Ministry of Higher Education and Scientific Research
AL-Mustaqbal University College of Science
Department of medical biotechnology

Biochemistry

Lecture 7

Glycolysis

By

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GLYCOLYSIS

GLYCOLYSIS

Glycolysis comes from a merger of two Greek words:

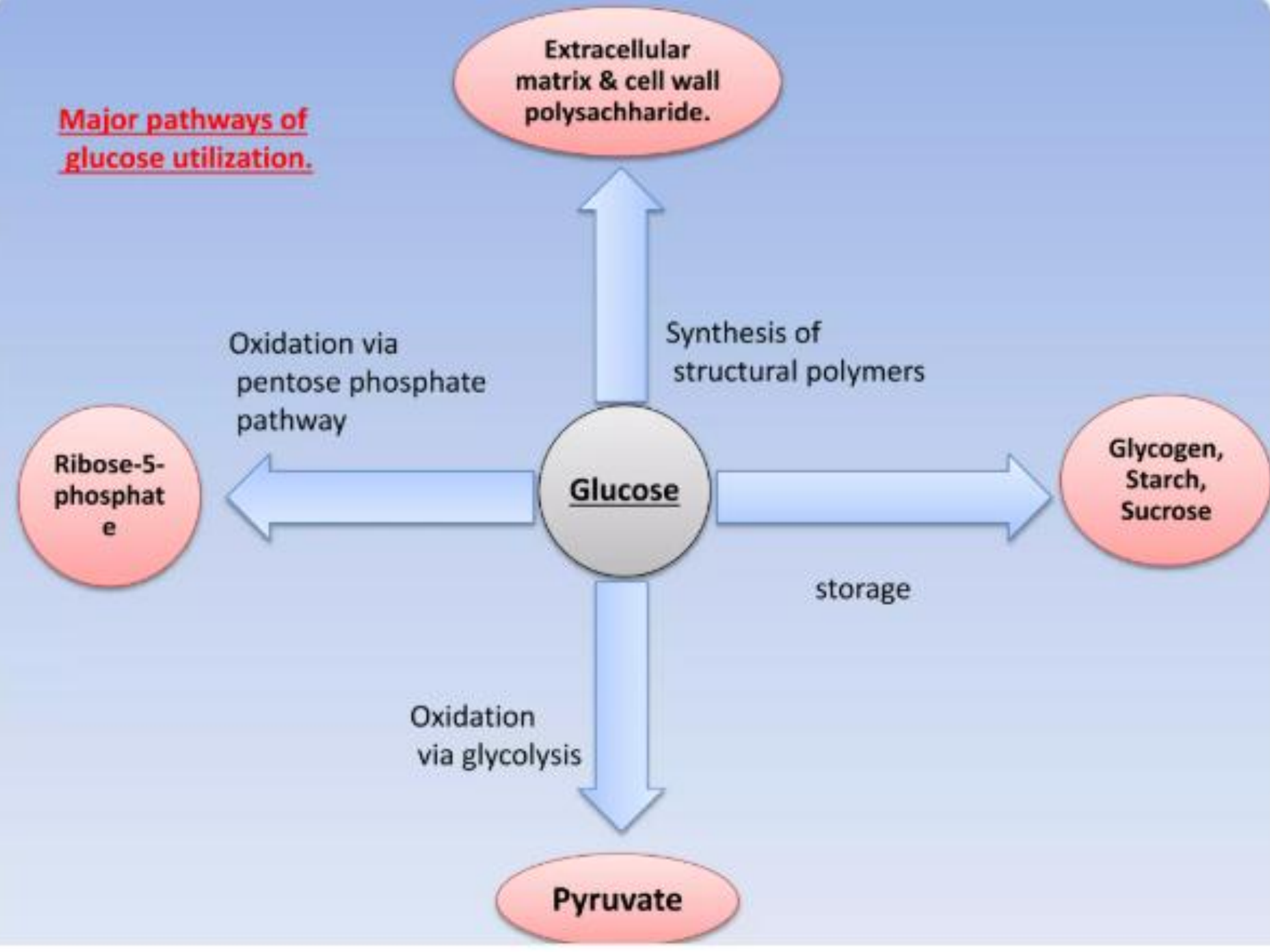
- **Glykys = sweet**
- **Lysis = breakdown/ splitting**

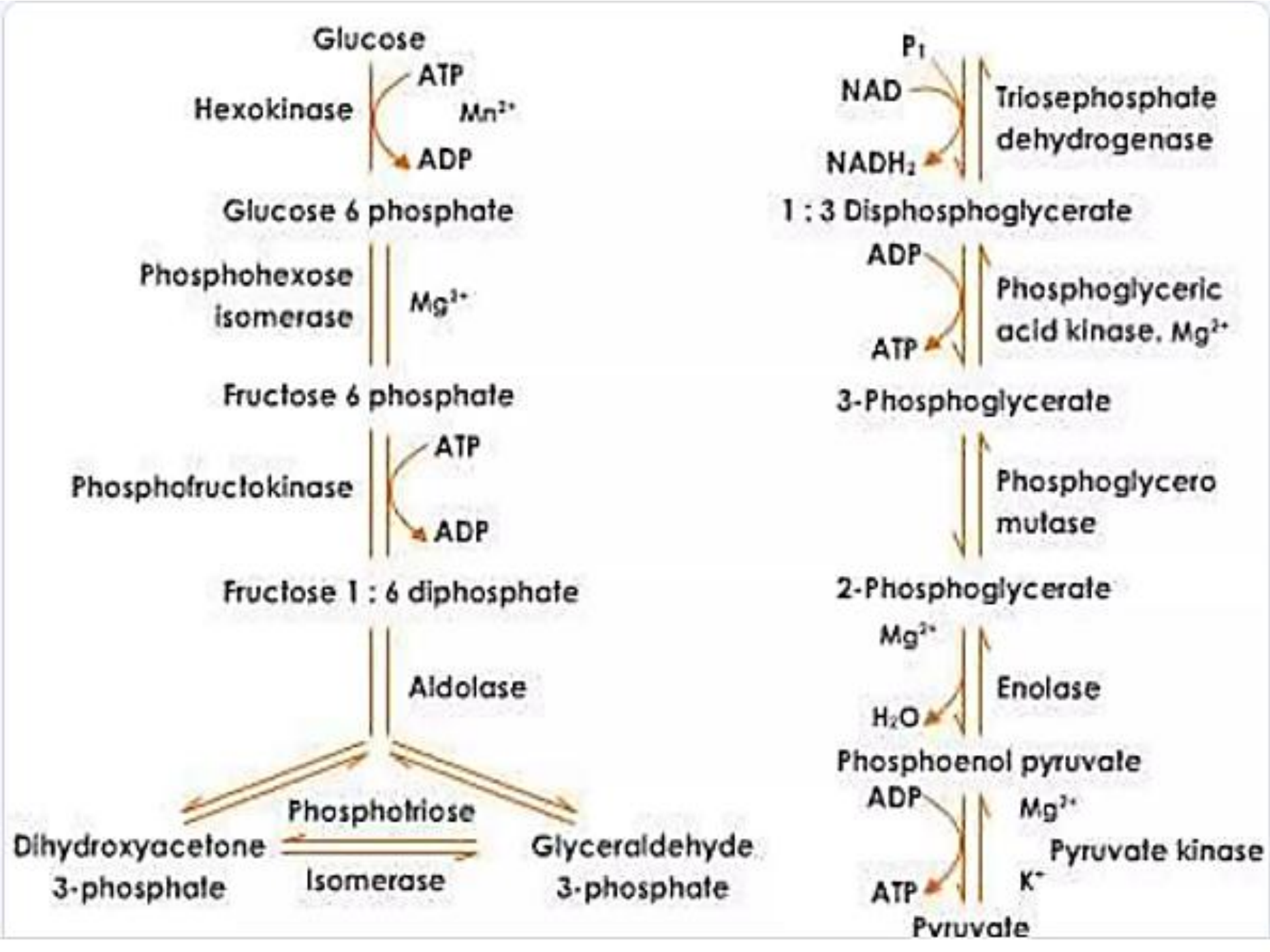
It is also known as Embden-Meyerhof-Parnas pathway or EMP pathway.

INTRODUCTION

- GLYCOLYSIS is the sequence of 10 enzyme-catalyzed reactions that converts glucose into pyruvate with simultaneous production on of ATP.
- In this oxidative process, 1mol of glucose is partially oxidised to 2 moles of pyruvate.
- This major pathway of glucose metabolism occurs in the cytosol of all cell.
- This unique pathway occurs **aerobically** as well as **anaerobically & doesn't involve molecular oxygen.**

- It also includes formation of Lactate from Pyruvate.
- The glycolytic sequence of reactions differ from species to species only in the mechanism of its regulation & in the subsequent metabolic fate of the pyruvate formed.
- In aerobic organisms, glycolysis is the prelude to Citric acid cycle and ETC.
- Glycolysis is the central pathway for Glucose catabolism.


Major pathways of glucose utilization.
Extracellular matrix & cell wall polysachharide.
Synthesis of structural polymers
Oxidation via pentose phosphate pathway
Ribose-5-phosphate
Glucose
Glycogen, Starch, Sucrose
storage
Oxidation via glycolysis
Pyruvate


Glucose
ATP
Hexokinase
Mn^{2+}
ADP
Glucose 6 phosphate
Phosphohexose isomerase
Mg^{2+}
Fructose 6 phosphate
ATP
Phosphofructokinase
ADP
Fructose 1 : 6 diphosphate
Aldolase
Phosphotriose
Dihydroxyacetone 3-phosphate
Isomerase
Glyceraldehyde 3-phosphate
P_i
NAD
$NADH_2$
Triosephosphate dehydrogenase
1 : 3 Disphosphoglycerate
ADP
ATP
Phosphoglyceric acid kinase, Mg^{2+}
3-Phosphoglycerate
Phosphoglycero mutase
2-Phosphoglycerate
Mg^{2+}
H_2O
Enolase
Phosphoenol pyruvate
ADP
ATP
Mg^{2+}
Pyruvate kinase
K^+
Pyruvate

TWO PHASES OF GLYCOLYSIS

- Glycolysis leads to breakdown of 6-C glucose into two molecules of 3-C pyruvate with the enzyme catalyzed reactions being bifurcated or categorized into 2 phases:

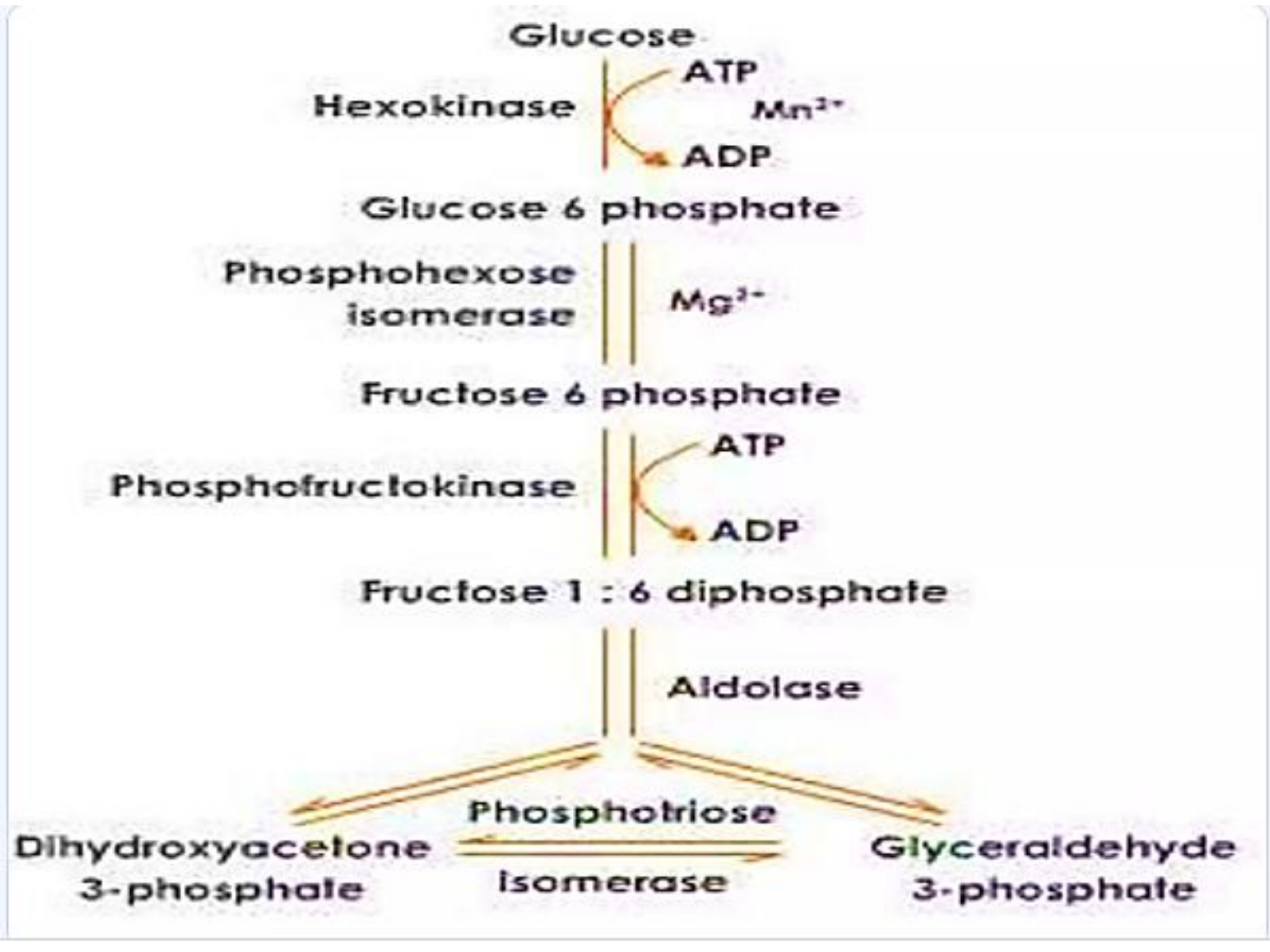
1. **Phase 1- preparatory phase**
2. **Phase 2- payoff phase.**

PREPARATORY PHASE

- It consists of the 1st 5 steps of glycolysis in which the glucose is enzymatically phosphorylated by ATP to yield Fructose-1,6-biphosphate.
- This fructuse-1,6-biphosphate is then split in half to yield 2 molecules of 3-carbon containing Glyceraldehyde-3-phosphate/ dihyroxyacteone phosphate.

- Thus the first phase **results in cleavage of the hexose chain.**

- This cleavage requires an investment of 2 ATP molecules to activate the glucose mole and prepare it for its cleavage into 3-carbon compound.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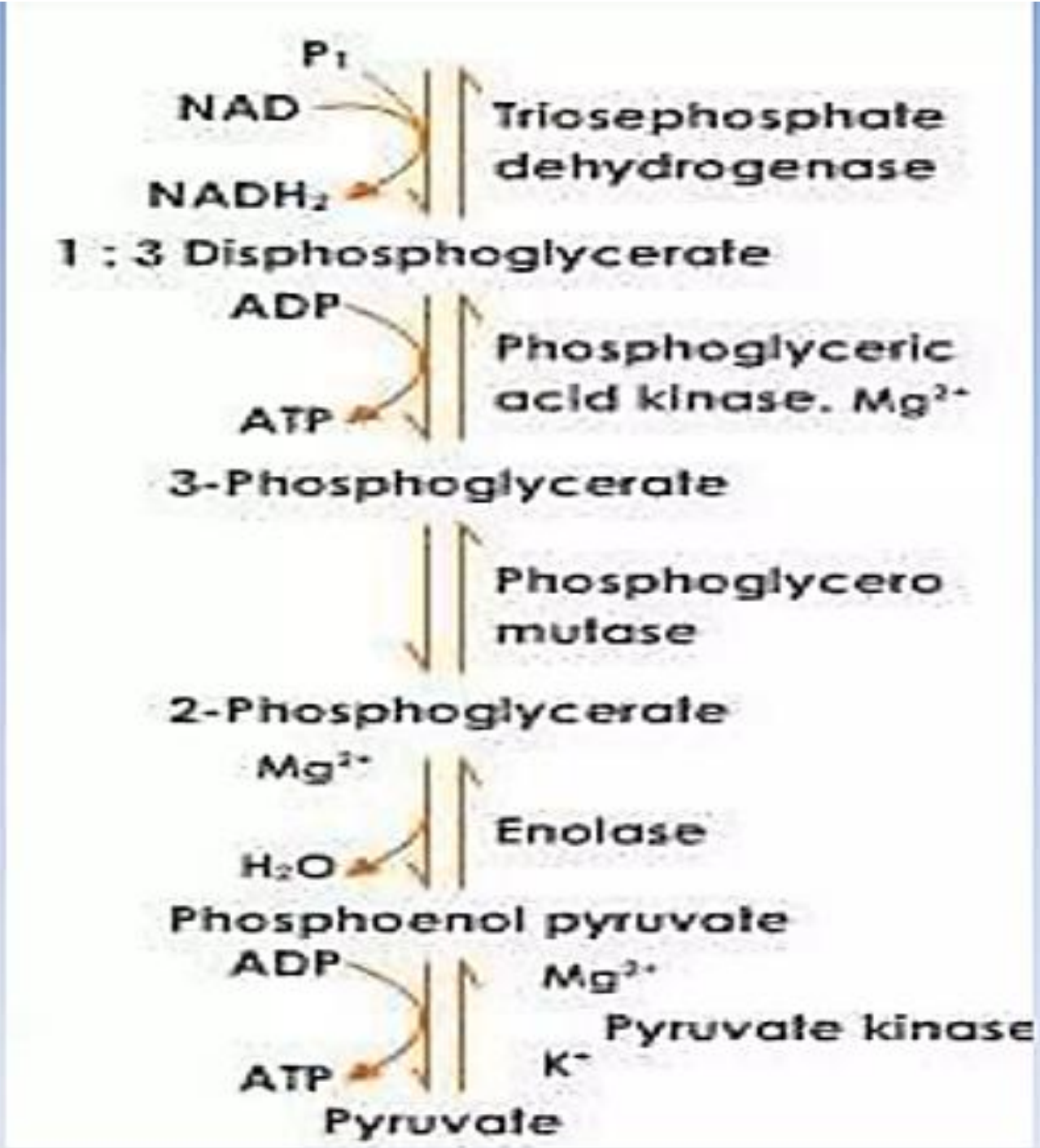
Mn^{2+}
ADP
Glucose 6 phosphate
Phosphohexose isomerase
Mg^{2+}
Fructose 6 phosphate
ATP
Phosphofructokinase
ADP
Fructose 1 : 6 diphosphate
Aldolase
Phosphotriose
Dihydroxyacetone 3-phosphate
isomerase
Glyceraldehyde 3-phosphate

PAYOFF PHASE

- This phase constitutes the last 5 reactions of Glycolysis.
- This phase marks the release of ATP molecules during conversion of Glyceraldehyde-3-phosphtae 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 utilized in Phase 1.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Phosphoenol pyruvate
ADP
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Pyruvate kinase
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Thank you