Aerobic Respiration : A catabolic process in which complete oxidation of Respiratory Substrate in presence of O_2 take place to release energy (38 ATP) & forming CO_2 & H_2O.

Starch + H_2O —Amylase→ **Maltose** —Maltase→ **Glucose**

Sucrose + H_2O —Invertase→ **Glucose + Fructose**

Major Steps of Aerobic Respiration:

1. **Glycolysis :** Breaking of glucose to Pyruvate
2. **Link Reaction:** Oxidation of Pyruvate to Acetyl CoA
3. **Krebs Cycle:** Oxidation of Acetyl CoA to CO_2 H_2O release of energy as NADH & $FADH_2$
4. **Electron Transport Chain:** High energy electron of NADH & $FADH_2$ passes through sequence of electron carriers.
5. **Oxidative Phosphorylation:** Energy of electron is utilised in formation of ATP from ADP.

Glycolysis or EMP Pathway (Embden Meyerhof & Parnas Pathway)

A multistep metabolic pathway in all living organism to **partially breakdown glucose** with the help of enzyme in absence of O_2 .Occur in cytoplasm, common for both Aerobic & Anaerobic respiration

The scheme of glycolysis is given by Gustav **Embden,** Otto **Meyerhof**, and Jakub Karol **Parnas.**

Final products of glycolysis are two molecules of **Pyruvic Acid, 2- ATP and 2 NADH+H^+.**

Steps of Glycolysis

Step 1: Glucose Phosphorylation

Glucose (6C) + ATP —Hexokinase / Mg^{++}→ Glucose-6-phosphate (6C) + ADP

Step 2: Glucose-6-phosphate Isomerization

Glucose-6-phosphate (6C) ⇌ (Phosphoglucoisomerase / Mg^{++}) Fructose-6-phosphate (6C)

Step 3: Fructose-6-phosphate Phosphorylation

Fructose-6-phosphate (6C) + ATP —Phosphofructokinase / Mg^{++}→ Fructose-1,6-bisphosphate (6C) + ADP

Step 4: Splitting or Lysis of Fructose-1,6-bisphosphate

Fructose-1,6-bisphosphate (6C) —Aldose→ 3-Phospho Glyceraldehyde (3C) (PGAL) + Dihydroxyacetone phosphate (3C) (DiHAP)

Step 5: Dihydroxyacetone Phosphate Isomerization

Dihydroxyacetone phosphate (3C) ⇌ (Triose Phosphate Isomerase) Glyceraldehyde-3-Phosphate (3C) **(2 Molecules)**

Step 6: Oxidation and Phosphorylation of 2× Glyceraldehyde-3-phosphate

2× Glyceraldehyde-3-phosphate + **2×** P_i + **2×** NAD^+ —(Glyceraldehyde Phosphate dehydrogenase)→ **2×** 1,3-Bisphosphoglycerate (BPGA) + **2×** NADH + **2×** H^+

(Two redox equivalents are removed in the form of two Hydrogen Atom.)

Step 7: Substrate-Level Phosphorylation of 1,3-Bisphosphoglycerate

2× 1,3-Bisphosphoglycerate + ADP ⇌ (Phosphoglycerate kinase / Mg^{++}) **2×**3-Phosphoglycerate (PGA) +**2×** ATP

Step 8: Isomerization of 3-Phosphoglycerate

2× 3-Phosphoglycerate ⇌ (Phosphoglycerate mutase) **2×** 2-Phosphoglycerate

Step 9: Dehydration of 2-Phosphoglycerate

2× 2-Phosphoglycerate ⇌ (Enolase) **2×** Phosphoenolpyruvate (PEP) + **2×** H_2O

(Two water molecules are removed and PEP molecule undergoes rearrangement to change its phosphate group to high energy phosphate bond.)

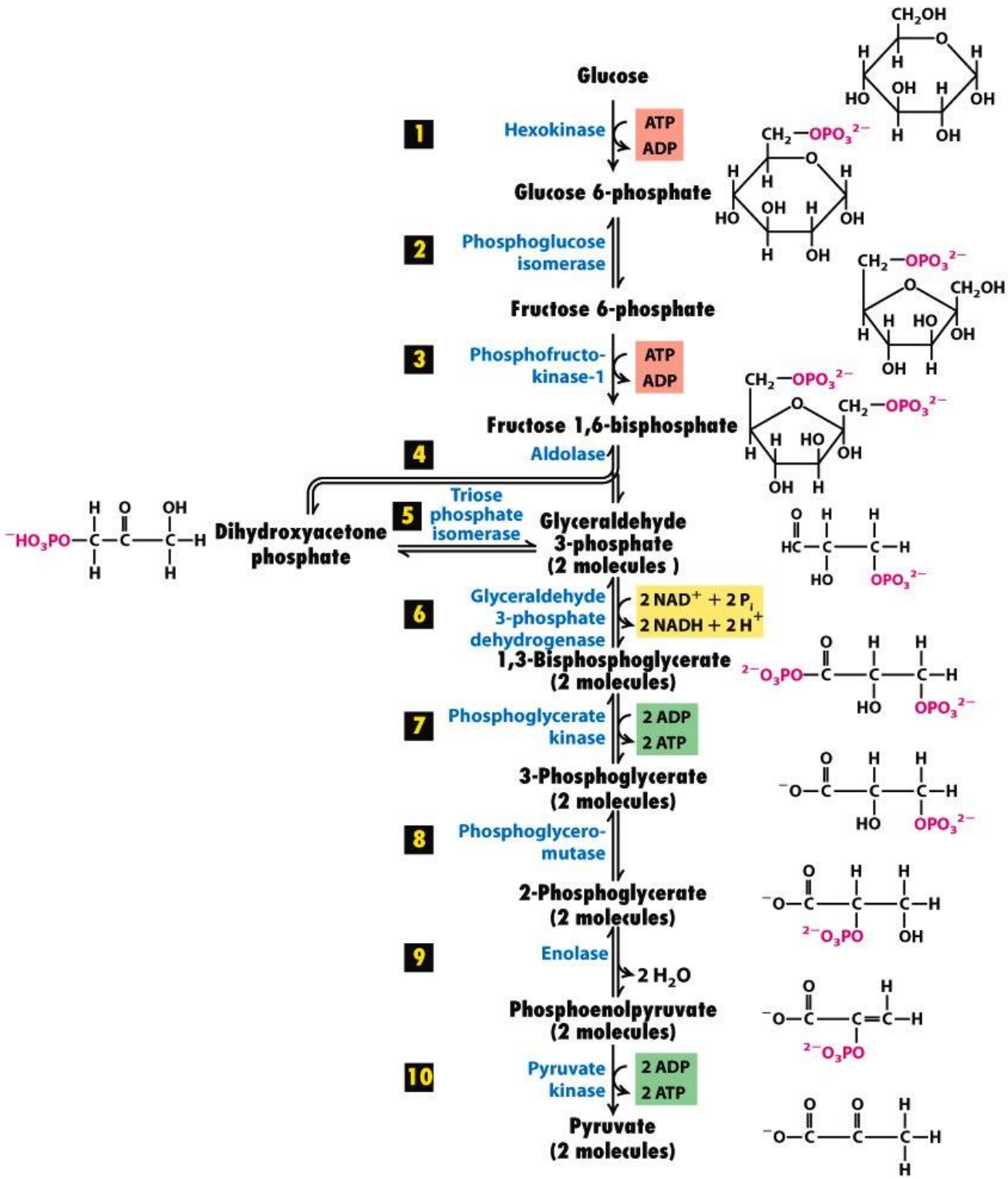
Step 10: Substrate-Level Phosphorylation

2× Phosphoenolpyruvate + **2×** ADP ⇌ (**Pyruvate kinase** Mg^{++} / K^+) **2×** Pyruvate + **2×** ATP

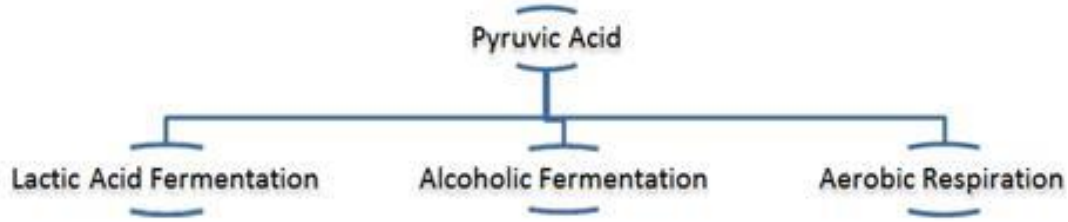
Mnemonics :

Guru	Glucose
Ganesh	Glucose-6-phosphate
Farmate	Fructose-6-phosphate
Fal	Fructose-1,6-bisphosphate
Dekar	Dihydroxyacetone phosphate
Ganga	Glyceraldehyde 3-Phospho
Bahate	1,3-Bisphosphoglycerate
Param	3-Phosphoglycerate
Pita	2-Phosphoglycerate
Pujiyne	Phosphoenolpyruvate
Paate	Pyruvate

Hasi	Hexokinase
Pal	Phosphoglucoisomerase
Pal	Phosphofructokinase
Aati	Aldose
Thi	Triose Phosphate Isomerase
Gauri	Glyceraldehyde Phosphate dehydrogenase
Par	Phosphoglycerate kinase
Pyaar	Phosphoglycerate mutase
Ek	Enolase
Pachtawahai	Pyruvate kinase



Fate of pyruvate:



• In Absence of Oxygen • Occur in Muscles • End Product is Lactic Acid • Total 2ATP produce	• In Absence of Oxygen • Occur in Organisms like Yeast • End Product is Ethanol & CO_2 • Total 2ATP produce	• In Presence of Oxygen • Occur in Mitochondria of Cell • End Product CO_2 & HO_2 • Total 38 ATP produce