Respiration

The process of release of energy through enzymatically controlled biological oxidation of (food) organic material occuring in all living cell is known as Respiration.

On the basis of availability and utilization of oxygen, respiration is mainly of two types:-

[A] Aerobic :- It needs oxygen. Here free oxygen is utilized. More energy (38 ATP) is produced from one (1) molecule of glucose. The substrate is completely oxidised into carbon dioxide (CO_2) and water (H_2O). Found in all eukaryotes.

$$\underset{\text{(Glucose)}}{C_6H_{12}O_6} + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38ATP$$

[B] Anaerobic :- It doesnot need oxygen. It does not utilize free oxygen. Less energy (only 2 ATP) is produced. It may take place even in absence of oxygen. Food is incompletely oxidised and certain other, smaller, organic compounds are formed. Found in certain micro-organism e.g. Bacteria, Fungi, and some eukaryotic cells - e.g. muscle cells.

$$\underset{\text{Glucose}}{C_6H_{12}O_6} \longrightarrow 2\underset{\substack{\text{Ethyl alcohol}\\ \text{or}\\ \text{Lactic Acid}}}{C_2H_5OH} + 2CO_2 + 2ATP$$

Mechanism of Respiration :- It is devided into many stages:-

[A] Glycolysis:- 1. It takes place in cytoplasm hence also known as Cytoplasmic Respiration

2. It is discovered by Embden, Mayerhof and Parnas. In their regard it is also known as Embden, Mayerhof and Parnas and E.M.P Pathway.

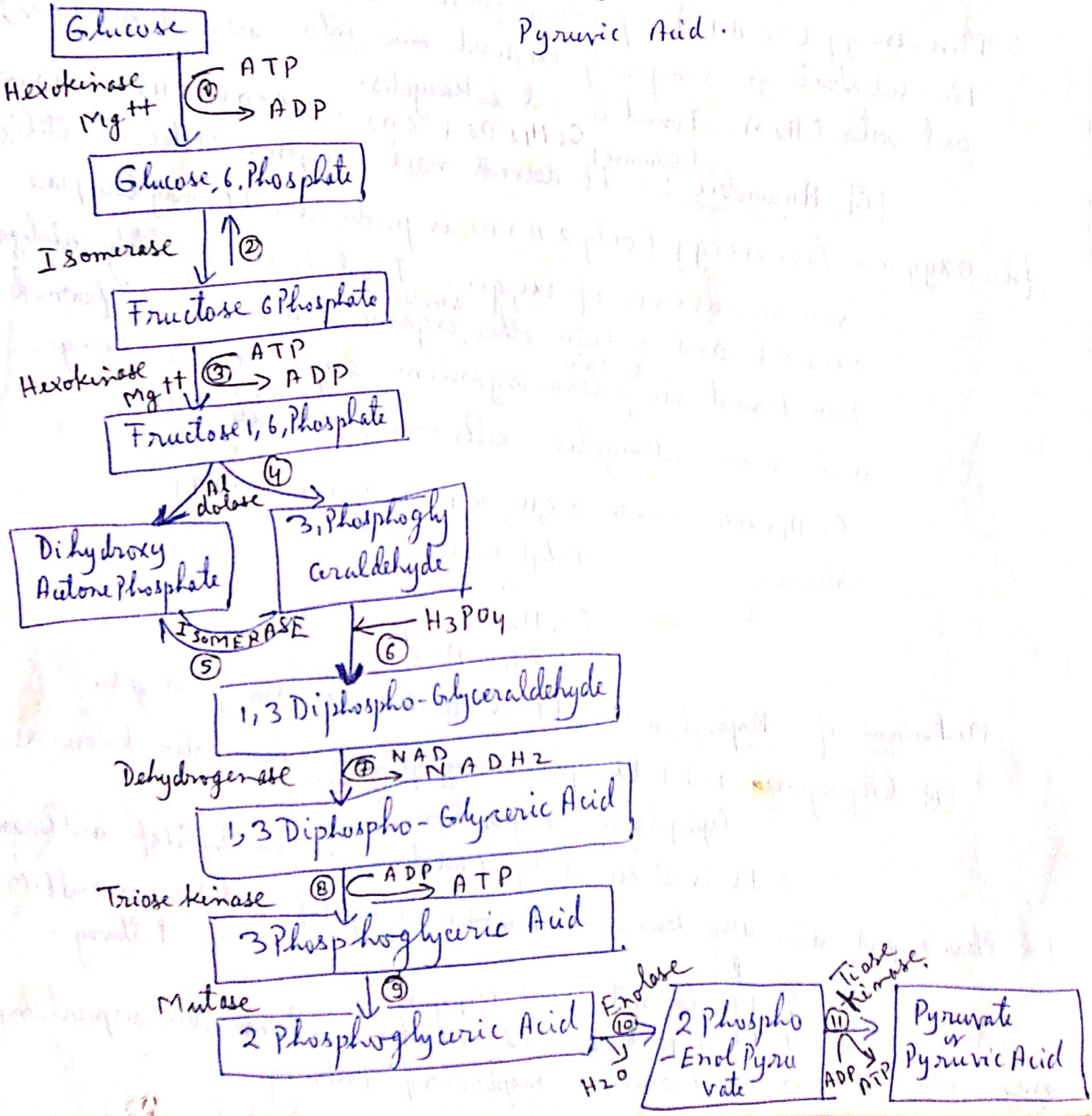
3. It does not need oxygen.

4. It is part of both aerobic and anaerobic respiration, hence also known as Common Respiratory Pathway.

5. It is stepwise enzymatic degradation of glucose to pyruvic acid.
6. It is broadly devided into 3 - stages.
   a) The conversion of Glucose to Fructose 1, 6, diphosphate.
   b) The splitting of Fr, 1;6, diphosphate into two 3-carbon compounds Dihydroxy Acetone Phosphate and 3-Phosphoglyceraldehyde.
   c) Conversion of 3-C compounds into Pyruvic Acid.

$$C_6H_{12}O_6 \longrightarrow C_3H_4O_3 \left(H_3-C-\overset{O}{\overset{\|}{C}}-COOH\right) + 2NADH_2 + 2ATP.$$

Pyruvic Acid.



Energy Status.

Substrate	Product	Step	Produced + Utilized
1. Glucose →	Gl, 6 Phosphate	→ Step (1)	— × × — 1 ATP.
2. Fr 6, Phosphate	→ Fructose 1,6 di Phosphate	→ Step (3)	— × × - 1 ATP.
3. 1,3 di phospho glyceraldehyde	→ 1,3 di phospho - Glyceric Acid	→ Step (7)	→ 2 × 1 ~~NADH2~~ ~~2 NADH2~~ = 2 NADH2
4. 1,3 diphospho Glyceric Acid	→ 3 Phospho Glycerate	→ Step (8)	→ 2 × 1 ~~ATP~~ ~~2 × 1 = 2 ATP.~~ 2 ATP
5. 2 Phospho enol Pyruvic Acid	→ Pyruvic Acid or Pyruvate	→ Step (11)	→ 2 × 1 ATP ~~2 × 1 = 2 ATP~~ = 2 ATP

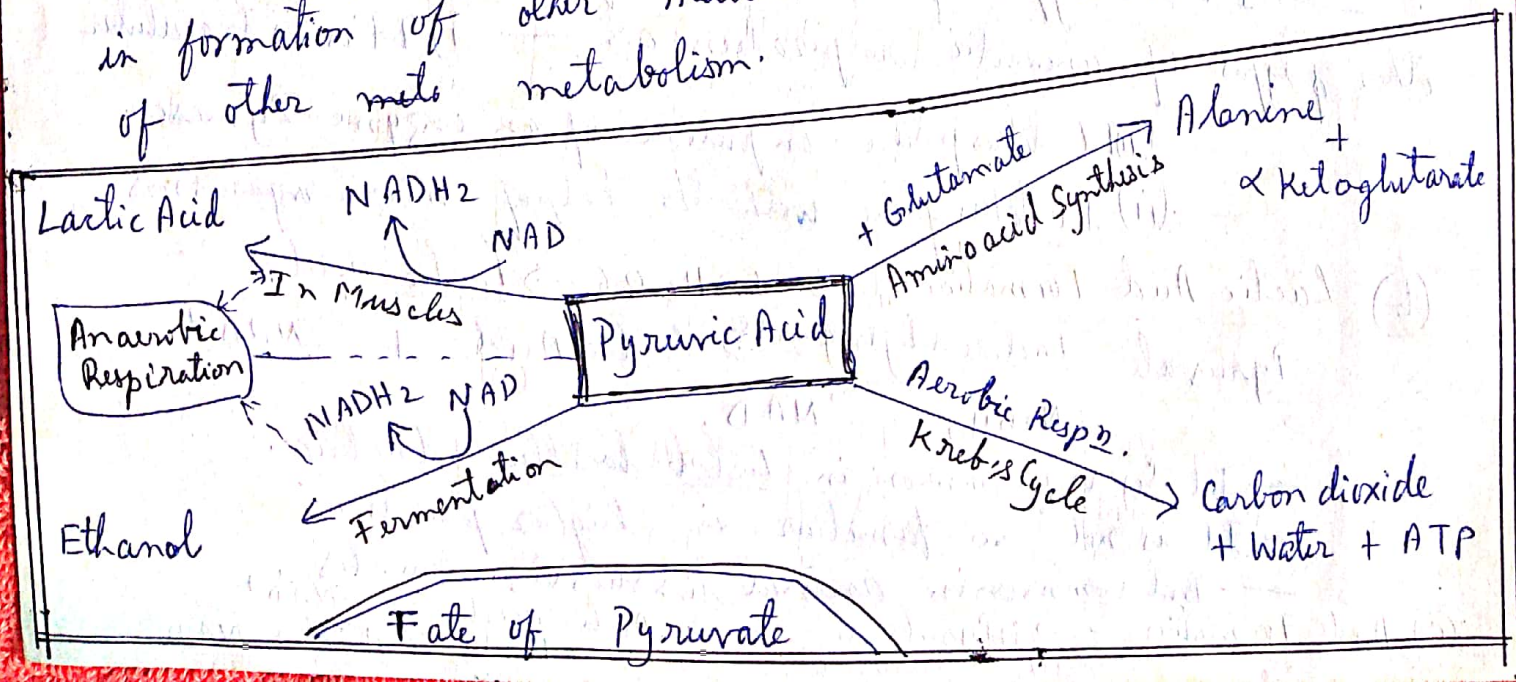
Sub-Total. → 2 NADH2 + 4 ATP — 2 ATP
& ~~4 ATP~~

Gain → 2 NADH2 + 2 ATP.

Net Gain in Glycolysis → 2 × 3 ATP + 2 ATP
= 6 ATP + 2 ATP = 8 ATP.

Direct ATP formed During Glycolysis = 2 ATP only.

The Pyruvate produced in Gly-colysis may be utilized in formation of other metabolites. It may be a substrate of other meta metabolism.



Fate of Pyruvate