Chapter Three

Concept of respiration and it's important to living organisms

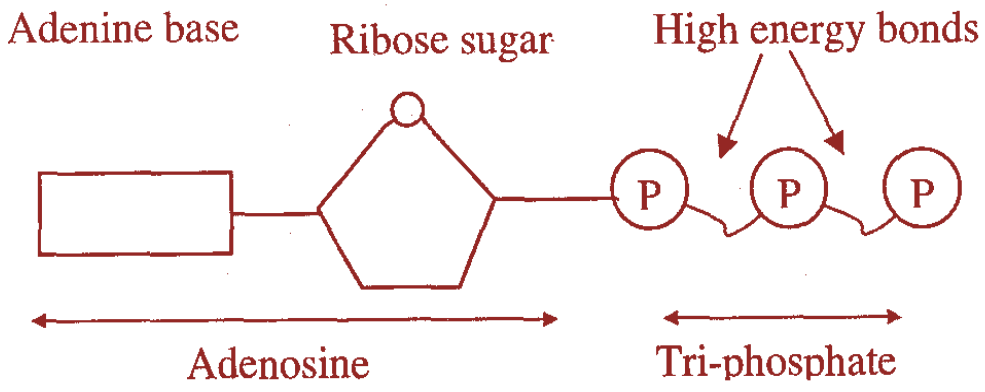
External respiration, internal respiration and cellular respiration

External respiration	*Internal respiration*	*Cellular respiration*
*Is also known as ventilation or breathing or gas exchange between air sacs (alveoli) **of** the lungs and blood*	*Is the gas exchange between blood and body cells?*	*Is the process in which energy is released (extracted) form chemical bonds in the food molecules*

i.e., the energy stored in the food molecules bonds is released when these bonds are broken down

* *This released energy is not used directly by the living organism, but it is used in producing molecules of adenosine triphosphate (ATP) inside its cells.*
* *ATP is the immediate source of energy in the cell. i.e., any energy required by the cell is obtained from ATP.*
* *ATP is considered as the pocket money or the international currency of the cell that can be spent and exchanged easily.*

Structure of ATP



ATP molecule is built from three sub- units, which are:-

Adenine	Ribose	Three phosphate groups
(a nitrogenous base)	(a 5-carbon or pentose sugar	Linked together by so weak bonds so they are easily broken releasing energy needed by the cell.

-In cellular reactions that need energy, only one of the bonds linking phosphate groups breaks down.

i.e., only one phosphate group is removed by hydrolysis of an ATP molecule, which becomes ADP + about 7-12k cal of released energy per molecule

-The process of cellular respiration starts with a glucose molecule, which is oxidized to release its stored energy

-The oxidation of glucose can be summarized by the following equation;

Oxidation of glucose molecule takes place in two stages;

1- The first stage Glycolysis

2- The second stage(Respiration) which is composed of two steps:

a- Krebs cycle

b- Electron transport system

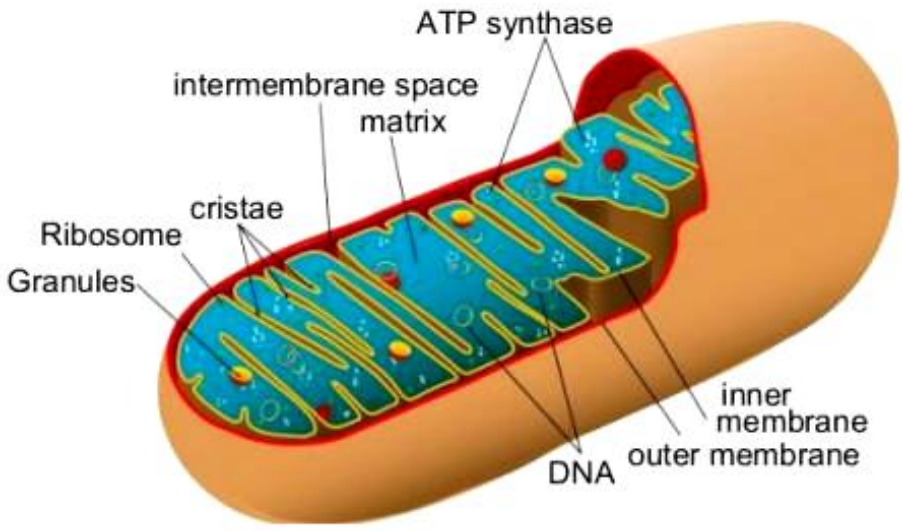
Glycolysis occurs in the cytosol (cytoplasm without organelles) of the cell, while the two steps of respiration occur inside the mitochondria.

The structure of mitochondria

Mitochondria are cytoplasmic organelles present in the cells of living organisms and they represent the center of respiration in the cell.

Each mitochondrion is bounded (enclosed) by two selectively permeable membranes

Mitochondrion under electron microscopic



Inner structure of a mitochondrion

-The external membrane is smooth, while the internal one is folded forming ridges called cristae (crista) which extend toward the interior of the mitochondrion, so, they increase the surface area of the inner membrane.

-In between the cristae is a dense fluid known as the matrix, which contains enzymes, co -enzymes, water, phosphates and other molecules.

-Some reactions of Krebs cycle take place in the matrix while the rest of reactions of this cycle and the reactions of electron transport occur in the inner membrane (cristae) where essential enzymes and electron carriers are present.

In the breakdown of glucose (Glycolysis) and in, Krebs cycle hydrogen atoms are removed from the carbon skeleton of glucose molecules and pass to co- enzymes act as hydrogen carriers or electron carriers

N.B. oxidation is loss of electrons and reduction is the gain of electrons.

One of these co- enzymes is NAV^{Y} (Nicotinamide adenine dinucleotide) which can receive a proton and two electrons to be reduced to NADI-1+11$^{'}$(°r to $NADH_2$ for simplicity)

Another co- enzyme is FAD (flavin adenine dinucleotide) which can receive two

hydrogen atoms (i.e. 2 protons and 2 electrons) to be reduced to FADH2

In the stage of respiration (electron transport system) both molecules $NADH_2$ and $FADH_2$ release their electrons down a chain of electron acceptors called cytochromes

Although these cytochromes are similar in structure they can carry electrons at different energy levels

So, when electrons descend step by step from higher to lower energy levels, energy is released.

- *This released energy is used to form ATP molecule from ADP and a phosphate group by a process called oxidative phosphorylation.*

When electrons reach the lowest energy level they combine together with protons to form hydrogen which combines with oxygen to form water.

CELLULAR RES PIRA LION

in Glycolysis, one molecule of glucose breaks down into two molecules of pyruvic acid, two molecules of ATP and two molecules of $NASH_2$ in the cytoplasm.

- *The two molecules of pyruvic acid pass from the cytoplasm of the cell across the outer and inner membranes of the mitochondria*
- *Before it reaches the matrix of the mitochondria (where Krebs cycle occurs) pyruvic acid is oxidized into 2- carbon acetyl group (by removal of CO_2 molecule), this is called decarboxylation:*
- *In these reactions a molecule of NADH is formed from $NAD^{\pm}$ molecule V.B. Two molecules of NADH are produced from the decarboxylation of the two pyruvic acid molecules*

in this way the original glucose molecule is oxidized into

2molecules of CO2

2acetyl group

4molecules of NADH

2 form Glycolysis

2 form oxidation of the two molecules of pyruvic acid

each acetyl group combines with a compound called co- enzyme A (CO- A) to give rise to acetyl co-enzyme A (or acetyl CO- A) or active acetic acid.

KREBS CYCLE (CITRIC ACID CYCLE)

- *This cycle was first discovered by Sir Hans Krebs in1937, for which he won the Nobel Prize in1953 and it includes two identical turns.*
- *Active acetic acid (acetyl CO A) joins Krebs cycle, where its co- enzyme (CO A) splits off to repeat its role.*

At the same time, the 2 carbon acetyl group combines with a 4 carbon oxaloacetic acid to form a 6 -carbon compound called citric acid.

Acetyl group (2carbon) oxaloacetic acid (4 carbon) ▸ Citric acid (6carbon)

In the pathway of the cycle, 2of the intermediate compounds are oxidized and two molecules of co_t are released.

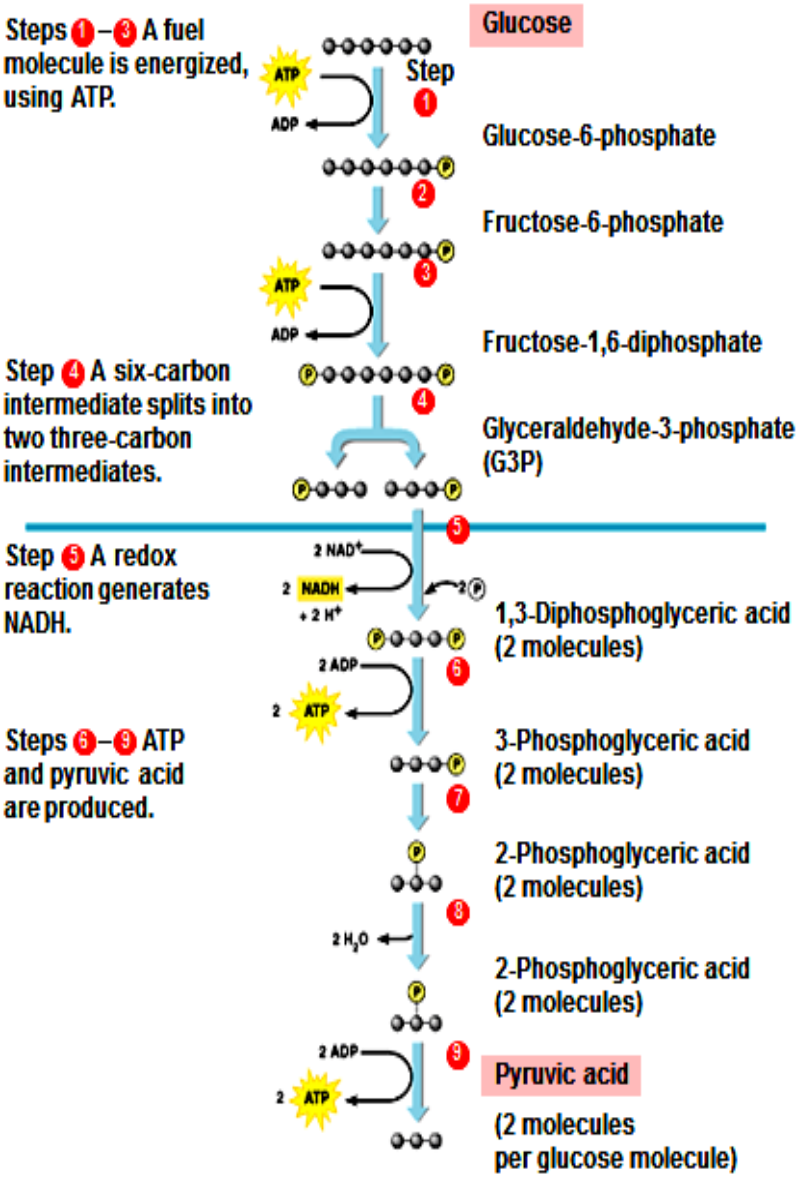
In each cycle, an acetyl group is used to give rise finally to oxaloacetic acid, which is ready to the cycle once more.

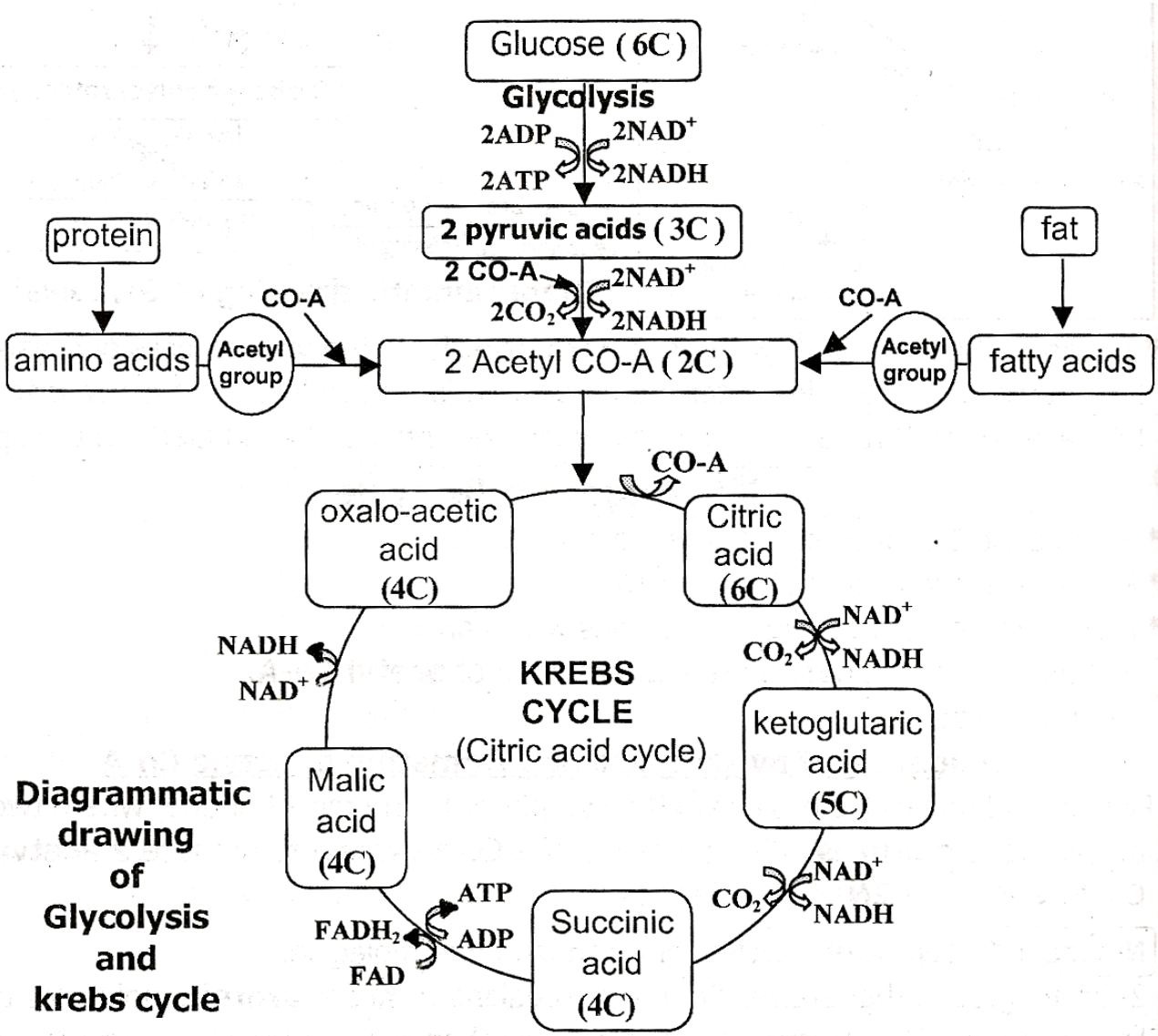
Glycolysis

Energy In: 2 ATP

Energy Out: 4 ATP

NET 2 ATP





Diagrammatic drawing of Glycolysis and krebs cycle

Along the steps of one turn of the Krebs cycle :-

part of the energy released from the oxidation of carbon the intermediate compounds used in convertingone molecules of ADP into ATP	***Another part of the released energy is used In producing NADH form NAD.***	**A third part is used in producing FADH2 form FAD**
One molecule in each turn of it cycle)	**(3molecules in each turn of the cycle)**	**(one molecule in each turn of the cycle)**

It is clear that Krebs cycle does not need oxygen because all electrons and protons (of hydrogen) removed during the oxidation of the intermediate compounds are received by NAD+ and FAD (not by oxygen) and oxidation is the loss of electrons.

i.e., in adding Krebs oxygen cycle, all intermediate compounds are oxidized by loss of electrons not by

Krebs cycle can be expressed by the following equation:

oxaloacetic acid + acetyl Co A + ADP+3NAD+ +FAD ⟶ oxaloacetic acid + 2CO2 + Co-A + ATP + *3NADH + FADH + 3Ir (3 protons)*

How many molecules of ATP are released from the oxidation of one glucose molecule?

The process	No. of produced mol. Of hydrogen carriers	No. of produced molecules of ATP
Glycolysis	**2NADH** **Produced directly** ⟶	**2x 3 ATP = 6 ATP** **2ATP produced directly**
oxidation of pyruvic acid acetyl group ⟶	**2NADH** ⟶	**2 x 3 ATP = 6ATP**
krebs cycle	**2NADH** **Produced directly** ⟶ **FADH2** **NADH**	**2x 3ATP = 6ATP** **lATP** **2ATP** **3ATP** **12 ATP x 2 = 24 ATP** **38 ATP molecule**

Electron transport

- *The glucose molecule is now completely oxidized.*
- *A part of its energy is used in producing ATP directly from ADP + phosphate groups (during Glycolysis and Krebs cycle)*
- *Most of glucose energy is transferred to the hydrogen carriers (NAD^+ and FAD where electrons are still in high energy level.*
- *At the last stage of respiration these high energy level electrons descend step!! step till they reach the low energy level of oxygen*
- *The energy released during this passage (descent) of electrons is used in a process, called oxidative phosphorylation form ATP molecules from ADP and phosphate group.*
- *In the chain of electron transport, electrons together with protons are transported (along certain carriers such as FAD and cytochromes.*
- *Each of these carriers can hold two electrons in their gradually decreasing energy levels.*
- *Finally the two electrons combine with two protons and an oxygen atom to form water according the following equation:*
- $2H^+ + 2e^-$ $O2 \longrightarrow H20$
- **N.B** *3 molecules of ATP are formed every time a pair of electrons is transferred through the entire carrier system.*

ANAEROBIC CELLULAR RESPIRATION

If oxygen is present, the organism uses the process of aerobic respiration to supply cells with energy	*If oxygen is absent or in low quantities the organism uses another process called anaerobic respiration or fermentation which does not need oxygen*

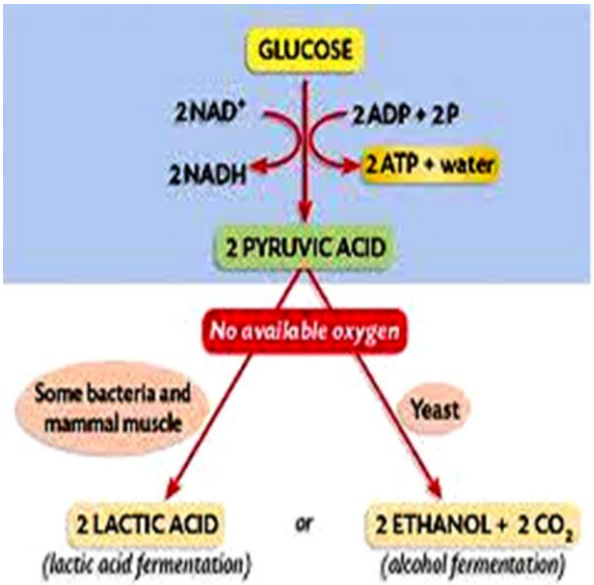
Anaerobic respiration starts the same way as aerobic respiration i.e. by Glycolysis (decomposition of a glucose molecule into two molecule of pyruvic acid) with the release of a small amount of energy (2 mol. of ATP)

Pyruvic acid is then converted into either ethyl alcohol or Lactic acid (not into active acetic acid)

A- In yeast fungus and other living organisms pyruvic acid converts into ethyl alcohol and CO_2 ***This process is called Alcoholic fermentation Which can be expressed by the following equation;*** **$C_6H_{12}O_6$ ⟶ $2C_2H_5OH$+ 2CO2 + Energy (2APP)** **Glucose ⟶ ethyl alcohol + carbon dioxide + 2ATP mol.** **This kind of fermentation is carried out by yeast fungus** **Ethyl alcohol is produced by this kind of fermentation**	**B - In case of animal tissues especially *muscle tissues*** ***If oxygen is insufficient for the muscle fibers to perform vigorous exercises, they convert pyruvic acid (pyruvate) into lactic acid, so, this process is called (lactic acid fermentation)*** **This process could be represented by the following equation ;** ***C6H1206 ⟶ 2C3I1603 + Energy (2ATP)*** ***This kind of fermentation is carried out by several kinds of bacteria*** ***Many milk products such as cheese, butter and yoghurt are manufactured by this kind of fermentation.***

-The energy released from anaerobic respiration is relatively low (2ATP) if compared with the large amount of energy stored in glucose

-In aerobic respiration a large amount of energy is released (38 ATP).



Representation of anaerobic respiration

Representation of anaerobic respiration

In case of unicellular organism oxygen needed for respiration, can be obtained directly from the respiratory medium (by diffusion) because the animal is directly exposed to the medium (air and water).	**- In case of large animals most of the body cells exist very deep away from the respiratory medium, so, the animal has a respiratory system which communicates between the blood and the respiratory medium In which it provides the blood with oxygen and takes CO_2 from it this is called gas exchange**

Gas exchange and cellular respiration

Gas exchange	*cellular respiration*
(between blood and lungs of the respiratory system) *In which oxygen diffuses from the Lungs to* **the blood and CO2 diffuses in the opposite direction, so,** *gases (O_2 and CO_2) are exchanged*	*In which the cell breaks down food molecules to release the energy used by the cell to perform its vital function. CO2 and 1120 are the final (waste) products of respiration which are carried by the blood from the body tissue to the lungs*

N.B :- Respiration in higher animals and man is carried out by the lungs

RESPIRATORY SYSTEM IN MAN

The air enters the body through the nose or the mouth, It is preferable (better) to breathe through the nose than through the mouth because the nasal cavity is warm (lined with blood capillaries), moist (secretes mucus) and acts as the filter (contains hairs which trap dust)

Air then passes through the pharynx (which is a common passage way for both air and food) than it enters the trachea (windpipe) through the larynx (voice box)

The trachea wall contains a series of cartilage rings (3/4 or incomplete rings) to keep it open passage way for air.

The lower part of trachea divides into to bronchi, each bronchus Divides and subdivides into smaller bronchioles which finally open into alveoli (air sacs)

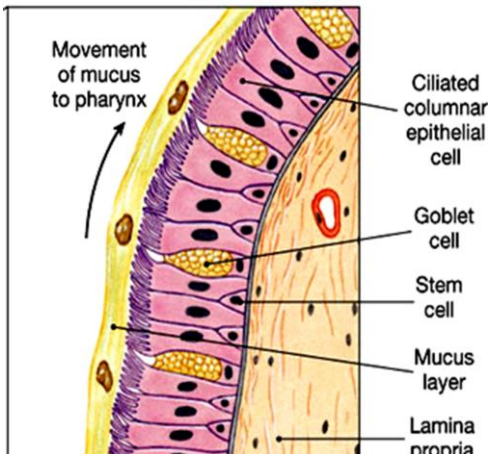
Summary **(organs of respiratory system)**

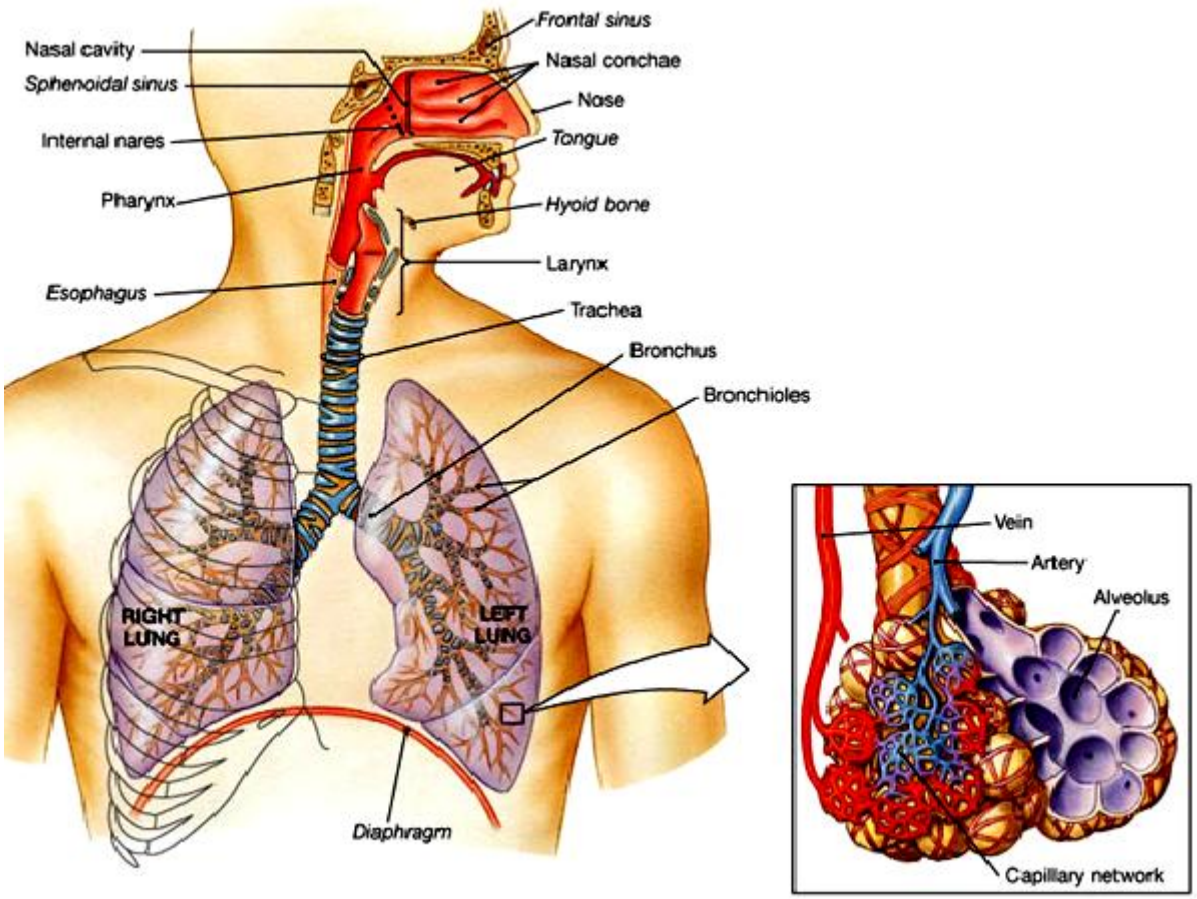
Nose Pharynx Larynx Trachea Bronchi Bronchioles Air sacs

There are about 600 million alveoli per each lung

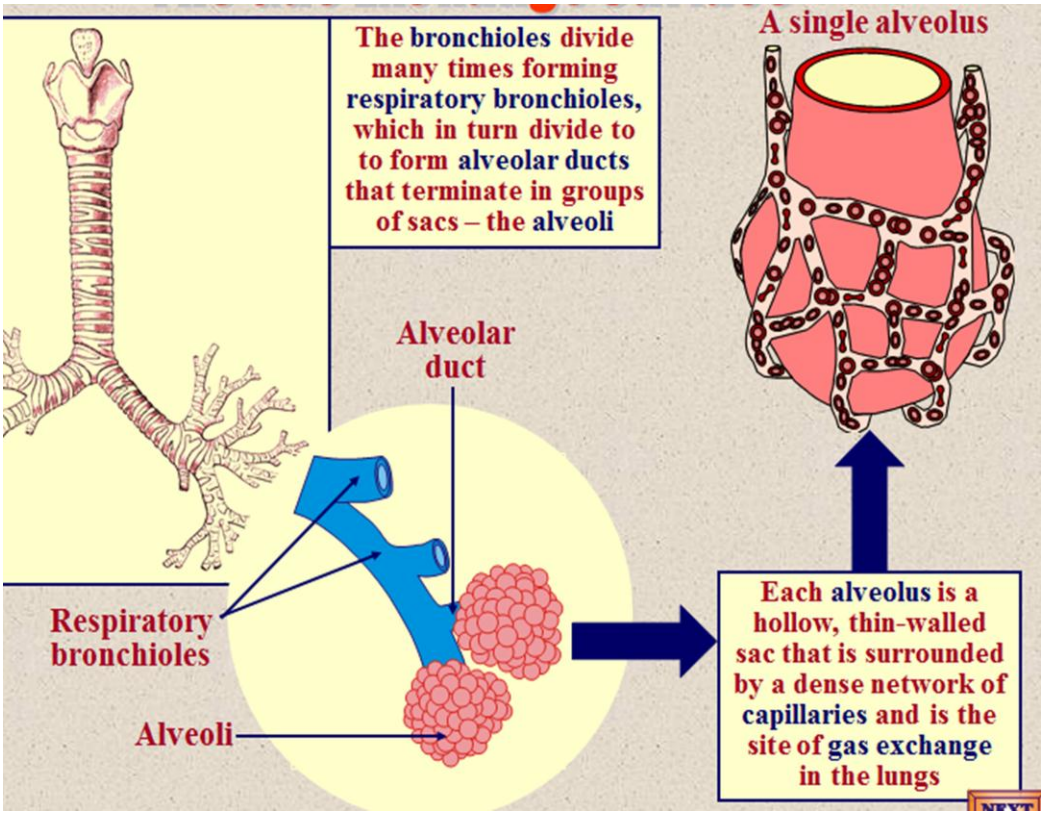
Alveoli have very thin walls surrounded with a la

to make gas exchange easier.





Respiratory system in man



1- ***Nose: air enters through the nose or the mouth, but through the nose is preferable from the hygienic point of view because***

a. ***Nose is lined by blood capillaries for warming the air.***

b. ***It secretes mucus that moisten the air.***

c. ***It contains hairs which act as a filter.***

2-.The Pharynx: air passes through pharynx, which is common passageway for air and food then enters the trachea through the larynx.

3. ***The larynx: (the voice box)***

4. ***The trachea:***

A)The trachea wall contains a series of 3/4 cartilage rings which prevent it from collapsing thus maintaining an open passageway for air.

B)The inner surface of trachea is lined with cilia which beat upwards to create air current this impedes the entry of foreign bodies and moves them to the larynx.

5.<u>The bronchi</u>: The trachea is divided at its lower end into two bronchi; each bronchus divides and subdivides into progressively smaller and smaller bronchioles

6.The bronchioles: Each bronchiole finally opens into one of the many alveoli 7.The alveoli (air sacs): The number of alveoli reaches about 600 million per lung

NB

a.Man has two lungs, a right and a left lung.

b.Each lung consists of bronchioles and alveoli together with the huge network of capillaries.

c.The alveolar walls are considered the actual respiratory surface because they are surrounded with a large network of blood capillaries where gas exchange takes place between the alveoli and capillaries, blood in capillaries receives oxygen from the alveolar air and carries it to the rest of the body, while the alveoli receive Coe from blood capillaries that it may get rid of.

RESPIRATION IN THE PLANT

In photosynthesis, green plants change light energy into chemical energy stored in high-energy complex organic food molecules.

(When the plant needs part of this stored energy, it releases this energy slowly in a chain of reactions which include the breaking down of carbon bonds of the food molecules.

This is called respiration in the plant, which could be:

Aerobic respiration	Anaerobic respiration
(if oxygen is present)	(if oxygen is absent)

1-Aerobic respiration in plants

- **Most of plants respire aerobically i.e. their cells need oxygen to release energy from food together with CO_2.**
- ***In most of plants each living cells are in direct communication with the environment, so, gas exchange is easy in which 0_2 diffuse inside and CO_2 diffuses outside the cell.***

In case of vascular plants, oxygen reaches the cell though various passage ways, such as

A. Stomata of the leaf:

- ***When stomata are open, air enters to the air chamber, and then diffuses through the intercellular spaces to various parts of the plant***

Oxygen diffuses through the cell membranes and dissolves in the cell water.

B)Some of the oxygen is carried through the phloem, Dissolved in water until it reaches stem and root tissues.

c)Oxygen may enter the plant through the root, Soluble in water of the soil solution

D) If the stem of the plant is green, air will enter the plant through stomata spread over the stem surface

E) Oxygen may get inside the through lenticels or any crack the bark of stems

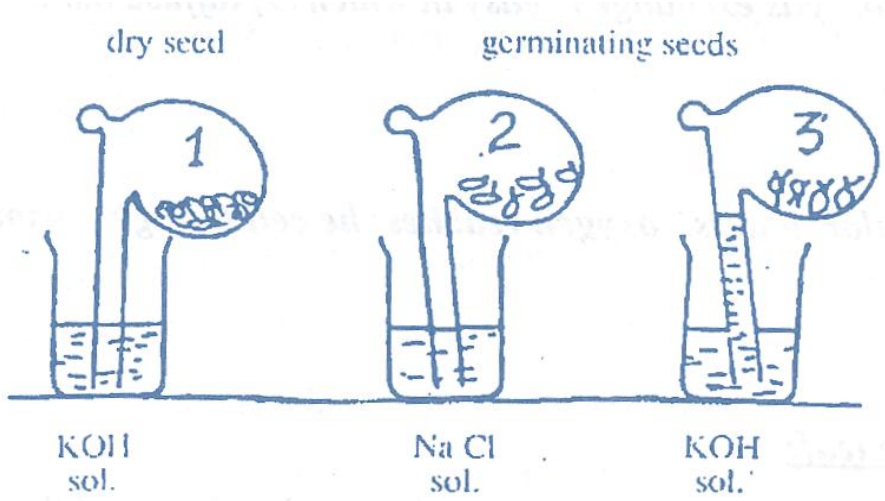
- **Also, the oxygen produced in the photosynthesis is used in aerobic respiration in the plant.**
- **CO_2 resulting from respiration of the plant is expelled by Diffusion from plum that are directly exposed to air or soil**
- **But, cells which lie deep in the plant may pass CO_2 to the xylem or phloem tissue which**

in turn carry CO_2 to stomata

- Part of CO_2 released in respiration, is used in photosynthesis
- So, most of gas exchange occurs directly because most of the plant tissues are in direct contact with the external environment.
- It also occurs between deep cells by mutual diffusion, or through xylem and phloem tissues.

Experiment:

To illustrate the evolution of CO, during aerobic respiration



Release of CO_2 during respiration of seeds

A-Non green parts of the plant (seeds)

1- Put some potassium hydroxide solution in a beaker, Put some dry seed (e.g. peas) in a glass retort,

Dip the end of the retort stem in the potassium hydroxide solution.

2-Put some sodium chloride solution in another beaker, Put some

Soaked (wet) seeds in another retort, Dip the end of the retort stem in the sodium chloride solution

Put other quantity of potassium hydroxide solution in the third beaker, Insert some of the soaked seeds in the third retort, Dip the end of the retort stem in the potassium hydroxide solution. 'Leave the three retorts for some time.

Observation

No change occurs in 1 and 2 while in 3 the potassium hydroxides solution rises in the stem of the retort

Interpretation:

- ***In retort (1), dry seeds do not respire, so, no change occurs***
- ***In retort (2) soaked seeds respire to get energy they need to germinate and grow***
- ***Seeds absorb oxygen from air and release an equal amount CO_2 which is not absorbed by sodium chloride solution***
- ***So, the components of the air inside the retort have changed but the total volume remains constant***
- ***In retort (3), the germinating seeds are respiring***
- ***The released CO_2 will be absorbed by KOH solution, so, it will rise up the stem of the retort***
- **So CO_2 is produced during respiration in non-green parts of the plant (seeds) By *comparing the 3 cases it is clear that***

1-Dry seeds do not respire actively

2-Germinating seeds respire actively and the volume of air remains constant during respiration because the released CO2 is equal in volume to the absorbed oxygen.

3-when germinating seeds (non-green parts of the plant) respire, they release carbon dioxide.

I. Respiration of green parts of the plant

1-take a green potted plant and places it on a glass plate, together with a small beaker containing clear lime water.

2-Invert a glass bell jar over the two, then cover the jar with a black piece of clothe stops the process of photosynthesis (which uses up CO2 inside

the bell jar which released during respiration)

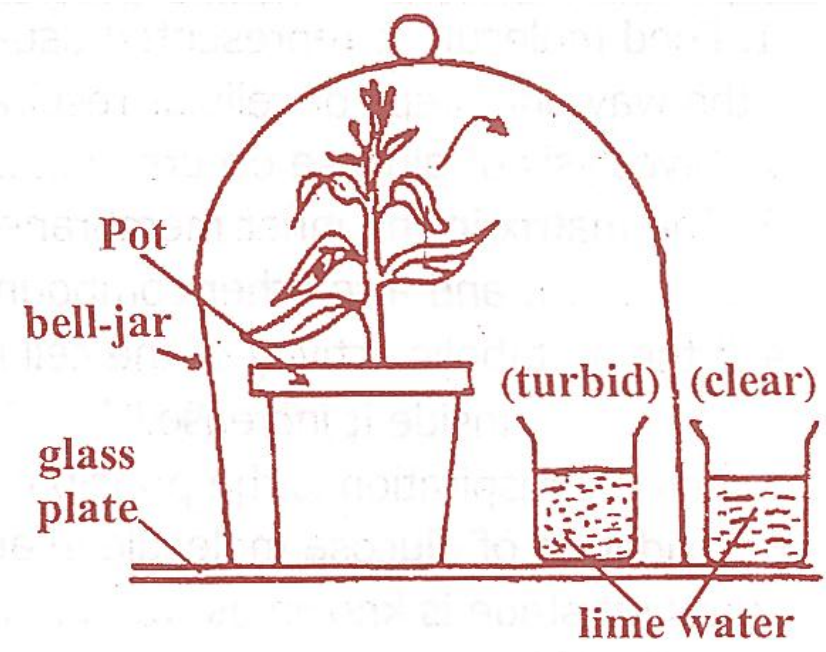
3-Prepare a similar apparatus, with the pot empty of any cultivated plant.

4-Put some clear lime-water in a small beaker

- *Leave the three for sometimes Observation:*

Observation:-

Lime-water becomes turbid (in 1 only)



Experiment to prove respiration in green plants

Interpretation:

In (1) the green plant in the pot respires and gives off CO_2 (which makes lime water turbid)

In (2) and (3), the lime-water does not become turbid due to the small percentage of CO_2 whether in the air of bell -jar or in atmospheric air So, the green plant releases CO_2 during respiration.

Experiment:

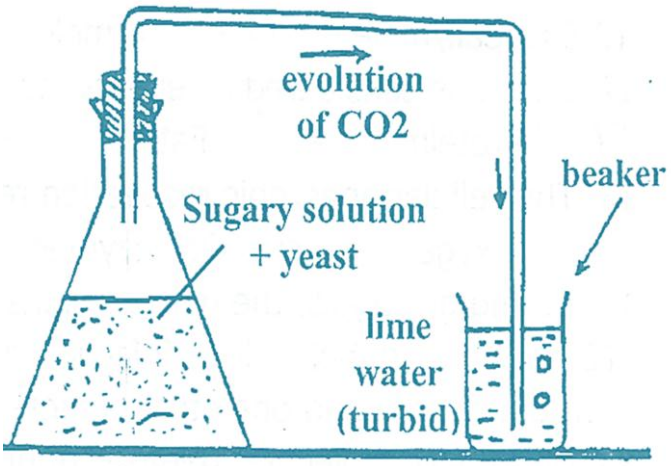
To illustrate the process of alcoholic fermentation:

Put a sugar solution or molasses diluted with the double of its volume of water in a conical flask.

- *Add some yeast and mix it thoroughly.*
- *Close the flask with a stopper through which delivery tube passes.*
- *Dip the free end of the delivery tube into a beaker containing lime-water.*
- *Leave the apparatus, in a warm place .for several hours.*

Observation

- *Gas bubbles are seen on the surface of the solution in the flask*
- *Lime- water has become turbid.*



Conclusion

- *As a result of anaerobic respiration in Yeast, co_2 is evolved which makes lime water turbid.*
- *Seeds of Angiosperms too, have the ability to respire anaerobically if they are kept under anaerobic conditions.*

General Questions on Cellular Respiration

Choose the correct answer:

1. ***The function of cellular respiration is to:***

   (a) make ATP (b) make NADH.

   (c) get rid of glucose. (d) get rid of carbon dioxide.

2. ***Each chemical reaction in cellular***

   respiration requires (a) a molecule of ATP.(b) a molecule of FAD.

   (c) a molecule of NAD (d) a specific enzyme.

3. *Which of the following molecules is glucose ?*

(a) C3 H 6 o 3 (b) C_3 H 12o6 (c) C_3 H 5 OH (d) $^{C}6\ ^{H}10$ o 5

4. *The term anaerobic means*

(q) with glucose. (b) with oxygen.

(c) without glucose. (d) without oxygen.

5. *Which of the following processes makes direct use of oxygen?*

(a) Glycolysis. (b) Fermentation.

(c) Krebs citric acid cycle. (d) Electron transport.

6. *Aerobic cellular respiration has three stages:.....,.....and.....*

7. *(a) What is the relation between aerobic cellular respiration and breathing? (b)What is the relation between the anaerobic cellular respiration (lactic aci fermentation) and breathing?*

Glycolysis

1- Glycolysis is a process found in

(a) eukaryotic cells. (b) anaerobic bacteria.

(c) most muscle cells (d) virtually all cells .

2- How many molecule of oxygen gas (0_2) are used during the glycolysis of one glucose molecule?

(a) 0 (b) 1 (c) 16 (d) 38

3- During glycolysis, glucose is split into

(a) two pyruvic acid molecule. (b) two lactic acid molecule. (c) one lactic acid plus one ethanol molecule. (d) two coenzyme A molecule.

4- Glyceraldehyde phosphate is oxidized during glycolysis. What happens to the hydrogen atom and electron that are removed during oxidation ?

(a) They reduce NAD+

(b) They oxidize NAD+

(c) They are transferred to pyruvic acid

(d) They are eliminated in the form of methane.

5- Which one of the following is not true of glycolysis?

(a) Substrate-level phosphorylation takes place

(b) The end products are carbon dioxide and water

(c) ATP is formed

(d) ATP is used.

6- During glycolysis,.....and.....are removed from the substrate and picked up by.....

7- The net result of the glycolysis of one glucose molecule is the formation. of

.....NADH and.....ATP.

8- When oxygen is available to a muscle cell, NADH formed during glycolysis dose not pass electrons to the electron transport system. Instead, it passes hydrogen atoms to

(a) acetyl coenzyme A.. *(b) pyruvic acid.*

(c) fructose. *(d) ADP.*

(10) Which one of the following processes releases a carbon dioxide molecule ?

(a) Glycolysis. *(b) Lactic acid fermentation.*

(c) Alcohol fermentation *d)Hydrolysis of glycogen.*

10- When a yeast is producing wine, which of the following is not formed ?

(a) Pyruvic acid *(b) Ethanol*

(c) carbon dioxide *d)Acetyl coenzyme A*

11- In fermentation the hydrogen atoms removed from glucose end up as part of a

*.....**Or**....., depending on the type of cell.*

12- In the production of wine, the glucose in fruit juice is converted by yeast to

..... This process is called.....

13- When not enough oxygen gets to muscle cells during a sprint, energy is provided by glycolysis of glucose to.....and then conversion of these molecules to.....

14- In the fermentation of one glucose molecule, there is a net gain of..... molecules of ATP.

15- In the conversion of pyruvic acid to acetyl coenzyme A, pyruvic acid is

(a) oxidized. *(b) reduced.*

(c) broken into one-carbon fragments

d)isomerized.

16- In the conversion of pyruvic acid to acetyl coenzyme A, NAD^+ is

(a) oxidized ***(b) reduced.***

(c) broken into one-carbon units. ***d) isomerized.***

17- The function of coenzyme A is to

(a) isomerized pyruvic acid. *(b) isomerized NAD+*

(c) activate the acetyl group(d) facilitate oxidative phosphoryl

18- **Glucose has.....carbon atoms, pyruvic acid has.....carbon atoms, and *the acetyl groups has.....carbon atoms.***

19- The formation of acetyl coenzyme A from pyruvic acid produces (in addition to acetyl coenzyme A): one molecule of .....one molecule of.....and

one molecule (ion) of.....

20- How many carbon atoms are in the oxaloacetic acid molecule, which joins with an acetyl group during step 1 of the krebs citric acid cycle ?

(a) 2 ***(b) 3*** ***(c) 4*** ***(d)6***

21- *How many carbon atoms are in a citric acid molecule ?*

(a) 2 (b) 3 (c) 4 (d) 6

22- *Oxidative decarboxylation, which occurs during step 3 and 4 of the krebs citric acid cycle, is the removal of both.....and..... _____ from a substrate at the same time.*

23- *FAD and $FADH_2$ are functionally most similar o.....and.....,also in the kerbs citric acid cycle.*

24- **A single turn of the kerbs citric acid cycle produces one molecule of.....one** ***molecule of.....two molecules of.....and three molecules of ..... For each glucose molecule processed, there are.....turns of the cycle.***

25- **At the end of the kerbs citric acid cycle, most of the energy removed from the glucose molecule has been transferred to**

(a) NADH and $FADH_2$ (b) ATP

(c) oxaloacetic acid(d) citric acid

26- **In the electron transport system, the final acceptor of electrons is**

(a) cytochrome b (b) cytochrome a_3 (c) oxygen

(d) uniquinone (substance Q).

27- **In the electron transport system, the final acceptor of protons is**

(a) cytochrome b (b) cytochrome a_3 (c) oxygen

(d) uniquinone (substance Q)

28- **The atom within each cytochrome molecule that actually accepts and releases electrons is**

(a) carbon (b) iron (c) zinc (d) oxygen

***29-* Most of the protons, which play a crucial role in oxidative phosphorylation, enter the mitochondrion as**

(a) glucose (C_6 H12 06) (b) pyruvic acid (C_3 H4 03)

(c) carbon dioxide (CO2) (d) oxygen gas (02)

***30-* Electrons enter the electron transport system as parts of hydrogen atoms attached to.....and.....**

***31-* In the electron transport system, each electron carrier in the series holds electrons at a.....energy level than the previous carrier.**

***32-* Energy released from electrons during electron transport is used to move.....out of the matrix into the intermembrane space of the4mitochondrion.**

-Energy stored in this way is then used to build.....

33- In aerobic cellular respiration, most of the ATP is synthesized during

(a) glycolysis (b) oxidation of pyruvic acid

(c) the krebs citric acid cycle (d) electron transport

34- The free energy change LAG from the conversion of one glucose to six molecules of carbon dioxide is -686 kal/mol, yet only about 266 kcal/mol of this is captured within ATP molecules. The rest is

(a) converted to heat. (b) lost within carbon dioxide.

(c) used to form lactic acid. (d) transferred

to water molecules.

35- In a eukaryotic cell, the breakdown of one molecule of glucose to six molecules of carbon dioxide causes formation of a total of.....molecules of ATP, of

Which.....are formed in the mitochondrion.

36- During electron transport, each molecule in the various phases of aerobic a maximum of.....molecules of ATP.

37- Disadvantage of using amino acids as fuels for cellular respiration in that the waste product ..... is formed, and it must be removed from the human **body by the.....which may become stressed from the overwork**

38- In a eukaryotic cell, glycolysis takes place.

a) within the nucleus. b) on the rough endoplasmic reticulum.

c) in the cytoplasm, but outside the organelles. d) within the mitochondria.

39- In a eukaryotic cell, the Kerbs citric acid cycle and terminal electron transport take place.

a) within the nucleus.

b) on the rough endoplasmic reticulum.

d) in the cytoplasm, but outside the organelles.

e) within the mitochondria.

40- The inner membrane of the mitochondrion is very selective about what it normally allows to enter the organelle.

One molecule it regularly allows in is

a) citric acid. b) ATP. C) pyruvic acid. d) glucose.

41- The inner membrane of the mitochondrion is very selective about what it normally allows to enter the organelle.

-One molecule it regularly allows in is

a) citric acid. b) ATP. C) pyruvic acid. d) glucose.

42- The electron chain is a group of molecules located in the

a) Inner membrane of the mitochondrion.

b) Store coenzyme A.

c) Increase the surface area of the inner membrane.

d) Increase the availability of phospholipids.

43- The function of the mitochondrial cristae is to

a) prevent escape of oxygen gas.

b) Store coenzyme A.

c) Increase the surface of the inner membrane.

d) Increase the availability of phospholipids.

44- Seven of the eight steps of the Kerbs citric acid cycle take place within the of the mitochondrion. Only the production of.....occurs elsewhere.

45- For animal cell, the main advantage of aerobic cellular respiration over lactic acid fermentation is that

a) more energy is released from each glucose molecule.

b) Less carbon dioxide is released.

c)More carbon dioxide is released.

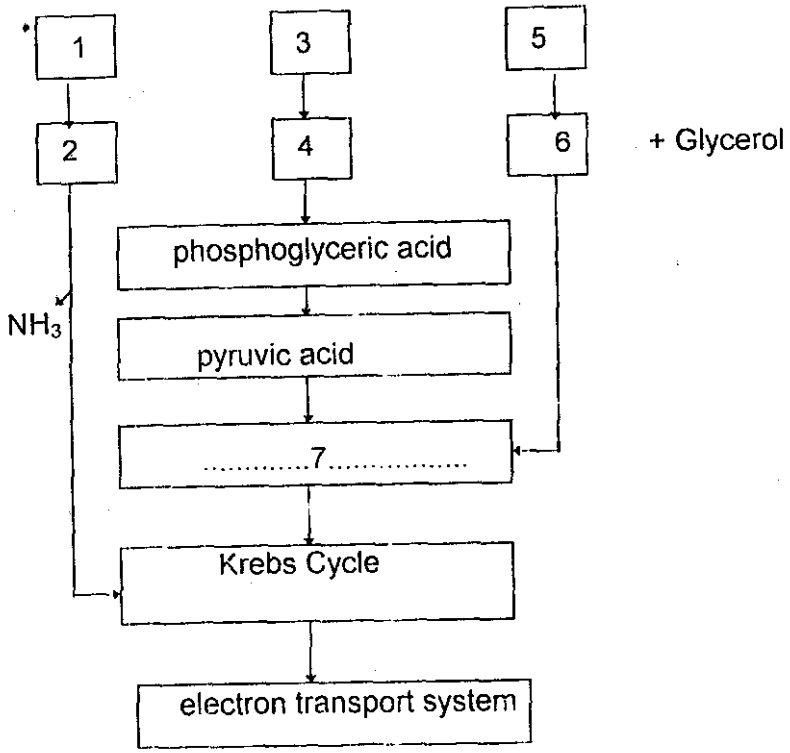
d)Fats and proteins are not used as fuel.

RESPIRATION IN THE LIVING ORGANISMS

EXERCISE I

These are some steps of cellular respiration

- Write the compounds in the squares from I – 7



2- Complete the following statements with suitable words

1- During respiration . food molecule is usually represented by a.....molecule

because it is used by the cells of most living organisms more than any other food molecule.

I- During anaerobic respiration, Pyruvic acid converts into..... or.....

2-.....molecules of ATP are produced during anaerobic respiration whileare produced during aerobic respiration.

3-The bronehioles end with.....which have.....walls.....which.....are surrounded by a network of.....

4- During anaerobic respiration, pyruvic acid converts into in.....yeast fungus nor converts into.....in the muscle cells..

EXERCISE 2

I- Complete the following statements with suitable Words

1. **Burning process differs from respiration process in that the energy from fuel oxidation is released once in the form of ..... while in case of respiration, the *energy is***

released gradually in the form of……

2. In wine production, glucose sugar in fruit juice converts by yeast into…… this reaction is known as……

3. In the last stage of respiration, both molecules of NADH and $FADH_2$ release their electrons down to.....

4-In the chain of electron transport, electrons are transported by certain carriers such as.....and.....each of these can hold.....in.....their.....gradually decreasing energy levels.

4. Alcoholic fermentation can be used in producing.....and.....

2- Match each statement of column (b) with the suitable one of column (a)

Column (A)	Column (B)
a. Oxygen is a ***b. Cytochromes are*** ***c.Lactic acid is***	*1.Final acceptor of electrons in aerobic respiration* **2. Final product of fermentation in yeast.** **3.electron acceptore** ***4. Final product of aerobic respiration.*** ***5.Final product of fermentation in muscles*** ***6.An important agent in protein formation***

3- Choose the right answer for each of the following:

1- The amount of released energy from the conversion of ATP into ADP is estimated. by about:

a) 2-6 Kilo - Calorie / mole b) 7-12 Kilo - Calorie / mole

c) 15-20 kilo - Calorie / mole d) 25-50 Kilo - Calorie / mole

2- The descent of high energy level electrons to low energy level and the use of the released energy to construct ATP from ADP is called:

a) krebs cycle b) oxidative phosphoryl3tion

c) Fermentation d) Splitting of glucose

3. The cellular anaerobic respiration requires the presence of:

a) Oxygen b) Carbon dioxide

c) Specific enzymes d) Ethyl alcohol

V. Give reasons for:

1. ***Krebs cycle doesn't need oxygen.***
2. ***Breathing through the nose is better for health***
3. ***Getting oxygen is always necessary***
4. ***Some times the living organisms tend to respire anaerobically***

EXERCISE 3

I- Choose the right answer for each of the following:

I. The active oxygen which takes part in the electron transport system enter as an atom of molecule

a) Glucose b) Pyruvic acid c) CO_2 d) 02

2. The total amount of energy released from complete oxidation of one molecule of glucose in the presence of oxygen is

a) One molecule of ATP b) 36 molecule of ATP

c) 38 molecule of ADP d) 38 molecule of ATP

3. The stored carbohydrates substance inside the animal tissues is called:

a) Starch b) Glucose c) Glycogen

d) Lactic acid

4. Complete Burning of one molecule of glucose needs that krebs cycle turns:

a) Twice / molecule ***b) Once /molecule***

c) Three times / molecule ***d) Five times / molecule***

5. While converting of pyruvic acid into A cetyl-Co A the NAD molecule will be

a) Oxidized *b) Reduced*

c) Broken - down to non-identical molecules

d) Broken - down to identical molecules

6. Conversion of C5 H12 0_6 into two molecules of C3 H5 03 and formation of two molecules of ATP indicates the occurrence of:

a) Aerobic respiration

b) Anaerobic respiration

c) Electron transport

d) Krebs cycle

7. During glycolysis, the glucose splits into:

a) Two molecules of pyruvic acid

b) Two molecules of lactic acid

c) One molecules of antic acid + one molecules of ethanol

d) Two molecules of Co-enyzme A

- Complete the following statements with suitable words

1) Glycolysis of... occurs in the cytosol, while and occur inside the

2)..... Glucose molecule is oxidized by removing hydrogen which is received by.....*SO, they convert into .....*

3.3) Hydrolysis of glucose occurs in..... of

.....

4.4)AS the metabolic activity of the ceil increases the number of inside it and the amounts of..... increase.

5) The inner membrane of the mitochondria contains .....and other molecules.

EXERCISE 4

I- Answer the following questions:

1. ***Explain the meaning of cellular respiration in the living Organisms***
2. **Explain how anaerobic cellular respiration takes place in the animal.**
3. **Where and how carbon dioxide is formed in mammals? Explain in details how carbon dioxide is transported to the lungs and then to the outside:**
4. ***Mention the names of the initial protracts of photosynthesis***
5. ***What could happen for each of these products inside the plant***
6. ***What is the importance of photosynthesis to mammals***

II- Complete the following statements with suitable words

1. ***Some reactions of krebs cycle take place in.....while the rest of reactions, together with the reactions of electron transport occur in.....***
2. *The conversion of pyruvic acid into acetyl co-enzyme-A produces one molecule o .....one molecule of..... and one molecule of.....*
3. ***Glucose contains..... carbon atoms, and pyruvic acid contains .....carbon atoms, and Acetyl group has.....carbon atoms.***
4. *During fermentation process, hydrogen atoms are taken off from*

the glucose and

..... Or …… are produced depending on the kind of the cell.

5. *In the plant, gas exchange occurs mainly by ....because most of the living*

   tissues are in direct contact with .....

6. *Fermentation process is catalyzed by a group of enzymes called.....*

7. **Match each statement of column (b) with the suitable one of column (a)**

Column (A)	Column (B)
a.Aerobic respiration is *b.Anaerobic respiration* *c.Electrons transport is* *d.Krebs cycle is*	*I. Decomposition of glucose molecule and release] of great amount of energy (38 ATP molecules).* *2. Decomposition of sucrose molecule and release of great is amount of energy (38 ATP molecules).* *3. Decomposition of (2) molecules of glucose and releasing of great amount of energy (38 ATP molecules).* *4.Decomposition o one molecule of glucose and releasing of small amount of energy (2 ATP molecules).* *5.It occurs two times for each glucose molecule including decomposition Of pyruvic acid into Acetyl-co enzyme A and ending with formation of oxalo acetic acid* *6.Transport of high energy electrons of high energy compounds such as (NADH) step by step from high energy to low energy level of oxygen.* *7.Combination of pyruvic acid with Acetyl Co-A and formation of citric acid.*

EXERCISE 5

I- **Match each statement of column (b) with the suitable one of column (a)**

Column (A)	Column (B)
a. Lactic acid is produced from b. pyruvic acid is produced from c. Citric acid is produced from	1. The split down of glucose molecule during glyolysis process. 2. The anaerobic respiration process in some of the animal tissues. 3. The combination of acetyl Co-A with oxalo acetic acid 4. The split-down of glucose molecule during anaerobic respiration as a final product in the yeast plant. 5. The split-down of sucrose molecule during aerobic respiration and releasing 2 ATP energy

II- Complete the following Statements with suitable words

I. A molecule of ATP is built up of three subunits, the first is..... which is a nitrogenous base, the second is a pentose sugar called.....and the third is.....

2. When ATP decomposes into ADP, an amount of..... is released which help to

3. Oxidation of glucose molecule takes place in two major stages, the first stage is known as....., the second stage is called .....which takes place in two steps,the first is.....and the final one is.....

4. Aerobic respiration is the principal way to obtain energy in presence of.....

5. ..... or fermentation occurs by the help of

.....enzymes group.

6. Anaerobic respiration starts by the decomposition of.....molecule into two molecules of.....

III- Choose the right answer for each of the following:

1. CO_2 molecule is released as a result of

a) Glycolysis ***b) lactic - acid fermentation***

c) Alcoholic fermentation ***d) hydrolysis of glycogen***

2. Every vital activity in the cells needs to:

a) A molecule of ATP b) A molecule of FAD

c) A molecule of NAD d) A certain enzyme

3. In eucaryotic cells, the krebs cycle and electron transport occurs:

a) Inside the nucleus ***b) in the endoplasmic reticulum***

c) Inside the cytoplasm ***d) Inside the mitochondria***

Explain with an experiment the alcoholic fermentation process, write down your observations conclusion and write down the equation of the reaction.

EXERCISE 6

1- *What is the difference between gas exchange and cellular respiration.*

2- *Trace the path of air through the respiration system of animals which respire through lungs from its entrance through the nose until its exit again.*

3- *Trace with drawing the path of oxygen from the exterior lentil it reaches the leaf cells of the a flowering plant.*

4- *What do you know about pyruvic acid? where and when is it formed in the living organism?*

5-What do you know about: a) ATP b) NAD c) FAD d) Co - A

6.What are the factors which help to raise the efficiency of Ventilations of the aquatic plants.

Complete the following statements with suitable words

1-.....Krebs cycle is started by a reaction of 2-carbon compound which is..... with a 4- carbon compound which is.....and..... is produced.

1-Krebs cycle turns ..... when a molecule of is completely oxidized.

4.It is more healthy to respire through the nose, because it is ..... and.....

5.The pharynx is considered as a common pathway for both and.....

6.The trachea is lined by to purify air.

7.Gas exchange in the green stems takes place through ..... while in the woody stems it takes place through

III- Choose the right answer for each of the following: 1.The cristae of mitochondria perform the function of

a) Preventing oxygen from escaping B)Store Co-enzyme A

C) increasing the surface area of the inner membrane

D)Increasing the vitality of the phospholipids

2. The final products of the cellular respiration is the energy besides:

a) 11$_2$0 and 02 b) $H_2$0 and CO2

c) Pyruvic acid and Co-enzyme A d) CO_2 and 02

3. The cellular respiration starts with a molecule.

a) glucose b) NAD c) ADP

d) protein

4. In the break-down of glucose and krebs-cycle the hydrogen atoms are removed from the carbon skeleton of glucose and pass to:

a) ATP molecule b) ADP molecule

c) Co-enzymes d) The nitrogen base

5. Muscle fibers which perform some vigorons exercises form high percentage of:

a) Lactic acid b) Pyruvic acid c) Citric acid

d)Acetic acid

EXERCISE 7

I- Choose the right answer for each of the following:

1- Oxidation of glucose during aerobic respiration occurs through:

a)Combination of glucose with oxygen by

b)Loss of glucose to hydrogen

c) Combination of glucose with hydrogen

d)Loss of glucose to electrons

2- Glycolysis of glucose occurs in:

a) The cells of eucaryotes b) The

bacterial cell

c) Most of the muscular cells ***d) Almost all the cells***

3- The number of carbon atoms in oxalo-acetic acid molecule which combine with a cetyle Co-A in the first step of krebs cycle is:

a) 2 ***b) 3*** ***c) 4***

d) 6

4-The necessary energy needed for the cellular activity becomes released after the conversion of

a) ATP into ADP *b) NAD^+ into NADH2*

c) $FADH_2$ into FAD ***d) ADP into ATP***

5- The following equation indicates to.....

Glucose Enzyme----> lactic acid + ATP

a) Hydrolysis ***b) Anaerobic respiration***

c) Aerobic respiration ***d) photosynthesis***

6- During inhalation in man the diaphragm:

a) Becomes more up ***b) Becomes more down***

c) Remains as it isd) Becomes more down then more up

7- Krebs cycle starts by the combination of:

a) A Molecule of A cetyl Co-enzyme A with citric acid

b) A Molecule of A cetyl Co-enzyme A with exam - acetic acid

c) An oxals acetic acid Wrath Co-enzyme A

d) Citric acid with Co-enzyme A

II- Answer the following questions:

1- Compare between burning a piece of sugar in the air and its burring inside a cell of a living organisms.

2- ***Do unicellular animals respire (as in case of amoeba)? if they are explain how does it take place.***

3- *The cellular respiration starts in the cytosol and ends in the mitochondria. Discus this statement and explain the steps which take place inside each of the cytosol and the mitochondria.*

4- *Explain with a drawing how energy is released in the chain of electron transport inside the mitochondria. Mention the role of cytochromes and FAD in the process.*

5- *Describe the structure of ATP molecule.*

EXERCISE 8

I- Answer the following questions:

1- ***Explain the process of electron transport in respiration and illustrate your answer with a drawing.***

2- ***Explain how oxygen reaches the cells of the Vascular plants of complicated structure.***

3- ***What is the importance of photosynthesis for respiration of plants and living organisms.***

4. *Explain how the plant gets rid of carbon dioxide resulting from respiration process.*

5. *What is meant by oxidative phosphorylation.*

II- Choose the right answer for each of the following

1- In eucaryotic cells, the splitting of glucose molecule occur in:

a) The nucleus ***b) The endoplasmic reticulum***

c) The cytoplasm ***d) Inside the mitochondria***

2- Respiration in the animal cell differs from fermentation in:

a) Releasing more energy from each molecule of glucose

b) Releasing less amount of CO2

c) Releasing of more amount of 02

d) Non using of fats and protein as a fuel

3- The molecule of ATP is formed of:

a) Adenine *b) Ribose (pentose) sugar*

c) Three phosphate groups *d) All the above*

4- Breaking down of one phosphate bond from ATP molecule leads to:

a) Formation of ADP and release of energy

b) Formation of ADP and no energy is released

c) Formation of ribose sugar

d) Formation of adenine base

5- Most of the respiratory enzymes and the co-enzyme are found in the cell in:

a) The nucleus ***b) The mitochordria***

c) The ribosome ***d) The plasid***

6- The substance which can not provide energy for the living cell is:

a) The carbohydrate ***b) The protein***

c) Water ***d) Fats***

7- The fatty acids enter the cellular respiration in the form of:

a) One carbon molecule ***b) Two carbon molecule***

c) Three carbon molecule ***d) Long chain of 13-19 carbon atoms***

EXERCISE 9

I- Answer the following questions:

1- Give short account on krebs cycle, illustrate your answer with drawing and write down the equation of the reaction.

2- Describe the mechanism of respiration in Man.

3- Explain with drawing an experiment to illustrate the release of carbon dioxide during aerobic respiration in the non - green pans of the plant. Mention your observation and the main conclusions.

4- *Explain with a drawing an experiment to illustrte the release of carbon dioxide during aerobic respiration in the green parts of the plant. Mention your observation and the main conclusions.*

5- *Compare between aerobic respiration and anaerobic respiration (fermentation) from the following points of view.*

a) The fuel ***b) the final product***

c) The amount of released energy

6- *Mention briefly the steps of glucose molecule oxidation and illustrate it with an equation.*

General Questions

Complete:

1-Fermentation in animal tissues happens by changing glucose into

2-During anaerobic respiration the pyruvic acid is changed into.....and in yeast plants.

3-During anaerobic respiration the oxidation of one glucose molecule produces 38

1- When the metabolism rate of the cells increases the number of.....increases.

2-During anaerobic respiration pyruvic acid is converted into either.....or .....according to the type of the cells.

Choose the correct words:-

-During cellular respiration glycolysis takes place in ....

[nucleus - endoplasmic reticulum - cytoplasm - mitochondria]

2-NAD molecule is.....when the pyruvic acid is changed into CO-A.

[oxidized -reduced - hydrolysed]

3-Molecules which perform high activities produce high percentage of

pyruvic acid - lactic acid - citric acid - acetic acid]

Write a short account on the role of oxalo acetic acid through Kreb's cycle

Correct without changing the underlined words.

1- During aerobic respiration, the oxidation of one glucose molecule produces 2ATP.

Give reason for :

1- Accumulation of Lactic acid in animal muscles after vigorous work.

Correct the only wrong word :

1- Electron Transport is the first step in the oxidation of glucose.

-Explain and Draw an experiment to prove that CO2 evolves during aerobic Respiration of plant parts which are not green - write an observation and results.

Write the scientific term:

A respiratory muscle which participates mainly on the mechanism of the respiration.

General question Group (b)

Complete each of the following :-

1. Food molecule is represented usually by molecule of .....during explaining the way and steps of cellular respiration.
2. Glycolysis of glucose occurs in .....inside .....
3. The matrix in the inner membrane of the mitochondria contains .....

   ,....., and also other compounds.

4 If the metabolic activity of the cell increases the number of..... and

   ..... inside it increase.

5. Aerobic respiration is the principal way to obtain energy in presence of.....
6. Oxidation of glucose molecule in aerobic respiration takes

place in three stages: the first stage is known as ....., the second stage is called .....

and the third is .....

7. A molecule of ATP is built up of three subunits, the 1st. is ..... which is a

nitrogen base, the 2nd. Is..... which is a pentose sugar and .....

8. After the oxidation of glucose molecule by taking off hydrogen from it, these atoms of hydrogen will be received by.....compound which is converted into

9. Glycolysis of ..... occurs in the cytosol, while ..... and ..... occur inside the mitochondria.

10. Oxidation of one glucose molecule in the presence of oxygen releases ..... ATP molecules.

* Choose the Correct answer

11. The amount of energy that released from the conversion of ATP into ADP is

(2-6 K. Cal./mole - 7-12 K. Cal./mole - 15-20 K. cal./mole - 25-30 K. cal./mole).

12. ..... is considered as energy stored food in cellular respiration.

(Proteins - Fats Enzymes – Glucose)

13. The cellular anaerobic respiration requires the presence of.....

(oxygen - specific enzymes - ethyl alcohol - carbon dioxide)

14. During glycolysis, the glucose splits into .....

(2 pyruvic acid molecules - 2 lactic acid molecules - 2 Co-A molecules - one lactic acid molecule and one ethanol molecule).

15. No. of ATP molecules releases during oxidation of glucose in the cytoplasm is

(38 ATP -36 ATP - 24 ATP -2 ATP)

16. The cellular respiration startes with a molecule of .....

(Glucose - ATP - NAD - Protein)

17. The living organism which converts pyruvic add into ethyl alcohol and CO_2 is (spirogyra - Amoeba- yeast - Euglena)

18. Muscle fibers which do heavy work produced a high percentage of

(Lactic add -pyruvic acid-citric acid - ethyl alcohol)

19. The substance that can not supply the cell with energy is .....

(carbohydrates – fats - water - proteins)

20. Energy released form cellular respiration is resulted due to conversion of.....(ADP to ATP - FAD into $FADH_2$ – NAD^+ to NADH - ATP to ADP)

***answer the following questions:-**

21. Write the terms indicated by numbers.

22. Mention the function on the figure no. 1

23. For what does this figure indicate.

Match :-

column (A)	column (B)
24. Oxygen is consider as	1. Final Product for electrons in aerobic respiration.
25. Cytochromes are consider as	2. Final Product in fermentation of yeast.
26. Lactic acid is consider as	3. Final Product of energy in case of anaerobic respiration.

Complete the following:-

27. Formation of acetyle Co-A from the pyruvic acid, produces one molecule of..... and one molecule of .....

28. Glucose contains ..... carbon atoms, pyruvic acid contains ..... carbon atoms, while acetyl Co-A consists of ..... carbon atom.

29. Krebs cycle turns ..... times when a molecule of

..... is completed oxidized.

30. Krebs cycle is started by a reaction of 2-carbon compound which is .....with a 4-carbon compound which is ..... to produce .....

31. When ATP decomposes into ADP then an amount of ..... is released which help to push .....

32. Burning process differs from respiration process in that, the energy from fuel oxidation is released in the form of ..... while in the respiration, the energy released in gradual steps in the form of.....

33. Aerobic or Anaerobic respiration starts by the decomposition of a glucose molecule into two molecules of .....

34. The hydrolysis of ATP molecule into ADP, the amount of energy that releases reaches about..... K. Cal./mole.

35. The universal energy currency of the cell is .....

36. NAD can receive ..... and.....to be thus reduced into NADH, while FAD can receive .....and ..... to be thus reduced into FADH2.

37. In the last stage of respiration, both molecules NADH, $FADH_2$ release their electron down a chain of electron carries called .....

38. In the last stage of electron transport chain, when electrons reach the lowest energy level, they combine together with ..... the form .....which combines with ..... to from .....

Choose the correct answer :-

10.The molecule of ATP is formed from.....

(Adenine - Ribose sugar - three phosphate groups - All the above)

12.The stored carbohydrates substance inside the animal tissues is called.....

1. **(starch - glycogen - glucose - lactic acid)**
2. **Complete oxidation of one molecule of glucose needs that krebs cycle turns**

..... (twice / molecule - one / molecule - three / molecule - 5 times / molecule)

15.....CO_2 molecule is released as a result of..... (glycolysis - alcoholic fermentation - hydrolysis of glycogen - lactic acid fermentation)

3. **Most enzymes and Co-enzymes for cellular respiration are found inside the cell in .....(nucleus - mitochondria - ribosomes - plastid)**

17.....In the break down of glucose and krebs cycle, the hydrogen atoms are removed from the carbon skeleton of glucose to pass to.....

4. **(ATP molecule - ADP molecules - Co-enzymes - nitrogen bases)**

18.....During inhalation in Man the diaphragm .....(becomes more up - becomes more down - Remain as it is - becomes more down then more up)

19.....Krebs cycle starts by the combination of .....

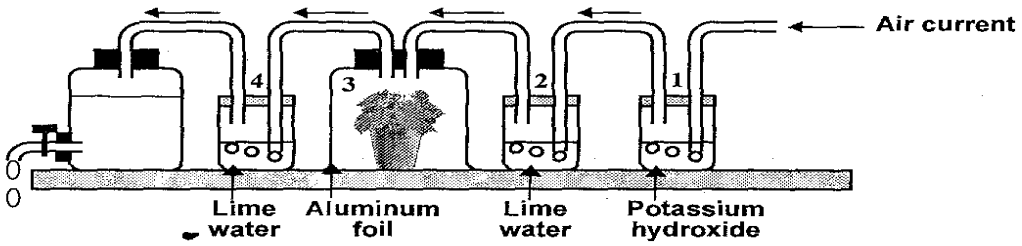
.a molecule of acetyl Co-A with citric acid. **• An oxaloacitic acid with Co-A.**

•a molecule of acetyl Co-A with oxaloacitic acid. **• a citric acid with Co-A.**

20.....Oxidation of glucose during the aerobic respiration occurs through .....

(combination of glucose with oxygen - loss of glucose to hydrogen - 21.combination of glucose with hydrogen - loss of glucose to electrons)

<u>study the illustrated experiment and answer the following</u>



49. the purpose or using potassium hydroxide *In* this experiment is .....

-absorbing 0_2 from the entering air. - absorbing humidity from the entering air.

-collecting 0_2 which reaches the plant . - preventing CO_2 from reacting the plant.

50. The purpose of using aluminum foil is .....

- to keep the heat inside the flask. - to keep the pressure constant.

-to prevent the plant from CO_2 production. - to prevent photosynthesis.

51. After 24 hours of the experiment, we find that lime water in flask no.2 is clear and flask no.4 is turbid, so we can deduce that .....-the plant produces 0_2 during respiration.....- the plant absorb CO_2 in darkness.

-the plant produce CO_2 in darkness. - caustic potash Sol. Produce CO_2 in flask no.1

-Match :-

column (A)	column (B)
52- Aerobic respiration is	1- Decomposition of glucose and release 38 ATP during respiration.
53- Anaerobic respiration is	2- Decomposition of sucrose and release 38 ATP during respiration.
54- electron transport is	3- Decomposition of 2 glucose molecules and release 38 ATP during respiration.
55- Krebs cycle is	4- Decomposition of one glucose molecules and release 2 ATP during respiration.
	5- Combination of oxaloacitic acid with acetyl - CoA to from citric acid that occurs 2 times for each glucose molecule.
	6- Combination of pyruvic acid with acetyl - CoA to from oxaloacitic acid.
	7- Compounds transport from high energy level such as NADH step by step to low energy.

Complete the following:-

56. The amount of energy from anaerobic respiration is ..... while that released from aerobic respiration is .....

57. Pyruvic acid is converted into ..... or..... during anaerobic respiration.

58. In chain of electron transport, electrons are transported by certain carriers such as .....

59. In the production of alcoholic drinks glucose sugar found in fruit juice is converted by yeast into

..... this reaction is known as.....

60. During alcoholic fermentation, glucose changes into ..... and .....

61. During anaerobic respiration, pyruvic acid is converted into ..... in yeast or converted into ..... in the muscle cells.

62. ..... or fermentation occurs by the help of..... group.

63. Anaerobic respiration starts by the decomposition of..... molecule into two molecules of .....

64. During fermentation process, hydrogen atom are taken off from the glucose and..... or ..... is produced depending on the kind of the cell.

65. The nose has .....which prevent the dust from entrance.

66. The trachea is divided at its lower end into two.....which divide and subdivide into .....

67. During expiration in Man, the intercostal muscles ..... and the diaphragm .....So, the internal pressure..... ....., this causes the air to be forced .....the lungs.

68. The pharynx is considered as a common organ for each of.....and .....

Choose the correct answer :-

69. The decent of high energy level electrons to low energy level and the use the released energy to convert ADP to ATP is called .....

(electron transport - fermentation - oxidative phosphorylation - splitting of glucose)

70. During expiration in Man the diaphragm .....

(rises - falls - remains immobile - falls and rises)

71. Conversion of glucose into two molecules of lactic acid and formation of two ATP molecules indicates .....

(electron transport - Krebs cycle - aerobic respiration - anaerobic respiration)

72. All the following are Co-enzyme except.....

(NAD^+ - FAD - NADP - CO2)

73. Muscle fibers which perform some vigorous exercises from high percentage of..... (lactic acid - pyruvic acid- citric acid -acetic acid)

74. The no. of ATP molecules that released from the oxidation of one glucose molecule in mitochondria during cellular respiration is .....

(38 molecules - 24 molecules - 36 molecules - 32 molecules)

75.Number of carbon atoms in oxaloacitic acid molecule which combine with acetyl Co-A in the first step of krebs cycle is (2 atoms -3 atoms - 4 atoms - 5 atoms)

75. What does the following equation indicate?

$$\text{Glucose} \xrightarrow{\text{enzyme}} \text{lactic acid} + 2\text{ATP}$$

hydrolysis - aerobic respiration - anaerobic respiration - photosynthesis)

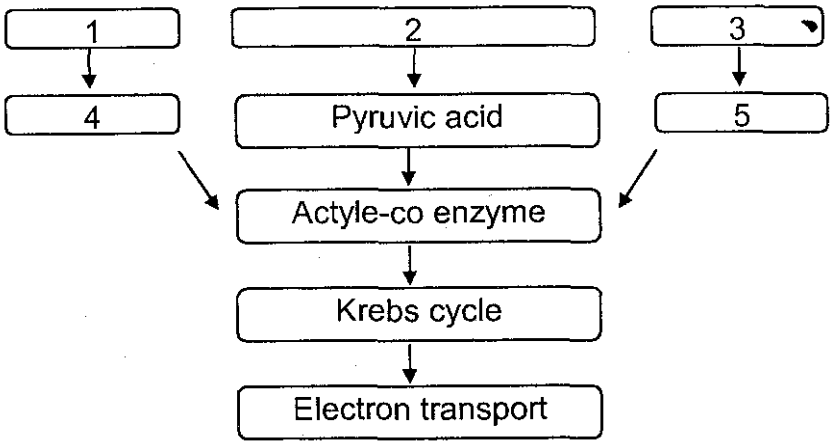
76. Cellular respiration differs from combustion as in respiration .....

(energy is respiration from bonds between carbon atoms - activation energy is required - CO2 is released as a waste product - energy released from it is stored in ATP).

78. (NAD^+ and FAD^+ compounds are considered

(pentose sugar - Co enzymes -nitrogenous bases- Enzymes)

79.These are some steps of cellular respiration, write the suitable compounds in the squares from 1 : 5.



Complete each of the following:

80.The trachea is lined by..... to purify air.

81.During inspiration, the intercostal muscles ..... and diaphragm ..... So,

the internal pressure , this causes the air to be forced ..... the lungs.

82.After the end of expiration, a part of air is always left in the lungs that help in.....and .....

83.The changes in the rate of respiration is accompanied with similar changes in..... which is regulated by..... in the brain.

84.The water that moistens the alveoli membranes is necessary for.....and.....