziness.
- 3) Respiratory symptoms such as coughing and running nose.
- 4) Pulmonary cancer caused by a series of carcinogen chemicals that through inhalation.
- 5) Pneumonia: Infection of lungs caused by bacteria.
- 6) Bronchitis: It is inflammation or swelling of bronchial tubes.
- 7) Emphysema: It is a lung condition in which tiny air sacs in lungs alveoli fill up with water.

**16. What procedure do you follow to understand anaerobic respiration in your school laboratory?**



A. **Aim:** To prove that CO<sub>2</sub> is released during anaerobic respiration.

**Apparatus:** Thermos flask, splitted corks, thermometer, wash bottle, glass tubes, liquid paraffin, glucose solution, yeast cells, bicarbonate solution, Janus Green B solution.

**Procedure:**

- 1) Heat the glucose solution in a beaker, pour it in a thermos flask.
- 2) To remove dissolved oxygen from glucose solution by boiling it in thermos flask for a minute and then cooling it without shaking.
- 3) Now add some yeast to the glucose solution and fix two-holed rubber stopper to the flask.
- 4) The Supply of oxygen from the air can be cut off by pouring a 1cm layer of liquid paraffin on the mixture
- 5) Insert one end of the thermomter into the thermos flask. See the end of thermomter kept inside the solution.

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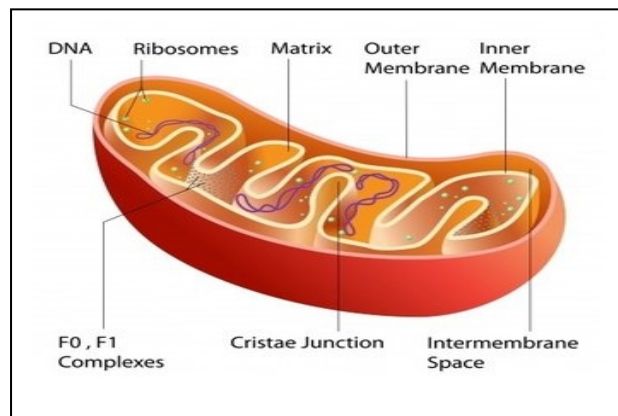
- 6) Arrange for any gas produced by the yeast to escape through a wash bottle containing bicarbonate solution or lime water as shown in the figure.
- 7) Add a few drops of diazine green (Janus Green B) solution to the yeast suspension before you pour liquid paraffin over it.
- 8) The blue diazine green solution turns pink when oxygen is in short supply around it.
- 9) Warm the apparatus to about 37<sup>0</sup> F in order to speed up the test.
- 10) Keep the apparatus undisturbed for one or two days.

### Observations:

- 1) After two days it can be observed that lime water of the wash bottle turns into milky white precipitate.
- 2) Increase in temperature noted on yeast cells respire and release energy.
- 3) Alcohol smell given off from the flask.

**Result:** These observation indicate that yeast cells respire anaerobically converting glucose solution into CO<sub>2</sub> ethyl alcohol and releasing heat energy.

Q **Explain how ATP is formed during Cellular Respiration. Explain how glucose is oxidized to release energy?**

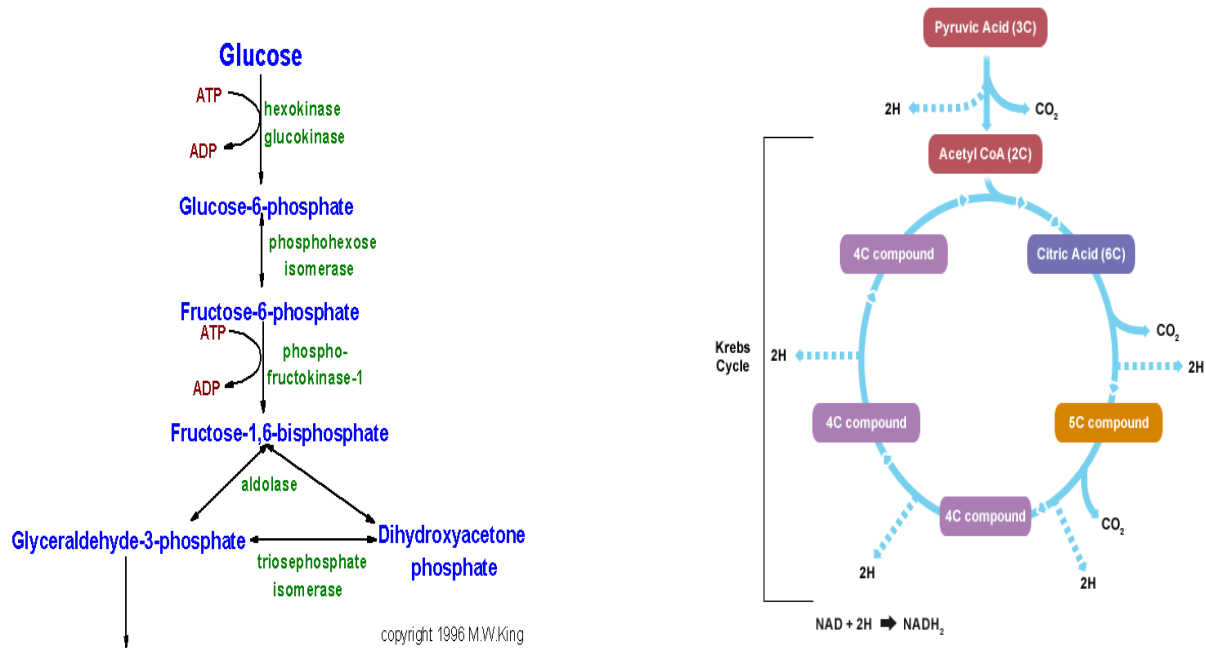


- A. Mitochondria is the site for cellular respiration.
- Mitochondria is known as “Power house of a cell” as the energy produced in mitochondria is stored up in the form of ATP (adenosine to phosphate)
  - The Glycolysis breakdown of glucose (Oxidation of Glucose) is the first step in respiration, which is common for all types of respiration that takes place in the cytoplasm of cells.
  - Pyruvic acid oxidize to give energy in second step called as krebs cycle in matrix of mitochondria.
  - During the oxidative breakdown of Glucose, the energy is released at several stages.
  - But Energy is not produced at each step, several Intermediates are formed.
  - The Energy produced is converted to chemical energy & stored in th form of ATP.
  - Energy currency of cell is “ATP” a energy rich compound helps in providing energy for various metabolic Activities.
  - ATP gives 7,200 Calories, the energy is stored in the form of Terminal phosphate bond  
ATP → ADP + InorganicPhosphate + energy

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**Q. Explain the stages of aerobic respiration through flow charts.**

A. a) Glycolysis      b) Krebs cycle



**Q. In which type of respiration more energy is Released?**

A. Aerobic Resiration.

**Q. During Ganesh Nimarjan every one was dancing a lot after some time people didn't show more interest in dancing, A student studied about the case by asking & knowing it from a Doctor.Why?**

A. i) people get pain in the Muscles due to accumulation of Lactic Acid?

**Q. How does this Lactic Acid concentration decreases?**

A. If people take more amount of O<sub>2</sub> Lactic acid concentration decreases.

**Q. In which condition Lactic Acid is formed?**

A. During vigorous muscular activity.

**Q. What happens if lactic acid is present in bloods.**

A. Muscle fatigue occurs

**Q. By which kind of respiration is lactic acid formed?**

A. Anaerabic respiration.

**Q. Why peole get sweat during dance?**

A. Heart rate & blood pressure, Increases, which inturn cause the body to pump out more sweat the ATP Molecules breaks & release dnergy in the form of heat.

**Q. Why does a person pant after the running race?**

A. In order to take up more O<sub>2</sub>, & the muscles have more pain as lactic acid gets accumulated. To decrease lactic acid concentration O<sub>2</sub> is required, Hence person pant.

**Q. In which Respiration less Energy is released? give an Examples.**

A. Anaerboic Respiration (absence of O<sub>2</sub>)

Eg: Lactic acid only 2ATP's.

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**Q. Why Muslce fatigue occurs?**

**Q. What is Oxygen debt?**

- A.
- 1) An Athlete can held his breath in 100m race, then after he pants, the muscles undergo anaerobic breakdown of glucose (Abs of O<sub>2</sub>) during his race.
  - 2) The (Accumulated) Lactic Acid formed in the muscles during Anaerobic respiration is removed as the athlete obtains Oxygen after race.
  - 3) As a person undertakes strenuous exercise he builds :Oxygen debt (Insufficiency of O<sub>2</sub> to convert pyruvate → Energy), which is repaid after the vigorous exercise.
  - 4) The presence of Lactic Acid results in muscle Fatigue. But if the person rests for a longer time, the tiredness is removed.

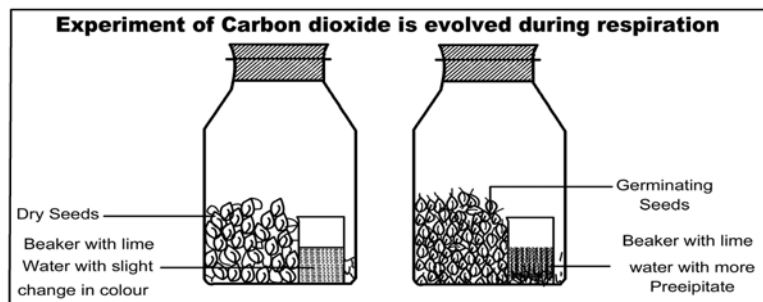
**Q. What is Anaerobic Respiration**

- A.
- 1) Respiration which occurs in the absence of oxygen.
  - 2) Very little energy is produced water is not formed CO<sub>2</sub> is formed, compounds like ethanal
  - 3) CO<sub>2</sub>) Lactic Acid are formed
- $$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2 + 56 \text{ Kcal.}$$

Lactic Acid

**6. How can you prove that carbon dioxide is released during respiration?**

A.



**Aim:**

To prove that carbon dioxide is evolved during aerobic respiration.

**Requirements:-**

1. Wide mouthed bottle
2. Rubber stoppers
3. Beaker with lime water
4. Germinating seeds
5. Dry seeds
6. Vaseline.

**Procedure:-**

1. Take two wide mouthed glass bottles with tight fitting rubber stoppers.
2. Keep a beaker containing lime water in each bottle.
3. Put some germinating seeds in one bottle and dry seeds in another bottle.
4. Close the bottles tightly with rubber stopper and apply Vaseline to the mouth of the bottle to prevent leakage of gases.
5. Keep this setup undisturbed for one or two days.

**Observation:**

We will observe more white precipitate in the lime water in the bottle containing germinating seeds.

More white precipitate indicates presence of more carbon dioxide.

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**Inference:-** So, it is proved that carbon dioxide is released during respiration .

Q. Write an Experiments with yeast to show Anaerobic respiration.

A. To check the rise in temperature, production of CO<sub>2</sub> during Anaerobic Respiration. yeast (Unicellular) grows if supplied with , Glucose, Hence the O<sub>2</sub> in Glucose must be removed.

1) Remove dissolved O<sub>2</sub> from Glucose by heating for a minute

↓

2) Cool it, Add some yeast, Add pour liquid paraffin on the mixture.

↓

3) To Test whether O<sub>2</sub> is Removed, Add few drops of diazine green (Janus Green-B) to Yeast suspension.

**Q Why glucose solution is heated for a minute?**

A. To remove oxygen in glucose solution.

**Q. What colour change do you observe if O<sub>2</sub> is in short supply.**

A 1) The Blue dye turns Pink if O<sub>2</sub> is in short supply.

2) The Gas produced during Anaerobic Respiration is passed over Bicarbonate solution.

**Q. Why Liquid paraffin is added above the Mixture?**

A If stops the supply of O<sub>2</sub> from Air to Yeast.

**Q Instead of Bicarbonate solution, if it is lime water, what happens?**

A The Lime water turns milky, as CO<sub>2</sub> is produced during Anaerobic Respiration.

**Q. What is Fermentation ?Why does baker use yeast?**

What happens when a baker prepares a dough by mixing yeast in it?

A. 1)  $Sugars \xrightarrow[\text{Absence of } O_2]{\text{Yeast}} \text{Alcohol (ethanol)}$

2) Characteristic smell of ethanol is observed if sugar & Yeast are mixed & allow to stand with out O<sub>2</sub> ethanol can be separated by Fractional distillation method at 70<sup>0</sup>C..

**How Respiration & Combustion are different?**

c) **Respiration and Combustion.**

A.

<i>Respiration</i>	<i>Combustion</i>
1. Oxidation of glucose to carbon dioxide and water is called Respiration	1. Sugar first chars and later burns producing flame. When sugar burn carbon dioxide and water are produced and energy is released as heat. This process is called Combustion.
2. No heat is applied for the oxidation of sugar molecules. The entire process occurs at the body temperature of the organism.	2. Heat to be applied for the sugar molecule to burn..
3. The energy is released in several stages	3. The energy is released at once as heat..
4. It occurs in the presence of water.	4. It occurs in the absence of water.
5. It is a controlled process.	5. It is an uncontrolled process.
6. Energy is stored in ATP in the body.	6. Energy is not stored and is released into the atmosphere.

## X State.Biology.Lesson-2.Study Material

**Q. How heat is produced by the living organisms?**

A. Heat is produced in body is the burning of Glucose. Living Organisms produce energy in the form of ATP and heat energy.

**Q. We feel warm when we wear sweater in winter season why ?**

A. In winter sweater prevents the loss of heat.

**Q. How heat is lost from the body? Is the heat lost from the body is replaced again?**

A. 1) Continuously heat is lost from the body & it is again replaced, as to maintain constant body temperature. During cellular Respiration, energy is released as it is stored in the form of ATP.

**Q. Why do we feel more warm during vigorous exercise?**

A. During strenuous exercise the energy is released in the form of heat for this Respiration Increases & persons feel warm.

If O<sub>2</sub> is not available in required levels, the muscles undergo Anaerobic Respiration. Producing “lactic acid” (pain in muscular)

**Q. Is the rate of heat production same during the year?**

A. Yes, we are homeotherms (Constant temperature is maintained irrespective of seasons) Deep breathe help us to resotre energy in the body.

**Q. Why old people shiver more in winter than youngsters? Lack of less fat & less muscle contraction.**

A. Lack of less fat and less muscle contraction.

**Q. Write sequence of respiratory organs in Cockroach:**

A. Spiracles/stigmata (10 pairs) →Atrium→ longitudinal →Tracheal Tru → Trachea →Tracheoles→Tissues

**Q. Write about evolutin in gaseous exchanging system.**

A. 1) Exchange of Gases in Amoeba & Hydra takes place by simple diffusison.  
2) Different organisms have different types of Respiratory systems i.e., for Aquatic (or) Terrestrial.  
3) Bodysize, availability of water & type of Circulatory system are the reasons to develop different Respiratory organs.  
4) Tracheal system-cockroach, Grasshoppers (Insects).

**Q. Write about Branchial Respiration(Gills)- Fishes with flowchart.**

A. Branchial Respiration takes place by gills in fishes .

→ Gills are present in Gill pouches, & are provided with leaf like folds called gill lamellae  
→ Water from outside→ mouth → oral cavity → Pharynx → Internal branchial aperture → Gill pouch → external branchial aperture → Outside.

Cutaneous Respiration (skin)-Frog.

Pulmonary Respiration (lungs)-Human.

Crocodiles & Dolphins breathe through lung.

**Q. A person observed a fish in an aquarium & he also observed Small bubbles coming out, from where they come? Why are those bubbles formed?**

A. Fish take O<sub>2</sub> from water (Dissolved O<sub>2</sub>) & uses it, CO<sub>2</sub> is generation out in the form of bubbles.

**Q. A student studied about the Respiration & plants he clarified his doubts by raising questions like.**

## **X State.Biology.Lesson-2.Study Material**

**Q. When do Respiration in plants occur?**

A. Respiration occurs through out the day but Respiration is more observed in night times as photosynthesis doesn't occur during night time.

**Q. Which gas required by the plants for Respiration**

A. Oxygen gas (O<sub>2</sub> gas)

**Q. Do plants also respire like Animal**

A. Yes

**Q. How do plants Respire?**

**Q. Do all parts of the plant Respire?**

A. 1) Stomata-Exchange of Gases in Leaves.  
2) Roots →Gaseous exchange also occur through surface  
3) Stem →Lenticels  
4) Mangrove →Breathing roots of Tissue in  
5) Orchids. → Tissues.

**Q. Do plants Respire through the Day?**

A. Yes

**Q. Is Respiration in plants so important?**

A. Yes

**Q. Which gas plays an Important role in Respiration in plants?**

A. Oxygen

→ The opening of stomata leads to a series of spaces which forms continuous network. The spaces are large & lined with water, where the O<sub>2</sub> dissolves & passes in to cytoplasm of a cell.

→ Hence the sugars are broken down into CO<sub>2</sub> & water with the Liberation of energy. The above process occurs by diffusion process. (Due of difference in conc of O<sub>2</sub> & CO<sub>2</sub> Inside & outside the cell.

**Q. If plants live in water, How do they Respire?**

A. Plants that live in water have hollow stem and respire through epidermis by collecting oxygen dissolved in water by diffusion process.

**Q. Do roots also Respire if so how?**

**Q. How Mangroove trees are adapted (or) How they have a special adaptation?**

A. Roots –aerate by surface of Root hairs (or) Lenticels.

A. Plants living in wet condition unable to obtain oxygen, Hence these plants have much large airspaces which connect the stems with roots, making diffusion from the upperparts much more efficient.Mangrooves develop aerial roots above the ground surface called pneumatophores (or) knees . The breathing roots play an Important role.

**Q. Name the organ present in older trees for exchange of gases?**

A. Lenticels.

**Q. A student observed a tree growing in a sea water having a special adaptation for breathing**

A. The tree observed by the student is mangroove tree. As they live in Salt water condition Mangroove trees have deficiency of O<sub>2</sub> in soil so roots come out on the surface of the soil as knee like structures called pneumatophores.

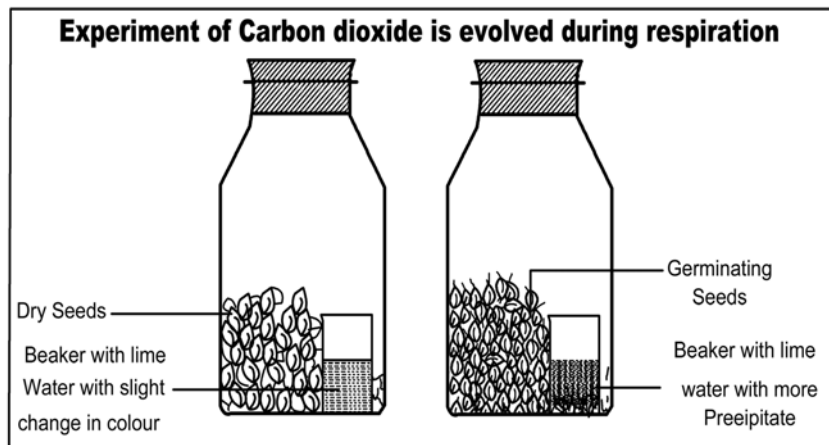
## X State.Biology.Lesson-2.Study Material

**Q. What is respiration (or) What are respiratory substrates?**

A. Oxidation of Respiratory substrates like Carbohydrates and fats to produce  $\text{CO}_2$  & water in presence of oxygen called respiration

**Q. Do Germinating seeds also Respire like plants? Explain an experiment.How do you prove that  $\text{CO}_2$  is evolved during Respiration?**

**Q. “Germinating seeds also Respiration “ = comment on it.**



A. Take 2 wide Mouthed glass bottles with fitting Rubber stoppers



Keep a beaker containing lime water in each bottle.



Put Germinating Bajra seeds (soak Bajra seeds in water for whole night) in one bottle & dry seeds in another bottle.



Close the bottles tightly with Rubber cork, keep the apparatus undisturbed for one to two days.



The lime water turns Milky white in a bottle containing germinating seeds, while the lime water remains same in the bottle containg dry seeds.

**Q. Why lime water turns Milky white?**

**Germinating seeds respire & release  $\text{CO}_2$ ,  $\text{CO}_2$  reacts with lime water & turns Milky white.**

How do you say that Respiration occurred in Germinating seeds,  
Lime water → Milky white (Colour change)

**Q. Do lime water turnsin to milky in the case of Non germinating seeds.**

A. No

**Q. Why non germinating seeds donot Respire?**

A. They don't take up oxygen, as seeds are in resting on dormancy stage.

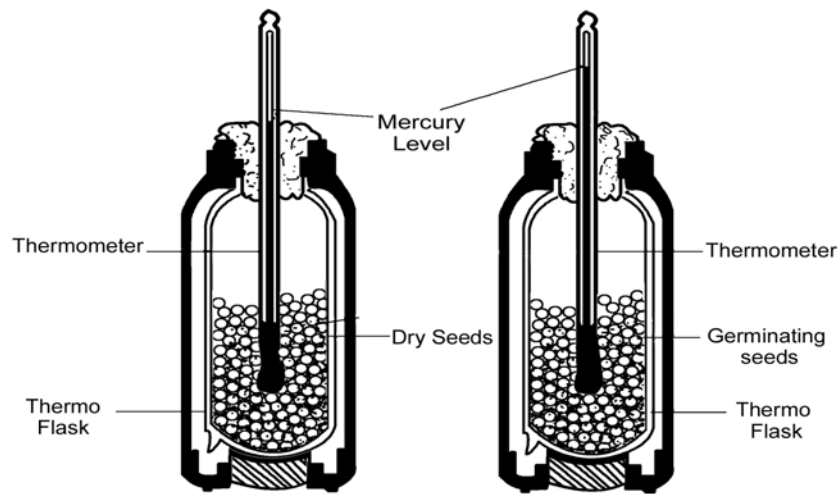
**Q. Write an experiment to prove that heat is evolved during Respiration.**



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### 5. How can we show that heat is liberated during respiration?

A.



#### AIM:-

To show that heat energy is liberated during respiration.

Requirements:-

- 1) Two thermos flasks
- 2) Corks
- 3) Germinating seeds
- 4) Dry seeds
- 5) Two thermometers.

#### Procedure:

1. Take two thermos flasks ..
2. Put germinating seeds into one of the thermos flasks and dry seeds in another flask.
3. Make a hole in the cork and insert a thermometer into the cork and see that the bulb of the thermometer is in the midst of the seeds.
4. Record the temperature in both the flasks for every two or three hour intervals for about 24 hours.

#### Observation:

After 24 hours, we will observe that the temperature in the flask with germinating seeds is higher than the temperature in the flask with dry seeds.

#### Inference:-

This indicates that heat is liberated during respiration.

**Q. In the above experiment the student didn't insert the bulb of Thermometer in to the germinating seeds what is the result?**

A The thermometer doesn't show the rise in temperature.

**Q. How do you determine graphically that heat is liberated during Respiration.**

→ In Germinating seeds thermo flask, the rate of Respiration (Heat liberation) is increased which is calculated by Thermometer reading.

→ Heat is liberated during the Respiration of Germinating seeds.

→ Give out few differences between photosynthesis & Respiration.

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**Q. Write a comparative account of photosynthesis and respiration?**

**A.**

<b>Photosynthesis</b>	<b>Respiration</b>
Occurs only in plants and some photosynthetic bacteria.	Occurs in all living organisms.
Takes place in the presence of sunlight only	Takes place through out the day (day and night)
A plant can survive without performing photosynthesis for a few days.	No organism can survive without respiration for few minutes.
In plants, only few cells perform photosynthesis.	All living cells of an organism perform respiration.
It occurs in chloroplast and is dependent on light.	It occurs in the mitochondria and is independent of light.
In this process, light energy is fixed.	In this process, chemical energy is released.
Raw materials are carbon dioxide and water.	Raw materials are oxygen and carbohydrates or organic substances.
Oxygen is released and carbon dioxide is utilized.	Oxygen is utilized and carbon dioxide is released.
Adds on weight (biomass to the organism).	Decrease the weight of the organism.
0. Converts radiant light energy into chemical energy.	Release chemical or potential energy for several other functions.
1. Produces ATP by using light energy. (Photophosphorylation).	Produces ATP by oxidizing glucose (oxidative phosphorylation)
2. NADP is reduced to NADPH using hydrogen of water molecule.	NADH is formed from hydrogen of carbohydrates (food substances)
3. ATP and NADPH are mainly used for synthesis of organic compounds	NADH and ATP are made available for cellular activities.
4. It is an anabolic process.	It is a catabolic process.
5. $6CO_2 + 12H_2O \xrightarrow[\text{chloroplast}]{\text{sunlight}}$ $C_6H_{12}O_6 + 6O_2 + 6H_2O$	$H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 686K.C$

**Q. A student removed leaves from a older plant still the stem Respired How?**

**A.** Lenticels present on the stem.

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- Q. In anaerobic Respiration experiment a student forgot to pour a layer of paraffin wax what happened.**
- A. Paraffin prevents the entry of O<sub>2</sub> in to the yeast Glucose Mixture. If paraffin is not used the yeast undergoes Aerobic Respiration. As paraffin cuts the supply of O<sub>2</sub>.
- Q. Which hood vessel carries oxygenated blood from lungs to the heart?**
- A. Pulmonary vein
- Q. Among two lungs which one is smaller?**
- A. Left lung.
- Q. How lungs are protected?**
- A. Pleura.
- Q. Can all the diseases of lungs be cured eminently?**
- A. NO
- Q. A person was studying about cellular respiration. He observed that cell resp in Eukaeyotes is different form pookaryotes How?
- A. As in Eukaryotes it occurs in Mitochondria & Cytoplas. As in prokaeyotes it occurs in Cytoplasm.**
- Q. He observed an organism which can undergo both aerobic & anerobic Respiration –
- A Yeast (unicellular Eukoryotic organization)**
- Q) Photosynthesis and Respiration:**

Photosynthesis	Respiration
1) Occurs only in plants and some photosynthetic bacrteria	1) Occurs in all living organisms.
2) Takes place in the presence of sunlight	2) Takes place throughout the day
3) It occurs in chloroplast and is dependent on light	3) Aerobic respiration occurs in cytoplasm and mitochondria and is independent of light
4) Raw materials are CO <sub>2</sub> and water	4) Uses carbohydrates or organic substances and oxygen
5) In this process light energy is fixed in the form of chemical energy and stored in carbohydrates.	5) In this process chemical energy stored in the carbohydrates burns to release energy.
6) Oxygen is liberated in this process and carbon dioxide is utilized.	6) Oxygen is utilized and carbon dioxide is released.
7) Produces ATP by use of light energy	7) produces ATP by oxidation of glucose
8) ATP and NADPH <sub>2</sub> are mainly used for synthesis of organic compounds	8) NADH <sub>2</sub> and ATP are made available for cellular respiration.
9) It is an anabolic process.	9) It is a catabolic process
10) $6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} C_6H_{12}O_6 + 6O_2 + 6H_2O$	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 686 K.cal$

## X State.Biology.Lesson-2.Study Material

**Q. Plants photosynthesize during daytime and respire during the night. Do you agree to this statement? Why? why not?**

- A.
- 1) Yes, I do agree partially with this statement. Plants photosynthesize during day time only. Dark reaction takes place during night time and respire during the day time as well as night time also.
  - 2) During day time when photosynthesis occurs, oxygen is produced. The leaves use some of this oxygen for respiration and the rest diffuses into air.
  - 3) During day time CO<sub>2</sub> produced by respiration is all used up in photosynthesis by leaves but rate of respiration is slow.
  - 4) At night time no photosynthesis occurs and oxygen diffuses into leaves to carryout respiration and during night dark reaction takes place O<sub>2</sub> releases. But rate of photosynthesis is sLow during night.

**Q. Raju said :stems also respire along with leaves in plants". Can you support this statement? Give your reasons.**

- A. Yes, I support the statement of Raju that stems also respire along with leaves in plants. The reasons are.
- 1) The stems of herbaceous plants have stomata.
  - 2) So the exchange of respiratory gases in the stems of herbaceous plants takes place through stomata.
  - 3) The oxyten from air diffuses in to the stem through stomata and reaches all the cells for respiration.
  - 4) The carbon dioxide released due to respiration diffuses out into the air through the stomata.
  - 5) In woody stems the bark has lenticels for gaseous exchange. Through lenticels oxygen diffuses in and carbon dioxide diffuses out into the air.

**Q What are your observations in combustion of sugar activity?**

- A.
1. When sugar is heated first it chars and later burns producing flames.
  2. When sugar combusted carbon dioxide and water are produced
  3. Energy is also released in the form of heat and it released at once.
  4. We cannot control the combustion of sugar and also intermediate products are not formed.
  5. We can combust sugar in the absence of water and also enzymes are not required.
  6. Due to combustion of sugar heat energy is released into the atmosphere and we cannot store it for further use.

**I. Choose the correct Answers:**

1. We will find vocal cords in [       ]  
A) Larynx                      B) Pharynx                      C) Nasal cavity                      D) Trachea
2. Cluster of air sacs in lungs are called [       ]  
A) Alveolus                      B) Bronchi                      C) Bronchioles                      D) Air spaces

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3. Which of the following is correct? [     ]  
A) The diaphragm contracts-volume of chest cavity increased.  
B) The diaphragm contracts-volume of chest cavity decreased.  
C) The diaphragm expands-volume of chest cavity increased.  
D) The diaphragm expands –volume of chest cavity decreased.
4. Respiration is a catabolic process because of [     ]  
A) Breakdown of complex food molecules     B) Conversion of light energy  
C) Synthesis of chemical energy     D) Energy storage
5. Energy is stored in [     ]  
A) Nucleus     B) Mitochondria     C) Ribosomes     D) Cell wall
6. The air which helps in burning is [     ]  
A) Oxygen     B) Carbon dioxide     C) Nitrogen     D) None
7. The chalky-acid air formed in lungs during respiration is [     ]  
A) Oxygen     B) Carbon dioxide     C) Nitrogen     D) Water vapour
8. From pharynx the air goes into [     ]  
A) Larynx     B) Trachea     C) Nasal cavity     D) Lungs
9. The volume of the chest cavity is increased in this phase [     ]  
A) Expiration     B) Respiration     C) Inspiration     D) All the above
10. The percentage of carbon dioxide in exhaled air is [     ]  
A) 0.04%     B) 0.03%     C) 4%     D) 5%
11. The protein that binds oxygen in blood is [     ]  
A) Chloroplast     B) Haemoglobin     C) Porphyrin     D) All the above
12. The percentage of oxygen in exhaled air is [     ]  
A) 14%     B) 15%     C) 16%     D) 17%
13. At a height of 13 km above the sea level, the concentration of oxygen. [     ]  
A) Medium     B) High     C) Nil     D) Less
14. In bacteria, cellular respiration occurs in. [     ]  
A) Cytoplasm     B) Mitochondria     C) Nucleus     D) None
15. In the absence of oxygen this forms in muscles. [     ]  
A) Sugar     B) Starch     C) Ethanol     D) Lactic acid
16. The most commonly used sugar for deriving energy in living organisms is. [     ]  
A) Cellulose     B) Starch     C) Glucose     D) Sucrose

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17. Respiration in amoeba occurs by . [     ]  
A) Transpiration     B) Osmosis     C) Diffusion     D) Inhalation
18. Alveoli occur in [     ]  
A) Skin     B) Trachea     C) Gills     D) Lungs
19. Terrestrial animals take oxygen from [     ]  
A) Pond     B) River     C) Air     D) Sea
20. Cutaneous respiration occurs in [     ]  
A) Cockroach     B) Earthworm     C) Crab     D) Parrot
21. Skin has no respiratory role in [     ]  
A) Earthworm     B) Lizard     C) Frog     D) Salamander
22. Amphibious animal [     ]  
A) Leech     B) Earthworm     C) Frog     D) Cockroach
23. A flap like structure over wind pipe [     ]  
A) Tongue     B) Gillis     C) Epiglottis     D) Operculum
24. Gills are the respiratory organs in [     ]  
A) Fish     B) Frog     C) Pigeon     D) Butterfly.
25. Trachea are found in [     ]  
A) Earthworm     B) Cockroach     C) Fish     D) Frog
26. The rate of respiration in a new born child [     ]  
A) 18 times     B) 32 times     C) 26 times     D) 16 times
27. The structure that plays major role in respiratory moments is [     ]  
A) Epiglottis     B) Sinus venosus     C) Stomach     D) Diaphragm
28. Pulmonary respiration occurs through [     ]  
A) Skin     B) Gills     C) Trachea     D) Lungs
29. Photosynthesis takes place in [     ]  
A) Cytoplasm     B) Chloroplast     C) Mitochondria     D) Nucleus
30. Respiration occurs in [     ]  
A) Chloroplast     B) Cytoplasm     C) Mitochondria     D) All the above
31. Respiration takes place in the presence of [     ]  
A) Light     B) Chlorophyll     C) Optimum temperature     D) Moisture

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### II. Fill in the Blanks:

1. Exhaled air contains \_\_\_\_\_ and \_\_\_\_\_.
2. A flap like muscular valve controls movement of air and food is \_\_\_\_\_.
3. Energy currency of the cell is called \_\_\_\_\_.
4. Lenticels are the respiratory organs that exist in \_\_\_\_\_ part of the plant
5. Mangrove trees respire with their \_\_\_\_\_
6. The term \_\_\_\_\_ was derived from a Latin word 'respire'
7. The word 'respire' means \_\_\_\_\_
8. A textbook of 'Human Physiology' was written by \_\_\_\_\_ a renowned chemist around mid 19<sup>th</sup> century.
9. \_\_\_\_\_ and \_\_\_\_\_ did a comprehensive work on properties of gases.
10. The presence of \_\_\_\_\_ in exhaled air, turns lime water into milky white.
11. Air usually enters the body through \_\_\_\_\_.
12. Air is filtered in \_\_\_\_\_ which removes dirt in the air.
13. \_\_\_\_\_ is a sound box that contains vocal cords.
14. The interior lung is divided into millions of small chambers called \_\_\_\_\_.
15. A flap like valve that protects the wind pipe is \_\_\_\_\_ ..
16. \_\_\_\_\_ is important in guiding the function of epiglottis and passages of food and air.
17. A flexible flattened muscle called \_\_\_\_\_ helps the lungs in moving air into and out of them.
18. Our lungs are spongy and \_\_\_\_\_ in nature.
19. Lungs are protected by two membranes called \_\_\_\_\_
20. Gaseous exchange takes place within the \_\_\_\_\_ by diffusion.
21. The percentage of oxygen in inhaled air is \_\_\_\_\_
22. The percentage of oxygen in exhaled air is \_\_\_\_\_
23. Oxygen combines with hemoglobin to form \_\_\_\_\_
24. \_\_\_\_\_ is present in hemoglobin and \_\_\_\_\_ is present in chlorophyll.
25. In eukaryotic cells cytoplasm and \_\_\_\_\_ are the sites of the reactions.
26. Each ATP molecule gives \_\_\_\_\_ calories of energy.

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27. Energy is stored in the form of \_\_\_\_\_ bonds.
28. \_\_\_\_\_ is the most commonly used sugar for deriving energy in living things.
29. The first stage in respiration is called \_\_\_\_\_.
30. If oxygen is not available pyruvic acid is converted into \_\_\_\_\_.
31. Accumulation of \_\_\_\_\_ results in muscular pain.
32. When we undertake strenuous exercise, we built up what is called an \_\_\_\_\_.
33. We can remove dissolved oxygen from glucose solution by \_\_\_\_\_.
34. \_\_\_\_\_ is an energy releasing pathway.
35. In mangrove plants oxygen enters in, through specialized structures called \_\_\_\_\_.
36. Photosynthesis is an \_\_\_\_\_ process.
37. Respiration is a \_\_\_\_\_ process.

### III. Match the following:

#### I. Group-A

1. Lungs [       ]
2. Skin [       ]
3. Amoeba [       ]
4. Cockroach [       ]
5. Fish [       ]

#### Group-B

- A) Diffusion
- B) Pulmonary respiration
- C) Cutaneous respiration
- D) Summer sleep
- E) Tracheal respiration
- F) Winter sleep
- G) Branchial respiration

#### II. Group-A

1. Trachea [       ]
2. Mucous glands [       ]
3. Gill lamellae [       ]
4. Alveoli [       ]
5. Coelomic fluid [       ]

#### Group-B

- A) Frog
- B) Fish
- C) Cockroach
- D) Birds
- E) Mammals
- F) Protozoans
- G) Earthworm

#### III. Group-A

1. Stomata [       ]
2. Lenticels [       ]
3. Marshes [       ]
4. Mangroves [       ]
5. Mitochondria [       ]

#### Group-B

- A) Air spaces connecting stems.
- B) Cellular respiration.
- C) Exchange of gases.
- D) Aerial roots.
- E) On stem.
- F) Chloroplast.
- G) Respiratory system.



