Breakdown of glucose to two pyruvate units : Glycolysis has been divided into two phases

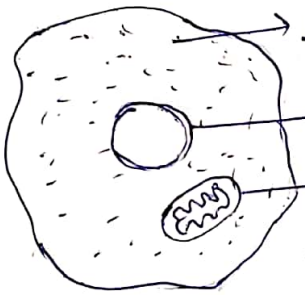
Phase-I

→ comprises of 5 enzyme catalyzed reactions
→ ATP is consumed (2)
→ also known as preparatory phase

Phase-II

→ comprises of 5 enzyme catalyzed Rxns
→ ATP is generated (4)
→ also known as pay off phase

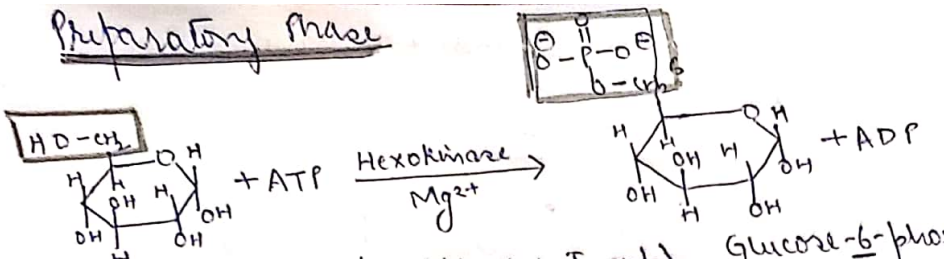
* Some plant tissues are modified to store starch & some aquatic plants derive energy from glycolysis.
* Glycolysis is an anerobic process.
* It occurs in cytoplasm or cytosol of the cell.
* It is also known as EMP [Embden-Meyerhof-Parnas] pathway.
* It occurs in simplest cell of simplest organism: Universal Central Pathway
* 2 ATP are consumed & 4 are generated by the end of Process.



Preparatory Phase

(2)

(1)



Glucose (addition of phosphate grp.) Glucose-6-phosphate
phosphorylation [Because phosphate grp is added on 6th carbon]

→ It is because of this step glucose can't go out of the cells it gets phosphorylated. Therefore phosphorylation is important.

→ It is irreversible reaction under intracellular conditions.

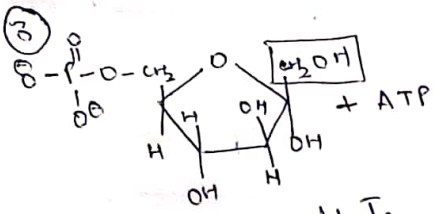
(2)

Glucose-6-phosphate Fructose-6-phosphate

[pls note that pyranose * is converted to furanose but there is no carbon loss

* Glucose is converted to fructose; both are isomers.

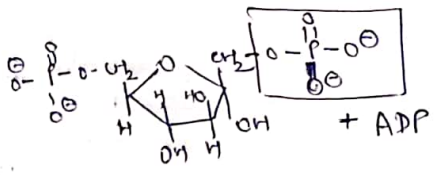
(3)



Fructose-6-phosphate

+ ATP

Phosphofructokinase



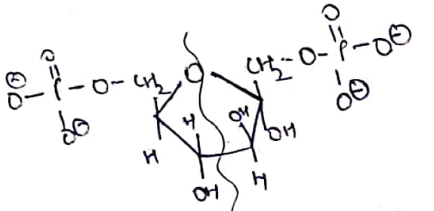
Fructose-1,6-diphosphate

+ ADP

(3)

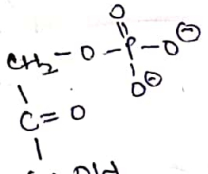
→ Phosphorylation on 1st carbon using ATP in presence of phosphofructokinase.

(4)



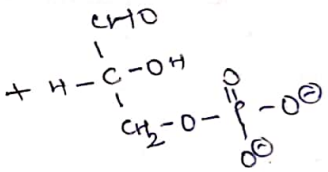
Fructose-1,6-diphosphate

Aldolase



Dihydroxyacetone phosphate

+



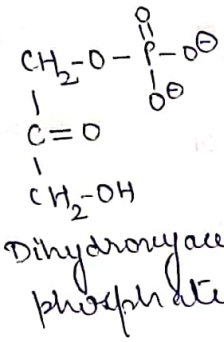
Glyceraldehyde-3-phosphate

→ cleavage of 6-carbon molecule to ~~3-carbon molecules~~ two molecules of 3-carbon each.

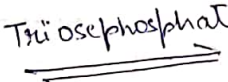
→ Pls Remember dihydroxy acetone phosphate is a derivative of acetone

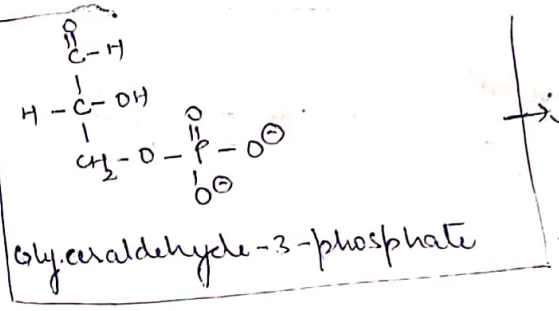
→ and Glyceraldehyde-3-phosphate is a derivative of Glyceraldehyde

(4)

(5) 

Dihydroxyacetone phosphate



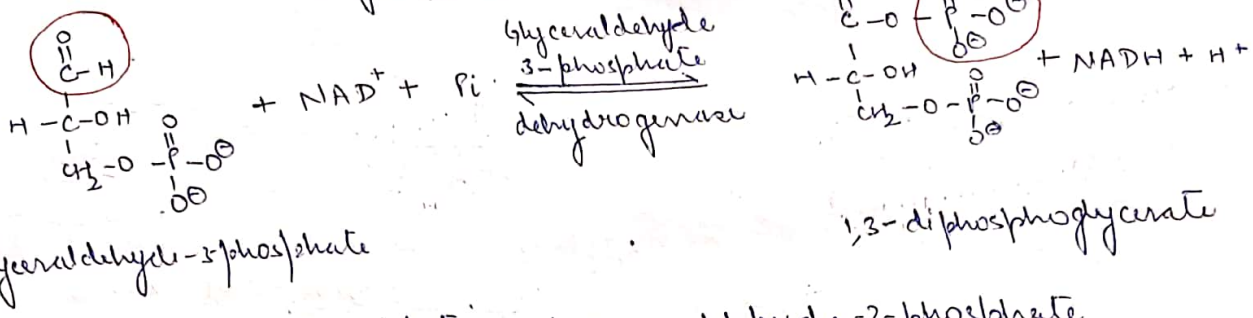


Glyceraldehyde-3-phosphate → Substrate for next phase.

* Since Glyceraldehyde-3-phosphate serves as the substrate for next phase. so out of the two products in step (4) dihydroxyacetone phosphate is converted to Glyceraldehyde-3-phosphate

Pay-off Phase

(6th)



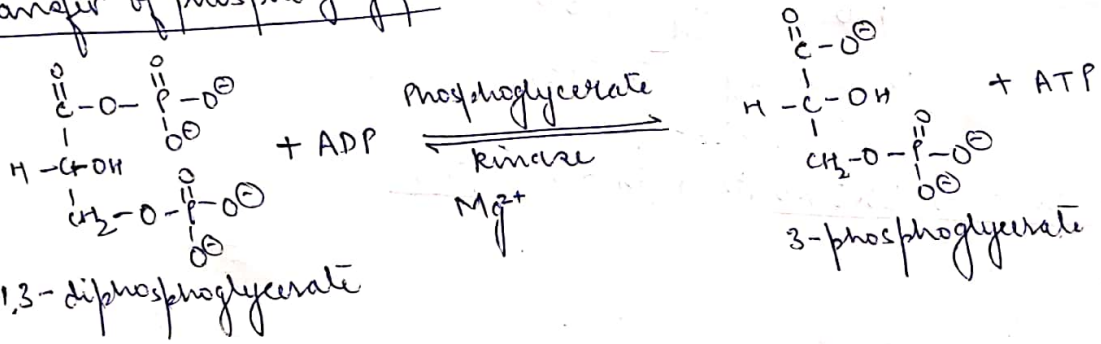
Glyceraldehyde-3-phosphate

1,3-diphosphoglycerate

* The step involved oxidation of glyceraldehyde-3-phosphate
* It is a phosphorylation reaction
* ~~NAD+ is~~ Glyceraldehyde-3-phosphate dehydrogenase is a NAD+ dependent enzyme

(7th)

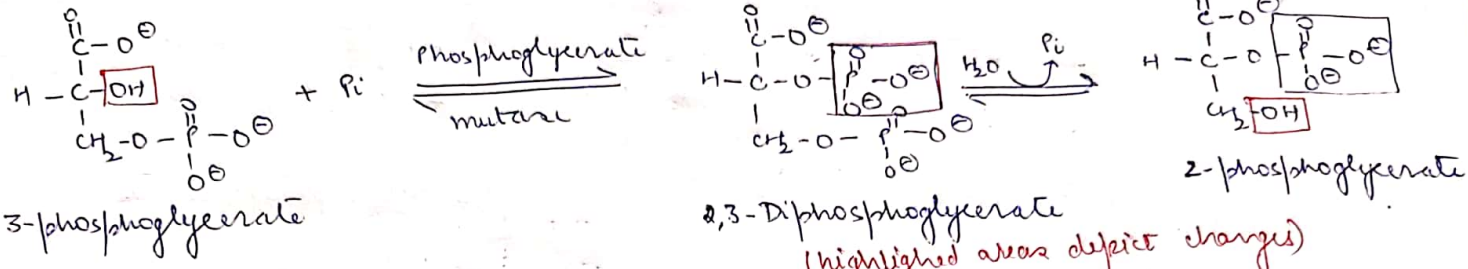
Transfer of phosphoryl grp



1,3-diphosphoglycerate

3-phosphoglycerate

(8) Isomerization of 3-phosphoglycerate to 2-phosphoglycerate



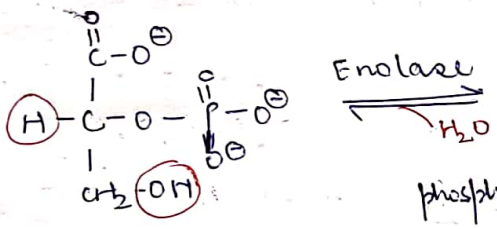
3-phosphoglycerate

2,3-Diphosphoglycerate

2-phosphoglycerate

(highlighted areas depict changes)

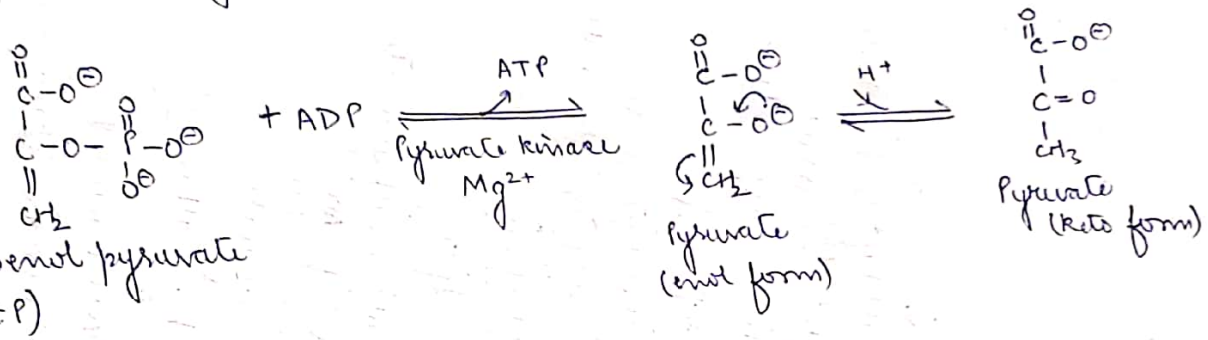
(9) Dehydration of 2-phosphoglycerate



phosphoenolpyruvate [PEP]
(enol form)

Water has been lost so it's called dehydration

10th Synthesis of Pyruvate



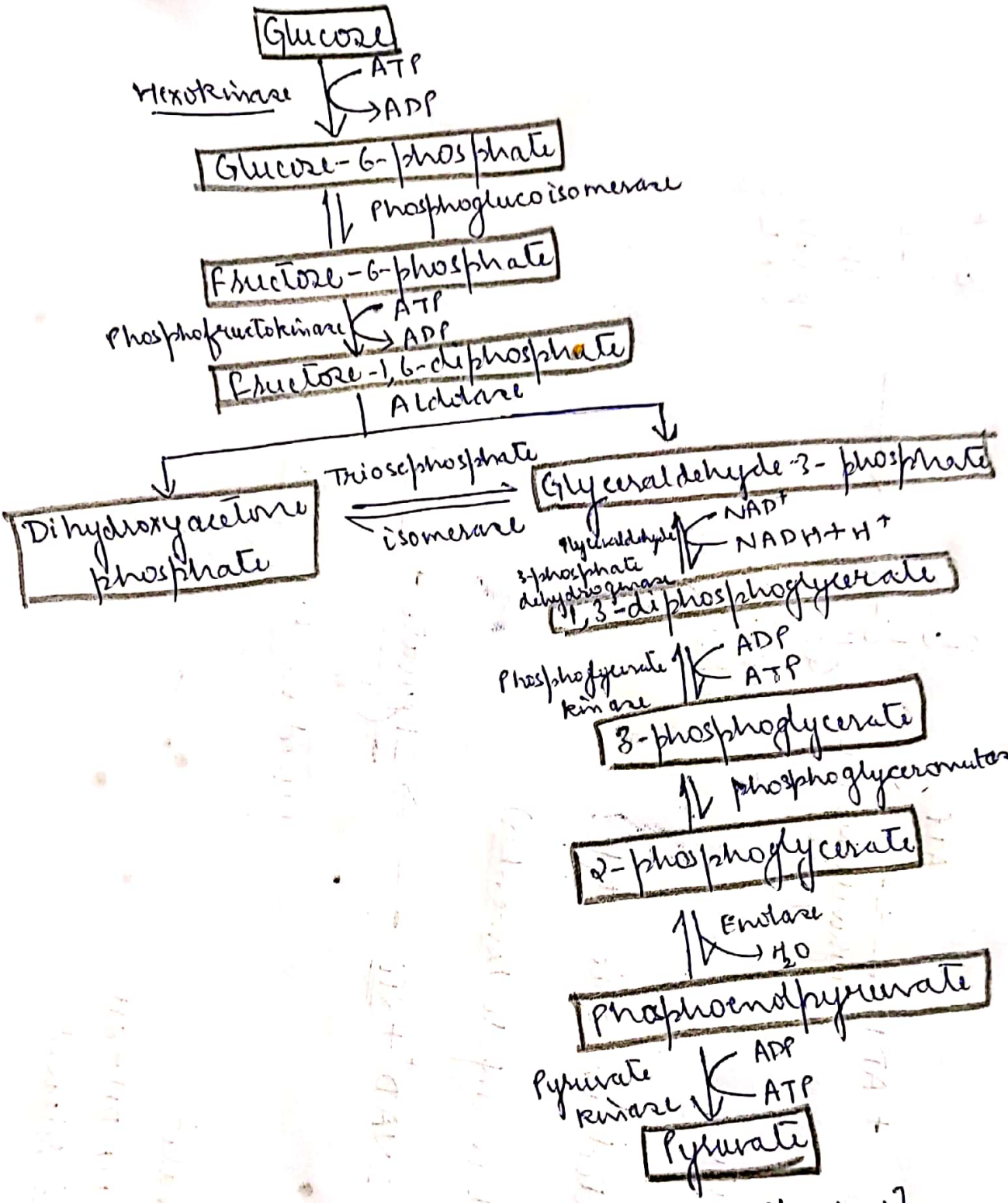
* ATP is generated in this step.

Overall Rxn (It is imp. to remember)

⇒ Glucose + 2 ADP + 2NAD$^+$ + 2Pi ⟶ 2 Pyruvate + 2ATP + 2NADH + 2H$^+$ + 2H_2O

2 Pyruvate ↓ Used in Krebs cycle

→ 2 ATP generated
→ 2NAD$^+$ ⟶ 2NADH + 2H$^+$
→ 2 H_2O molecules released



Summary without structures

[Supporting colored figure has been attached]

Facts

* In cancer cells the rate of glycolysis is much larger even when oxygen is available known as "Warburg effect".
* The ATP yield from glycolysis under anaerobic conditions is much smaller than that from the complete oxidation of glucose to CO_2 under aerobic conditions.