P.G. Sem II (CC4), Unit-2, Submit 2.3.

Metabolism of Carbohydrates: Glycolysis
Part I

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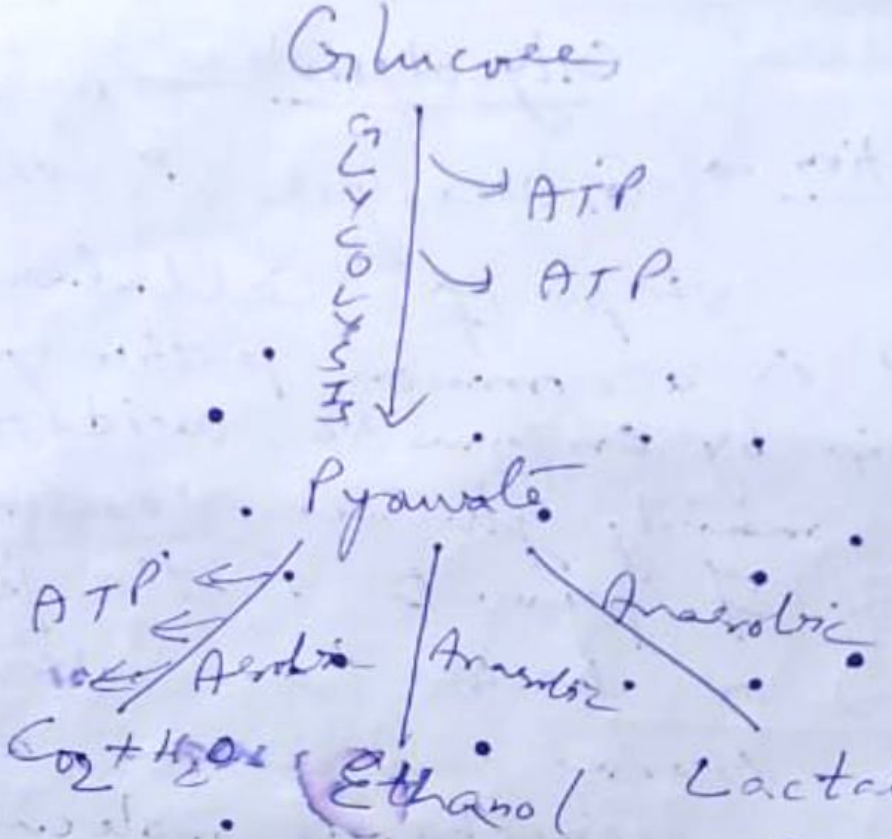
Introduction :- Glycolysis is the first step of cellular Respiration. It is Common pathway of ATP Synthesis by enzymatic oxidation of hexose, mainly glucose, leading to formation of pyruvate (in the presence of oxygen (aerobic) or absence (anaerobic) of oxygen. During this, a six-carbon monosaccharide molecule is degraded to two molecules of three Carbon pyruvate. In Aerobic glycolysis pyruvate is further oxidised to CO_2 and water through Krebs's Cycle & respiratory chain for the Synthesis of a large amount of ATP, whereas in anaerobic glycolysis, pyruvate gets reduced to lactate or is decarboxylated to acetaldehyde and finally to ethanol. Anaerobic glycolysis occurring in cytosol after lactate accumulates during intense muscular activity or excercise or running leads to Depletion of ATP & Replenishment of muscle exceeds

muscles exceeds their oxygen supply.



Steps of Glycolysis

Glycolysis involves reactions catalyzed by 10 enzymes acting in sequence and found in the cytosolic component of the cell.

The steps are —

1. **Phosphorylation of glucose** —

Glucose is first activated by phosphorylation of its sixth carbon forming glucose-6-phosphate. ATP complexed with Mg^{+2} ions donates phosphate and energy for

phosphorylation and is left out as ADP. The enzyme Hexokinase bringing out this reaction is found in all tissues except liver and Pancreas.

Glucose $\xrightarrow[\text{Hexokinase}]{ATP \rightarrow ADP+P}$ Glucose 6-PO4

2. Isomerization of glucose-6-PO4 to Fructose-6-PO4 -

In this step, glucose-6-PO4 become converted into Fructose-6-PO4 by the enzyme phosphohexose isomerase bringing about transfer of oxygen from Carbon 1 to Carbon-2.

Glucose-6-PO4 $\xleftrightarrow[\text{isomerase}]{\text{phosphohexose}}$ Fructose-6-PO4

3. phosphorylation of Fructose-6-PO4 →

In this step, Fructose-6-PO4 is phosphorylated to Fructose 1.6-biPO4 by enzyme phosphofructokinase in the presence of ATP complexed with Mg^{+2}

Fructose-6-PO4 $\xrightarrow[ATP \rightarrow ADP+P_i]{\text{phosphofructokinase}}$ Fructose 1.6 diphosphate

4. Cleavage of Fructose 1,6-biphosphate →

Fructose 1,6-biphosphate is cleaved in the middle by the enzyme Aldolase forming glyceraldehyde-3-POy and Dihydroxy acetone phosphate.

Fructose 1,6 BiPOy ⟷ (Aldolase) Dihydroxy Acetone POy. (DHAP) + Glyceraldehyde 3 POy

5. Isomerization of triose phosphates –

The enzyme phosphotriose isomerase brings about interconversion of glyceraldehyde-3-POy and Dihydroxy Acetone POy.

Dihydroxy Acetone POy ⟷ (Phosphotriose isomerase) glyceraldehyde-3-POy

However, in the subsequent steps of glycolysis only glyceraldehyde-3-POy undergoes further metabolism.

6. Oxidation of glyceraldehyde-3-POy –

In this step, glyceraldehyde-3-POy undergoes dehydrogenation by the enzyme glyceraldehyde-3-POy Dehydrogenase