Glycolysis, EMP or EMP Pathway

Glycolysis is the first step of cellular respiration that brings about breakdown of Glucose or related hexose sugar into two molecules of Pyruvic acid through enzyme mediated reactions. Two molecules each of ATP and NAD(+H+) are also produced. Glycolysis is also known as Embden- Meyerhof Pathway or Embden - Meyerhof- Parnas Pathway, after the names of Germal Scientist who discovered it in 1930s. It occurs in cytoplasm. The various steps involved in Glycolysis are as follows:

1. Phosphorylation of Glucose.

Glucose is converted into glucose 6- phosphate by ATP in the presence of enzyme hexokinase, Mg2+ is required.

2. Formation of fructose 6- phosphate. Glucose 6- phosphate is converted into its isomer fructose 6- phosphate by means of enzyme phosphohexose isomerase. The phenomenon is called isomerisation.

3. Second phosphorylation: A second phosphorylation with ATP converts fructose 6- phosphate to fructose 1,6 bis phosphate. The reaction is catalyzed by enzyme Phosphofructokinase in the presence of Mg2+.

4. Lysis: It occurs in the presence of enzyme Aldolase. Aldolase splits Fructose 1,6 bis phosphate into two 3 Carbon compounds, dihydroxy acetone 3- phosphate and Glyceraldehyde 3- Phosphate.

5. Isomerisation of dihydroxy acetone 3 phosphate is converted into its isomer glyceraldehyde 3 phosphate by means of enzyme Phosphotriose isomerase.

6. Oxidation:

Glyceraldehyde 3 phosphate is oxidized with the help of enzyme Glyceraldehyde phosphate dehydrogenase. It is accompanied by simultaneous phosphorylation of the product to form 1,3- Diphosphoglycerate. NAD+ picks up hydrogen from Glyceraldehyde 3 phosphate. It produce NADH(+H+).

7. Substrate level ATP synthesis: One ph6bond of 1,3- diphosphoglycerate carries more energy than the other. In the presence of ADP and enzyme phosphoglycerate kinase, the high energy bond breaks and ATP is synthesised.

8. Isomerisation or Rearrangement: Enzyme phosphoglyceromutase brings about Rearrangement of phosphate group from 3- Carbon position to 2- Carbon position. Consequently 3- Phosphoglycerate is converted into 2- Phosphoglycerate.

9. Dehydration: In presence of enzyme enolase and cofactor Mg^{2+}, 2- Phosphoglycerate loses a molecule of water and is changed into Phosphoenol Pyruvate (PEP).

10. Substrate level ATP synthesis and Pyruvate formation: the phosphate bond of Phosphoenol Pyruvate carries higher amount of energy than other chemical bonds. It is transferred to ADP by enzyme Pyruvate kinase in presence of Mg^{2+} and K^{+} ATP and Pyruvate are formed.