GLYCOLYSIS

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INTRODUCTION

Glycolysis comes from a merge of two Greek word :

1. **Glykys** = sweet
2. **Lykys =** breakdown/splitting

It is also known as **Embden- Meyerhof prans pathway or EMP pathway.**

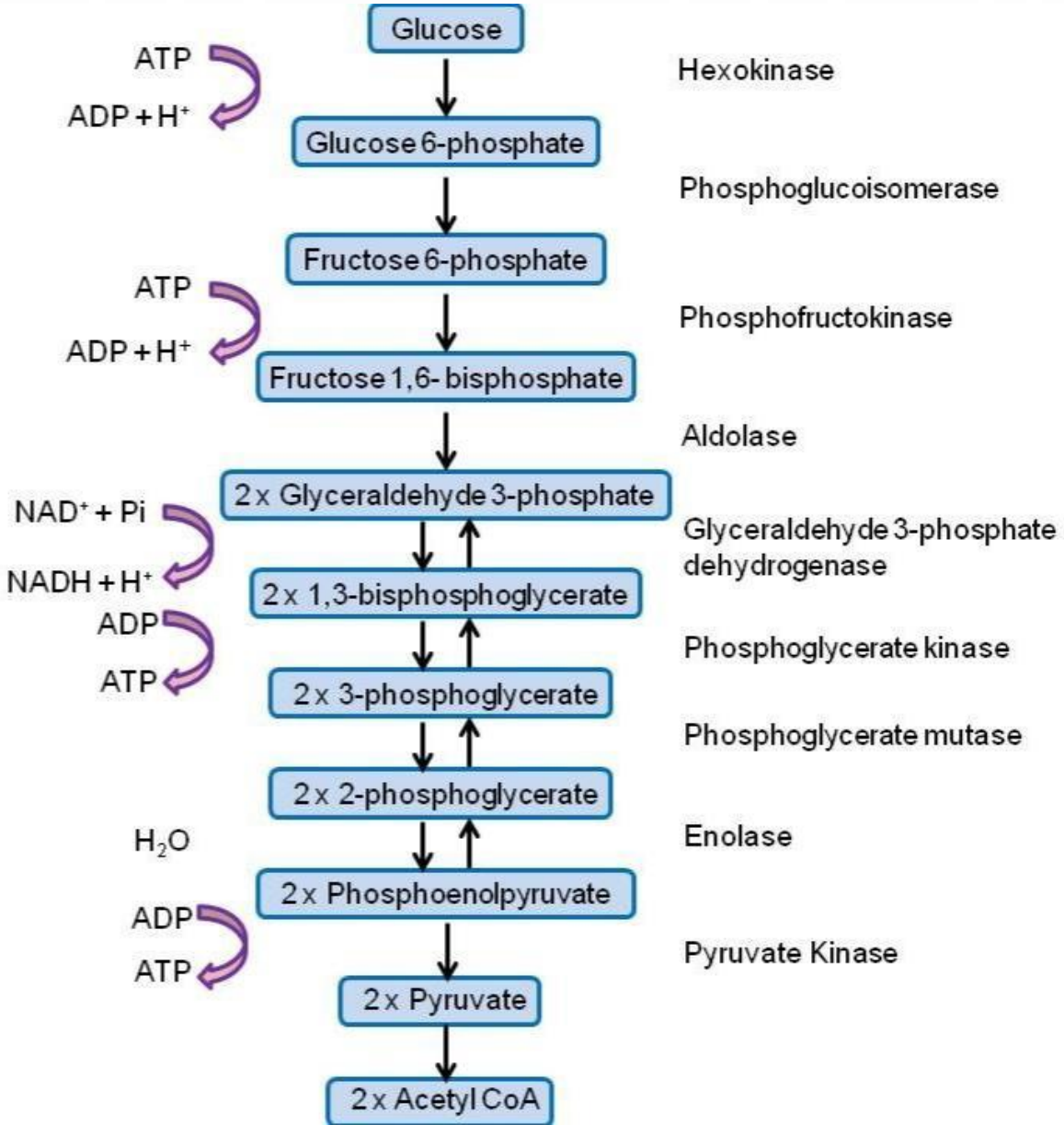
- Glycolysis is a series of enzymatic reactions that convert glucose into pyruvate, producing energy in the form of ATP.
- In this oxidative process ,1 mol of glucose is partially oxidised to 2 mol of Pyruvate .

Location : The major pathway of glucose metabolism occurs in cytoplasm of all cell.

Importance: Central pathway in cellular respiration and energy production.

- The unique pathway occurs aerobically as well as anaerobically and doesn’t involve molecular oxygen.
- It also include formation of lactate from Pyruvate.
- The glycolytic sequance of reactions difference from species to species only in the mechanism of its regulation fate of the Pyruvate formed.
- In aerobic organism, Glycolysis is the prelude to citric acid cycle and etc.
- Glycolysis is the central pathway for glucose catabolism

THE GLYCOLYSIS PATHWAY



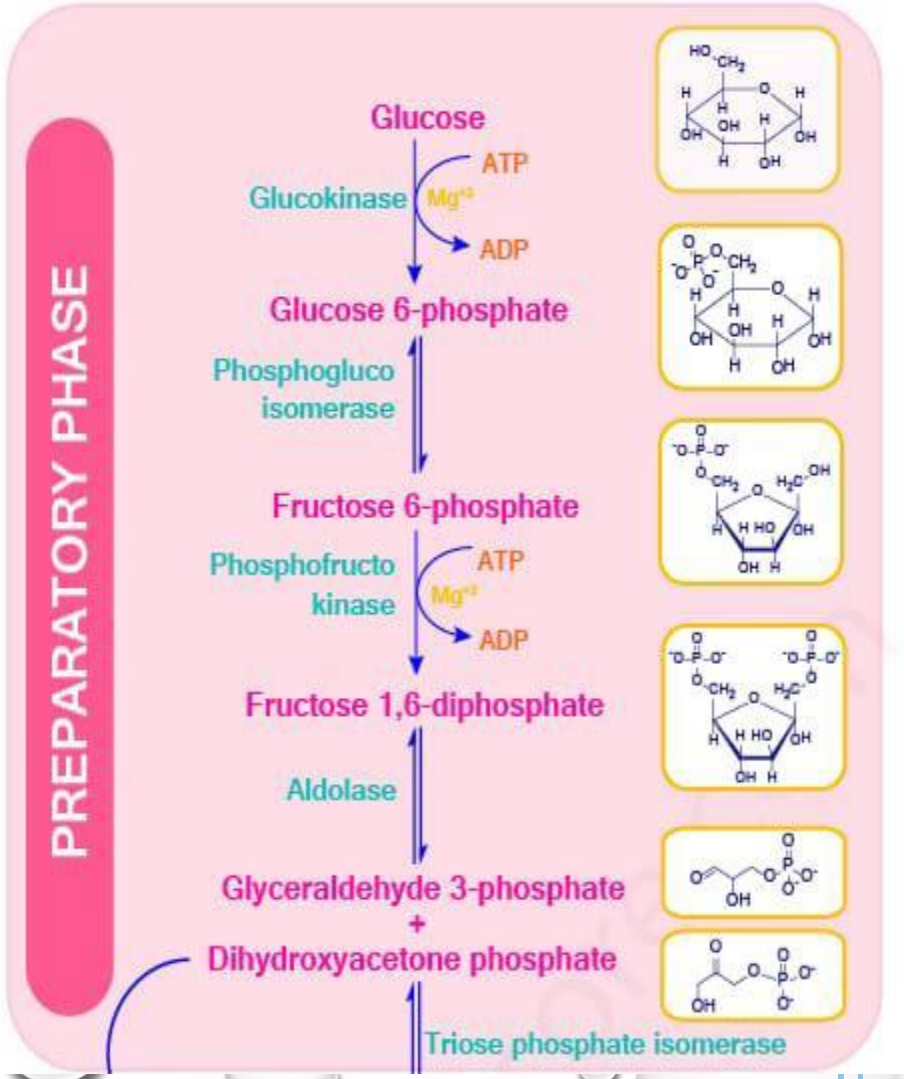
PHASES OF GLYCOLYSIS :

Glycolysis leads to breakdown of 6-c glucose into two molecules of 3-c pyruvate with enzyme catabolized reaction being bifructured or categorized into 2 phases.

- **Phase 1 : Preparatory phase**
- **Phase 2 : Payoff phase.**

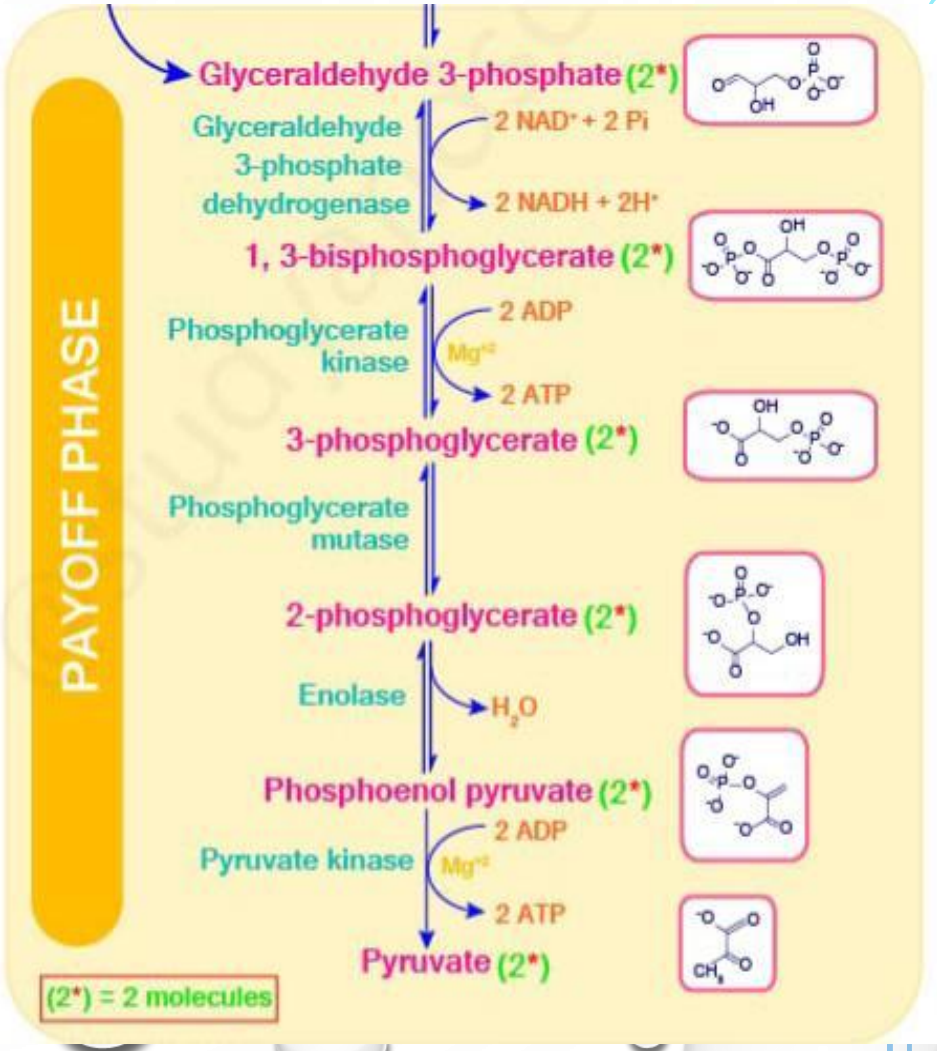
PREPARATORY PHASE

- In consist of the 1st step of glycolysis in which the glycose is enzymatically phosphorylated by ATP to yield fructose 1,6 biphosphate .
- This fructose 1,6 biphosphate is then split in half to yield 2 molecules of 3 carbon containing glyceraldehyde 3- phosphate / dihydroxyacetone phosphate.
- Thus the first phase results in cleavage of the hexose chain .
- This cleavage requires an investment of 2 ATP it for its cleavage into 3- carbon compound



PAYOFF PHASE

- This phase constitutes the last 5 reactions of Glycolysis.
- This phase marks the release of ATP molecules during conversion of Glyceraldehyde-3-phosphate to 2 moles of pyruvate.
- Here 4 moles of ADP are phosphorylated to ATP. Although 4 moles of ATP are formed the net result is only 2 moles of ATP per mole of glucose oxidized since 2 moles of ATP are utilised in phase 1.

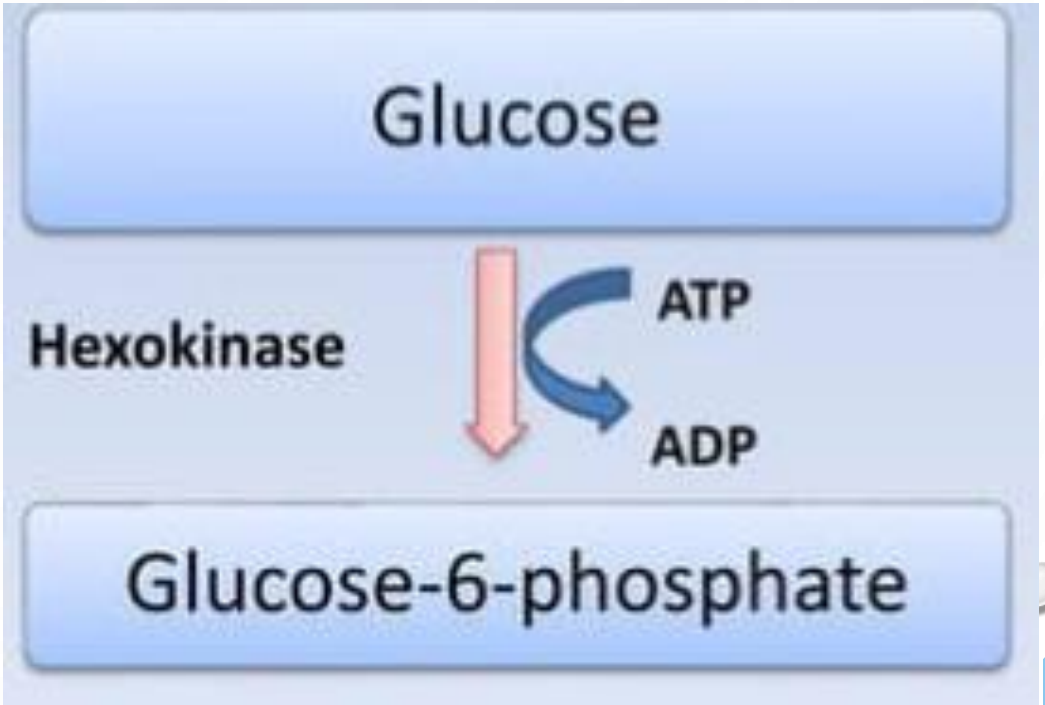


STEPWISE EXPLANATION OF GLYCOLYSIS

- **Step -1 PHOSPHORYLATION**

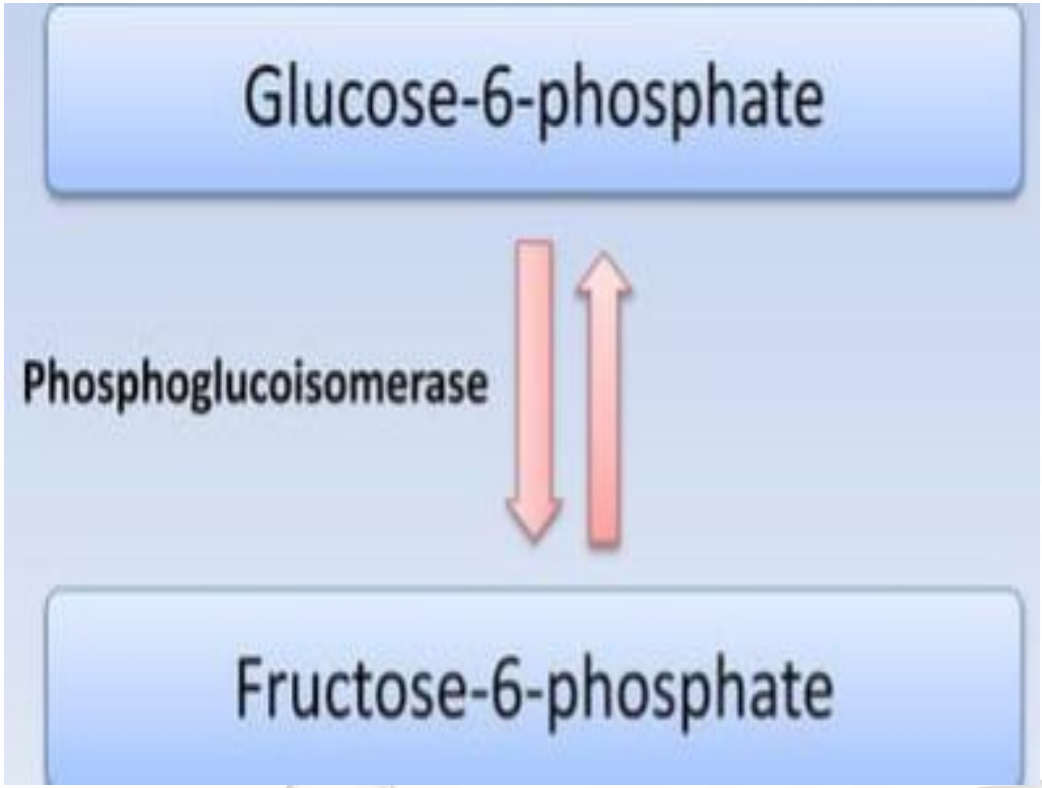
Glucose reacts with hexokinase by using ATP and convert into Glycose -6-phosphate.

KINASE : It is an enzyme which act Phosphorylation



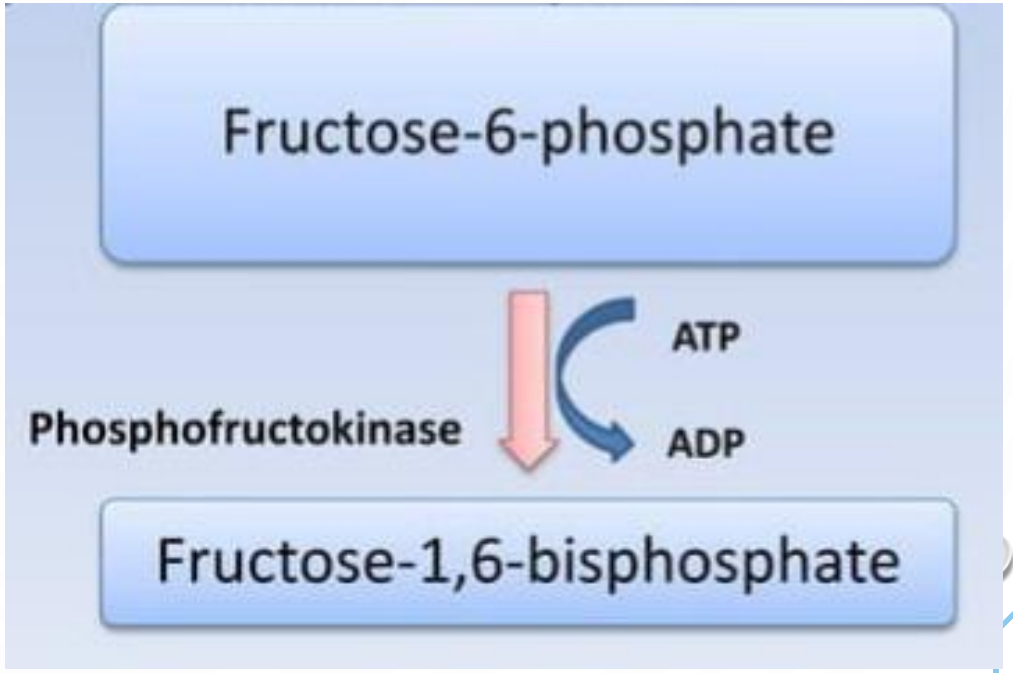
STEP 2 : ISOMERIZATION

- Glucose-6-phosphate again reacts with phosphohexose isomers to convert it into fructose-6-phosphate.



STEP 3 : PHOSPHORYLATION

- Fructose-6-phosphate reacts with phospho-fructo kinase to convert it to fructose-1-6-biphosphate



STEP 4 : BREAKDOWN

Fructose-1-6-biphosphate reacts with aldolase and breakdown into two parts Glyceraldehyde -3-phosphate (G3P) and Dihydroxy phosphate acetophosphate (DHAP)

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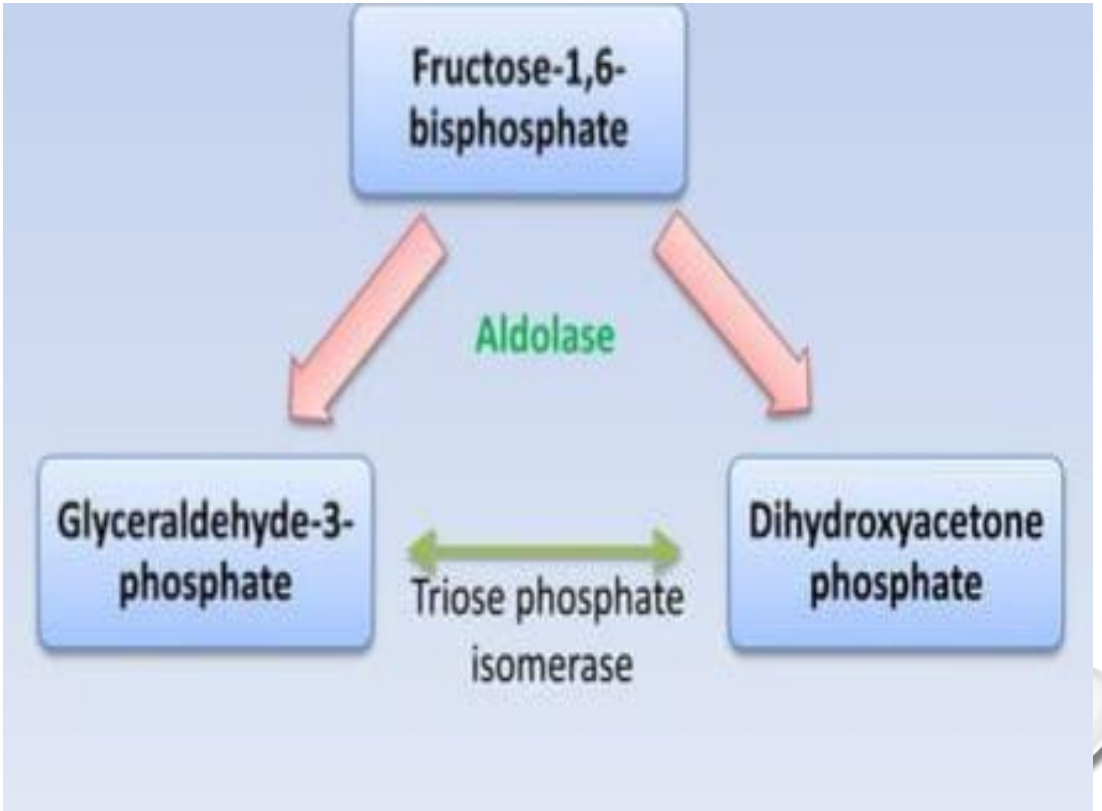
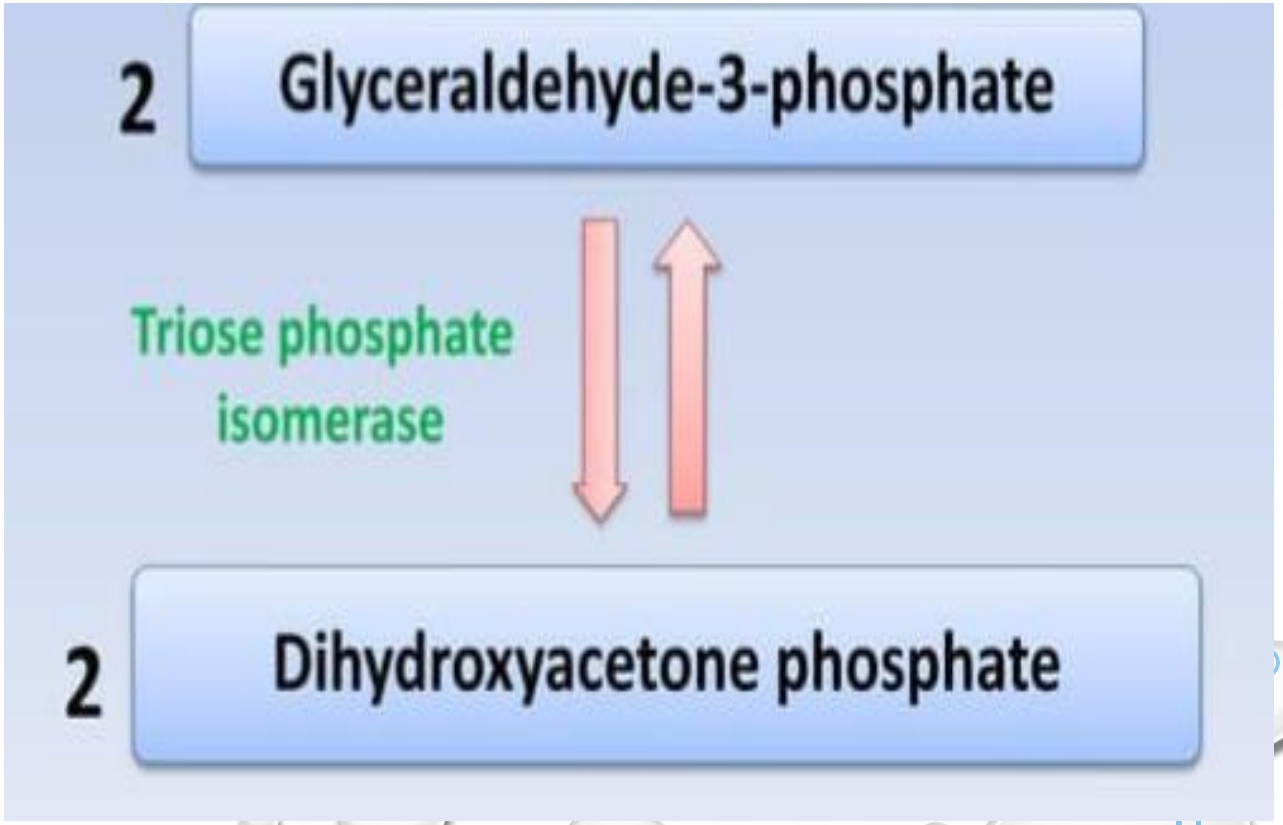
Aldolase : It is an enzyme that helps to breakdown to sugar to produce energy.



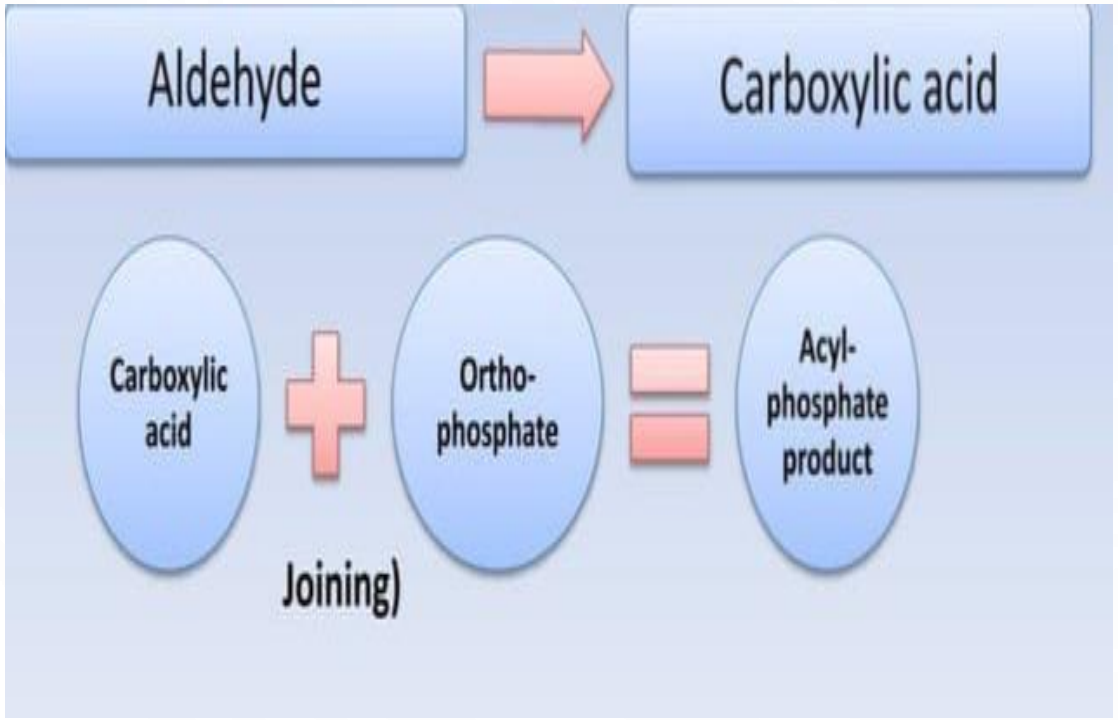
STEP 5 : ISOMERIZATION

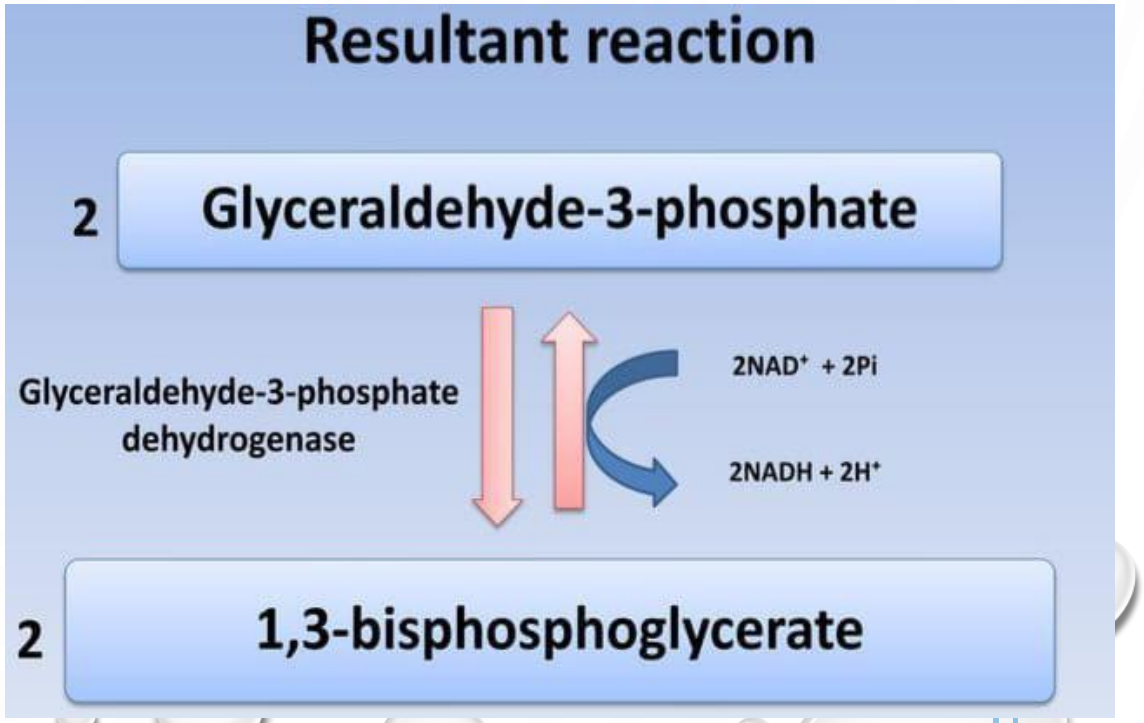
- Isomerization of dihydroxyacetone phosphate (DHAP) into glyceraldehyde-3-phosphate (G3P) because only G3P can be used further in glycolysis.



STEP 6 :

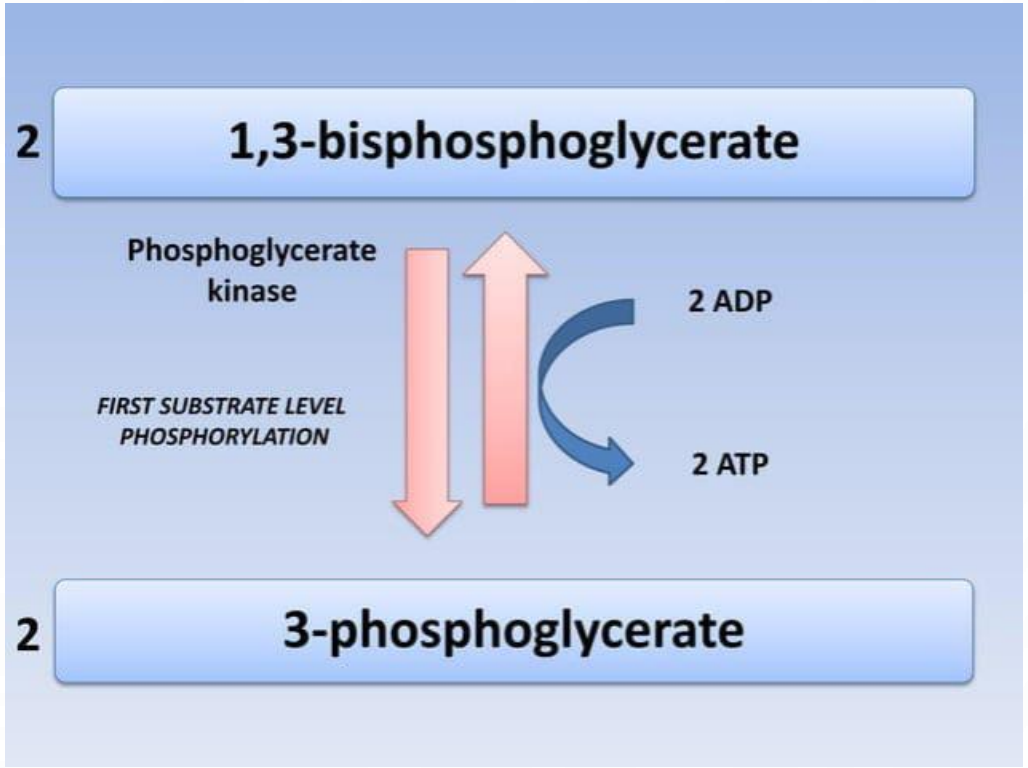
Glyceraldehyde-3-phosphate converts into 1-3-biphosphoglycerate by the help of Glyceraldehyde-3-phosphate dehydroxinase.





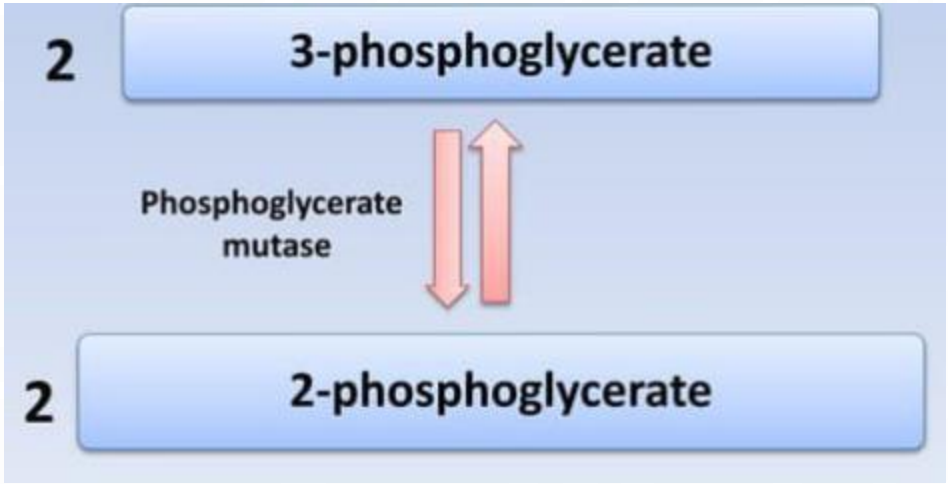
STEP 7 :

- The enzyme phosphoglycerate kinase act an 1-3-bisphosphoglycerate convert into 3-phosphoglycerate.



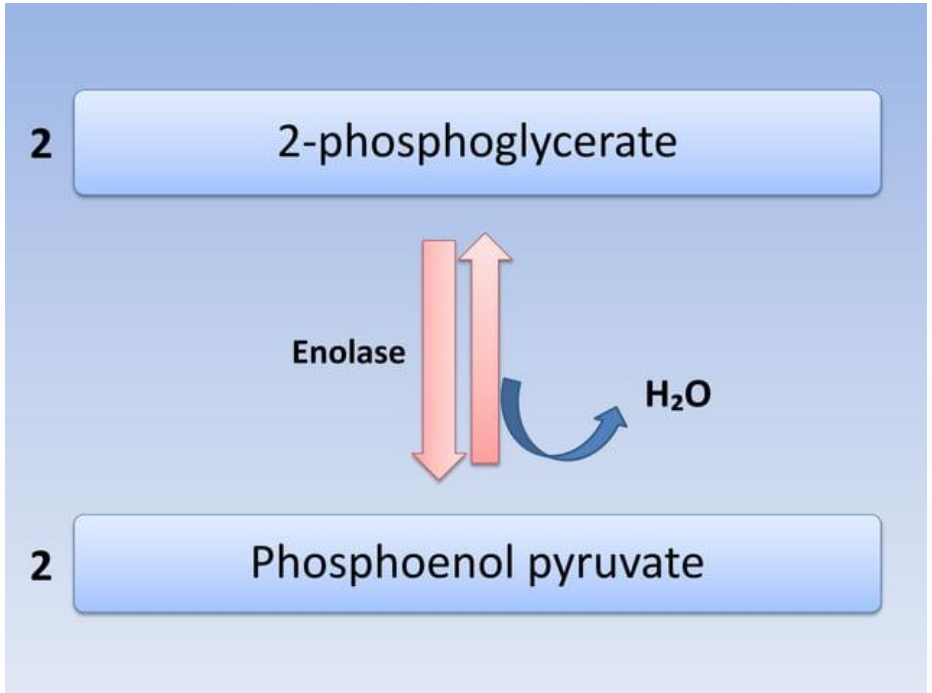
STEP 8 :

3-phosphoglycerate is converted into 2- phosphoglycerate by phosphoglycerate mutase.



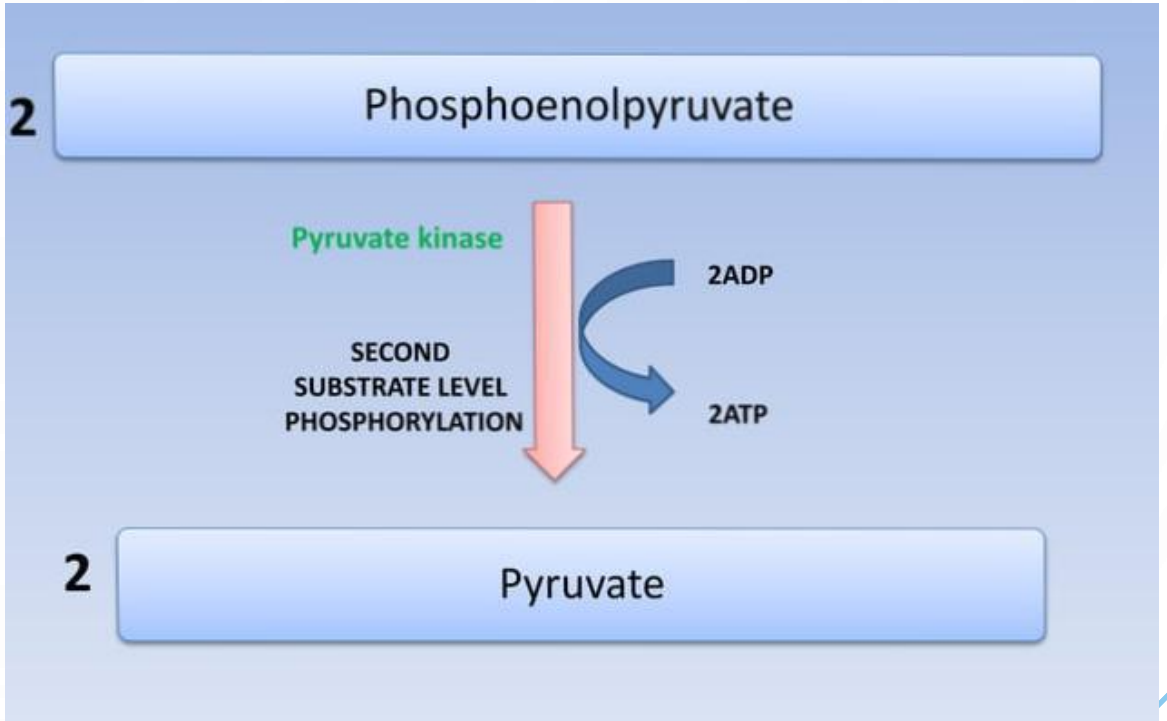
STEP 9:

- 2-phosphoglycerate reacts with enolase and it convert into phosphoenol pyruvate.



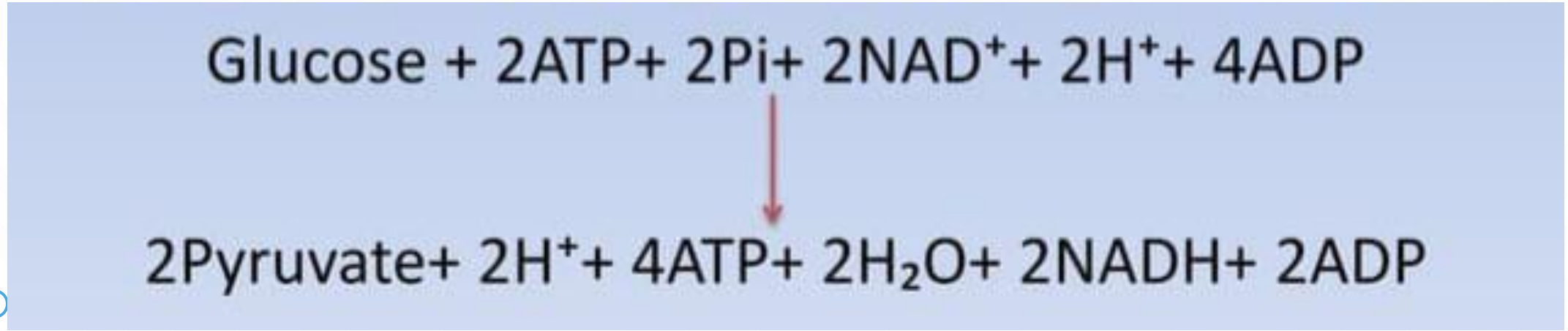
STEP 10 : TRANSFER OF PHOSPHATE FROM PEP TO ADP

- Phosphoenol pyruvate reacts with pyruvate with pyruvate kinase and it convert pyruvate and also produce ATP.



OVERALL BALANCE SHEET OF GLYCOLYSIS

Each molecules of glucose gives 2 molecules of Glyceraldehyde-3-phosphate.Therefore the total input of all 10 reaction can be summerized as :



- On concelling the common term from the above equation,we get the net equation:

Thus the stimultaneous reaction involved in glycolysis are :

- **Glucose is oxidised to pyruvate.**
- **NAD+ is reduced to NADH.**
- **ADP is phosphorylated to ATP.**

CLINICAL RELEVANCE

- **Cancer :** warburg effect.
- **Diabetes:** impaired glycolysis.
- **Nurological disorder :** impaired glycolysis.

Refferences:

- NCERT Biology book .
- MC cleland,B.L. and mayers (2020) by “**Glycolysis : A comprehensive review of the pathway.”**

THANK YOU