The net reaction of glycolysis is as follows:—

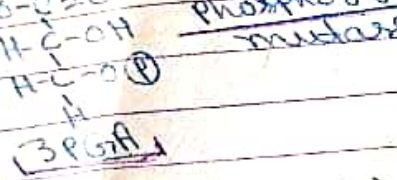
$C_6H_{12}O_6 + 2NAD + 2ADP + 2iP \rightleftharpoons 2C_3H_4O_3 + 2ATP + 2NADH_2 + 4(H)$

Glucose — Pyruvic acid

The over all reactions mentained above may be summerised as follows:—

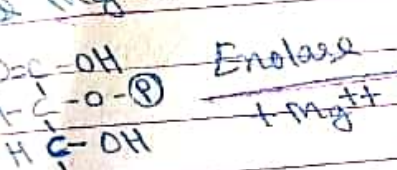
Glucose
↑↓ Hexokinase (ATP → ADP)
glucose-1-Phosphate
↑↓ Phosphohexomutase (ATP ← ADP)
Glucose-6-Phosphate
↑↓ Phosphohexoisomerase (ADP)
Fructose-6-Phosphate
↑↓ Phosphohexokinase (ATP ← ADP)
Fructose 1,6-diphosphate
↑↓ Aldolase
Dehydroxyacetone 3phosphate + 3 Phosphoglyceraldehyde
↑↓ Triosphosphate dehydrogenase (NAD → $NADH_2$)
1,3-diphosphoglyceric acid
↑↓ Phosphoglycokinase (ADP → ATP)
3 Phosphoglyceric acid
↑↓ Phosphoglycero mutase
2-Phosphoglyceric acid
↑↓ Enolase
2-Phosphoenol pyruvic acid
↑↓ Pyruvate kinase (ADP → ATP)
Enol pyruvic acid
↑↓
PYRUVIC ACID

8. 3-Phosphoglyceric acid is changed now to 2-Phosphoglyceric acid in presence of enzyme Phosphoglyceromutase.



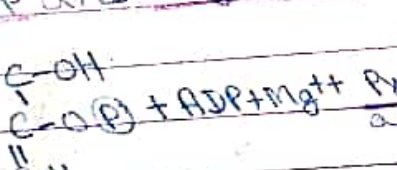
3 PGA → 2 PGA

9. 2-Phosphoglyceric acid converts into 2-Phosphoenol pyruvic acid in presence of enzyme enolase and Mg^{++}.



2 PGA → 2 Phosphoenol Pyruvic Acid or PEPA

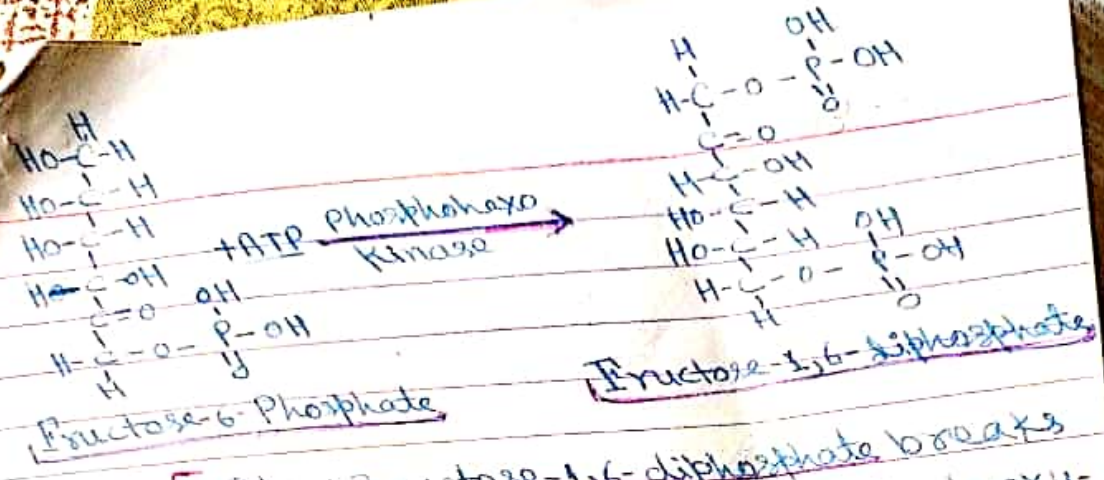
10. 2-Phosphoenol pyruvic acid converts into enol pyruvic acid, which converts into Pyruvic acid in presence of enzyme Pyruvic acid kinase, ADP and Mg^{++}.



2-PEPA → Enol Pyruvic acid → Pyruvic acid

Conclusion:-

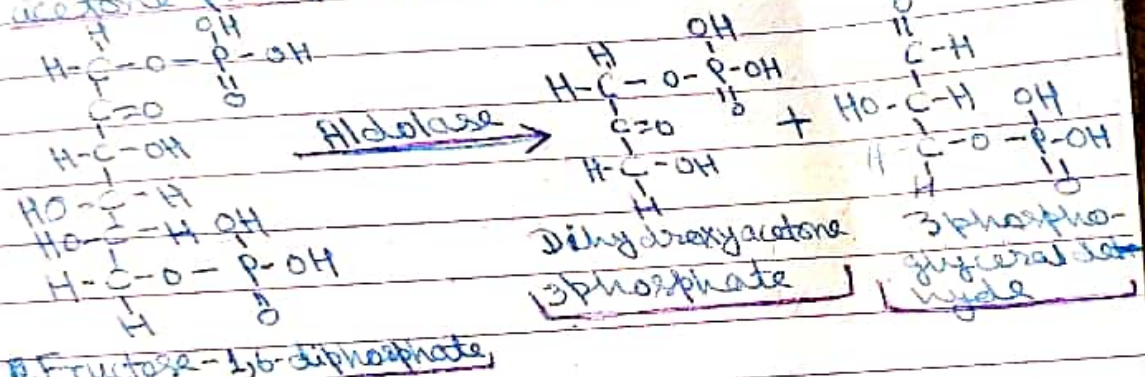
Pyruvic acid is the nodal point of the whole oxidation system and terminal point of the glycolysis. In glycolysis from one molecule of glucose, two molecules of pyruvic acid, 2 molecules of ATP and 2 molecules of $NADH_2$ are formed. The two molecules of ATP are consumed in the phosphorylation reactions. one molecule of $NADH_2$ liberates 3 molecules of ATP. Thus net gained of ATP molecules in glycolysis in presence of oxygen be 8.



Fructose-6-Phosphate

Fructose-1,6-diphosphate

5. Now Fructose-1,6-diphosphate breaks into 3-Phosphoglyceraldehyde and di-hydroxy-acetone phosphate in presence of enzyme Aldolase.

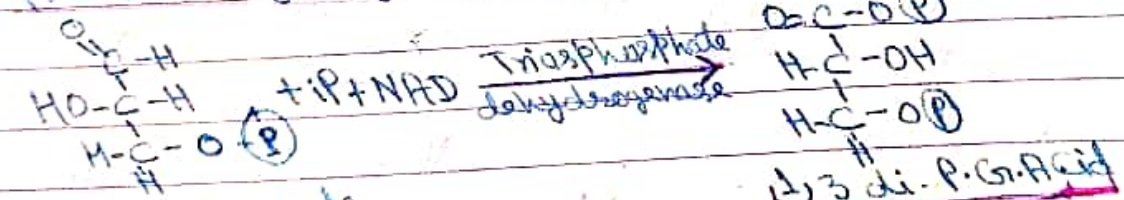


β Fructose-1,6-diphosphate

Dihydroxyacetone 3phosphate

3Phospho-glyceraldehyde

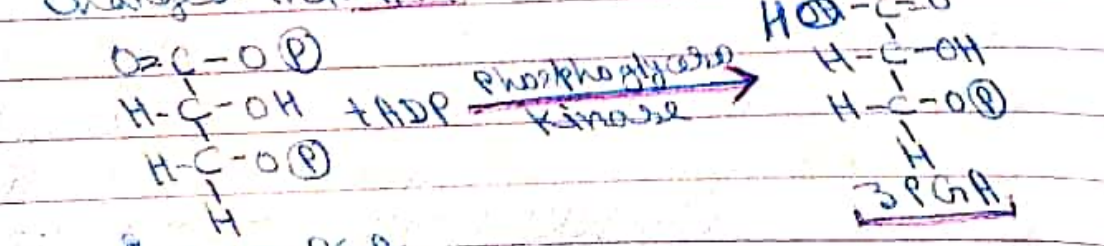
6. 3 Phosphoglyceraldehyde is oxidised to 1,3 diphosphoglyceric acid in presence of enzyme- Triosphosphate dehydrogenase, iP and NAD.



3PGAldehyde

1,3 di. P. Gr. Acid.

7. 1,3 di-phosphoglyceric Acid [1,3-diPGA] is changed into 3 Phosphoglyceric acid in presence of enzyme phosphoglycerokinase and ADP. ADP is changed into ATP.

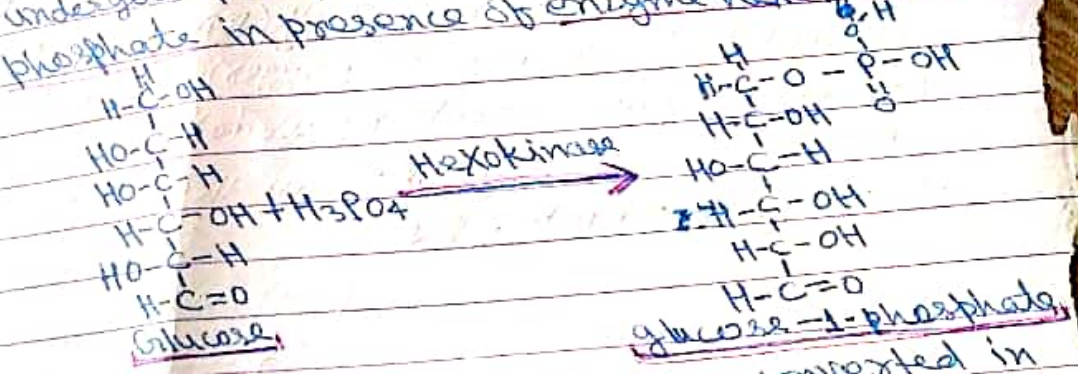


1,3, DiPGA

3PGA

undergoes ~~phosphorylation~~

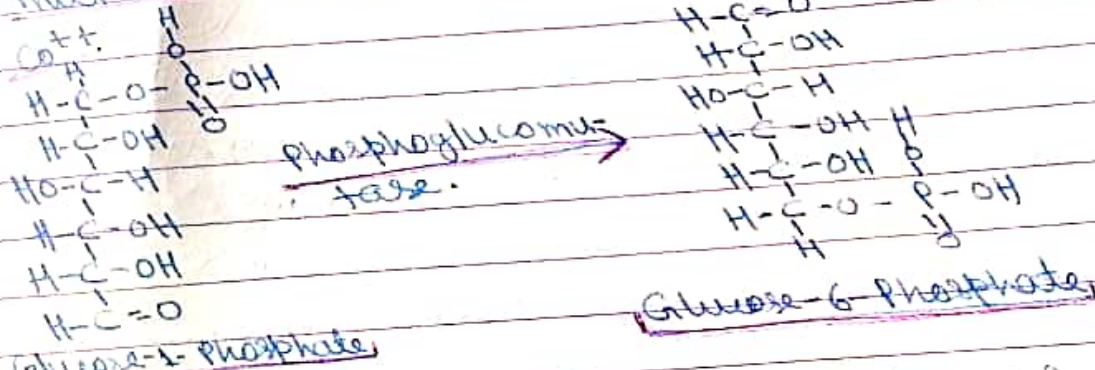
undergoes phosphorylation to produce glucose-1-phosphate in presence of enzyme hexokinase.



Glucose

glucose-1-phosphate

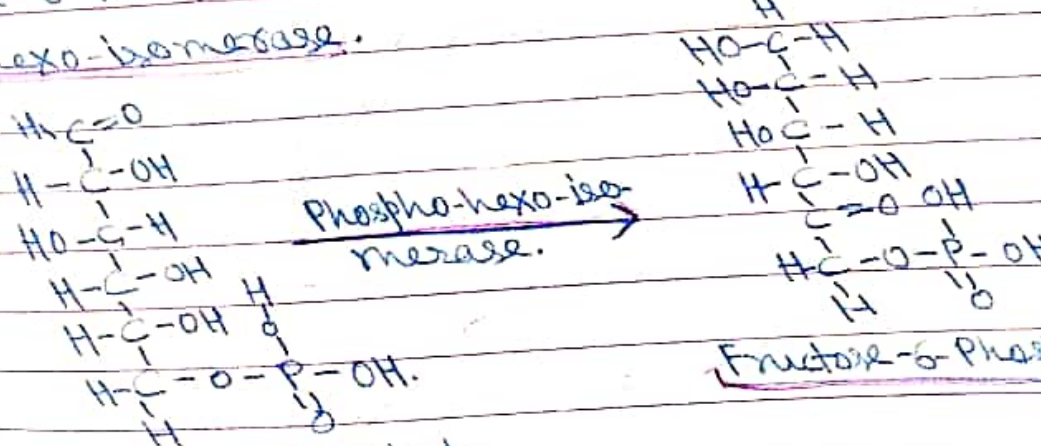
2. Glucose-1-phosphate is then converted in glucose-6-phosphate by the enzyme phosphoglucomutase in presence of the activator Mg^{++}, Mn^{++}, Co^{++}.



Glucose-1-phosphate

Glucose-6-Phosphate

3. Glucose-6-Phosphate converts into fructose-6-Phosphate in presence of enzyme phospho-hexo-isomerase.



Glucose 6 phosphate

Fructose-6-Phosphate

4. The fructose-6 phosphate in presence of enzyme phosphohexokinase reacts with ATP to form fructose 1-6- diphosphate.

Q/→ Describe the various steps of Embden Meyerhof - Parnas pathway (EMP). [Glycolysis or breakdown of (hexose sugars) upto the 'X'.] [Level of pyruvic acid (pyruvate). Discuss the role of various enzymes in the pathway].

Ans/→ **Introduction:-**

The respiration is a very complex oxidation and catabolic process which operates on the free surface of mitochondria resulting the breakdown the complex compounds like Carbohydrates (glucose etc) into simpler compounds such as CO_2 and H_2O with release of energy. Thus the mechanism of respiration consists of several reactions. Each reaction is reversible and requires an enzyme.

The breakdown of hexose sugar upto level of pyruvic acid in the process of respiration is known as glycolysis. It was worked out by 3 German Scientist - Embden, Meyerhof and Parnas [1924]. Therefore, it is named as Embden-Meyerhof-Parnas, or EMP pathway. It takes place in the cytoplasm. In glycolysis a molecule of hexose sugar [glucose or fructose] is oxidised to formed two molecules of pyruvic acids with release of four atoms of hydrogen as follows:—

$$\underset{\text{Glucose}}{C_6H_{12}O_6} \longrightarrow \underset{\text{Pyruvate}}{2C_3H_4O_3} + 4[H].$$

The above breakdown takes place in several steps, which are described as follows:—

[1] The first step of glycolysis a molecule of glucose in presence of inorganic phosphate (IP)