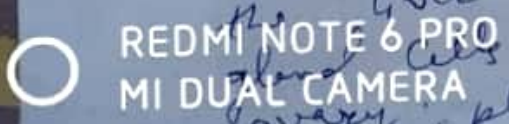


Pentose Phosphate Pathway or Hexose Monophosphate Shunt (HMP SHUNT)

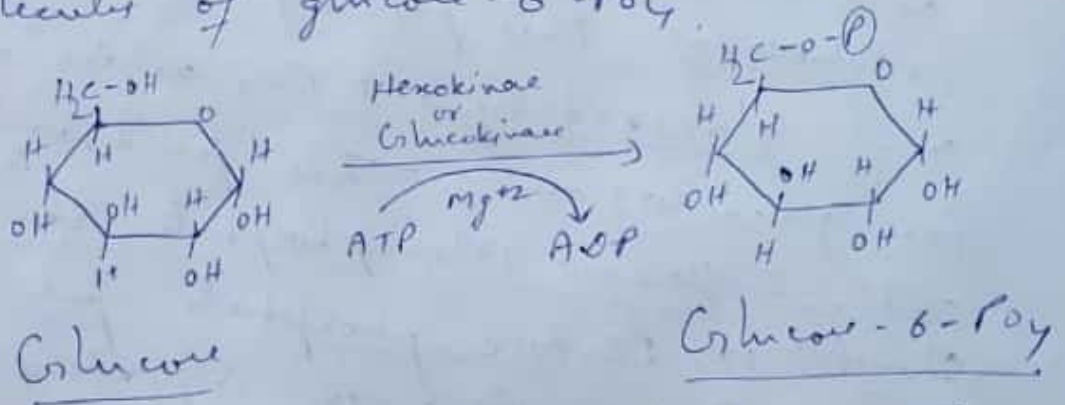
In normal pathway, glucose is oxidatively decarboxylated through glycolysis and Krebs cycle for ATP (Adenosine TriPhos) synthesis. But there exists another pathway of oxidative decarboxylation of glucose, which doesnot generate reduced NAD or ATP but generates reduced NADP and ribose-5-P₄ as intermediate metabolite. The end products of this pathway are Fructose-6-P₄ and glyceraldehyde 3 P₄ which are recycle for gluconeogenesis. This pathway is called Hexose Monophosphate shunt (HMP Shunt) or Pentose phosphate pathway. This pathway is very important for biosynthetic processes in the cells. This pathway is very important as the reduced NADP generated during the pathway is used for synthesis of fatty acids, steroids and ribose-5-P₄ is utilised for synthesis of nucleotides and nucleic acids. The enzyme system of this pathway is in the cytosol of liver cells, adipose tissues, Mammary glands, and steroidogenic cells of testis, placenta and adrenal cortex.



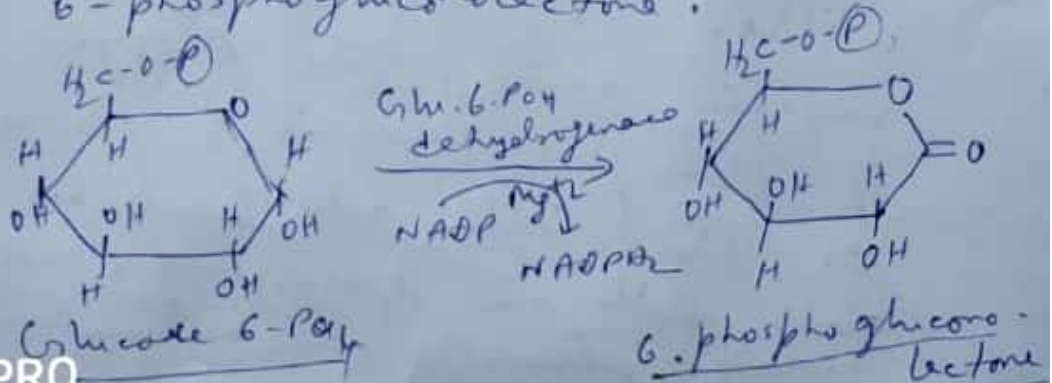
The HMP pathway though near some early reactions of glycolysis, is entirely different from glycolysis. The entire pathway involves

8 steps —

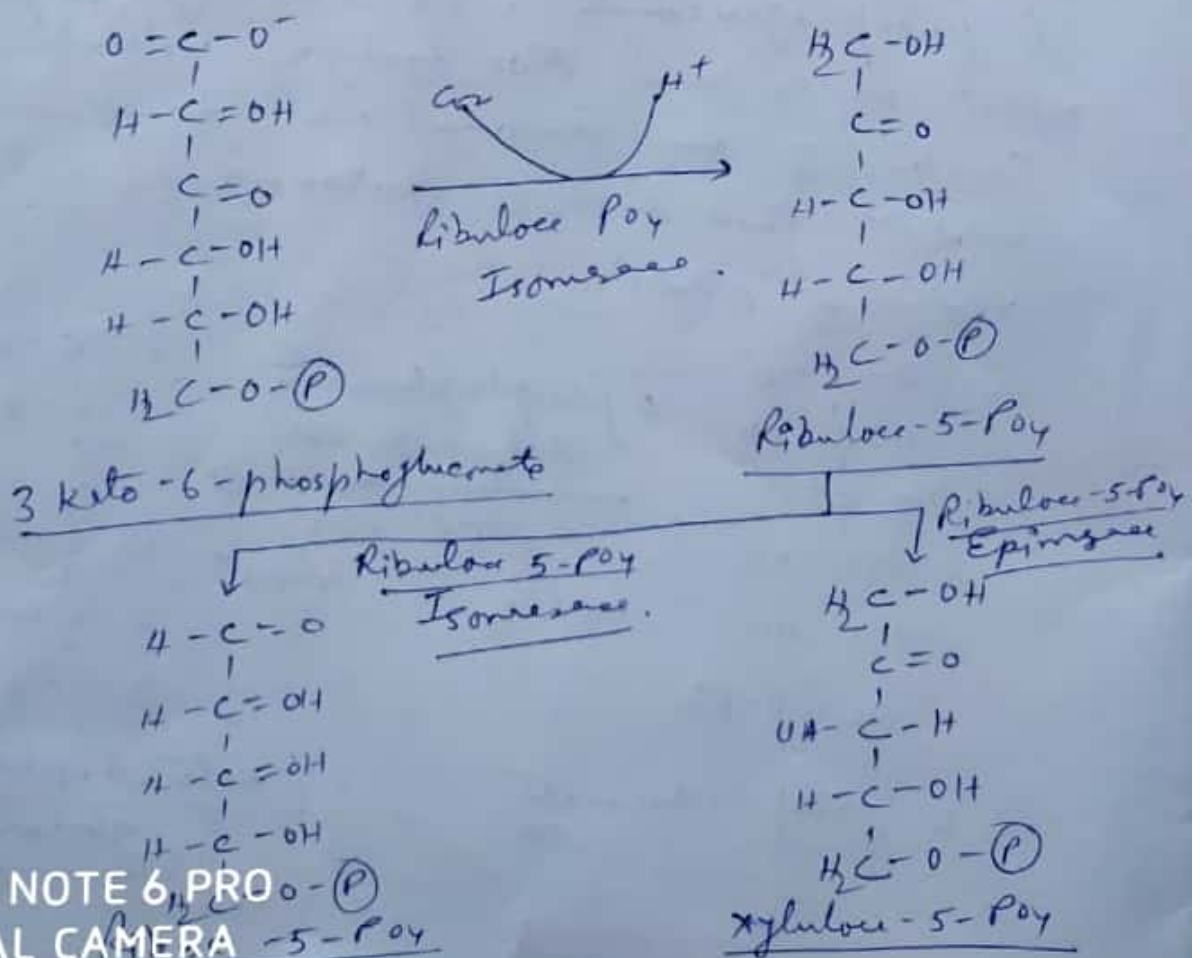
- ① Phosphorylation of glucose — The enzyme glucokinase or hexokinase, as in glycolysis, brings about phosphorylation of carbon-6 of glucose. ATP in the presence of Mg^{2+} provides both phosphate and energy for phosphorylation. Three such glucose molecules are simultaneously used in this pathway, generating three molecules of glucose-6-P₄.



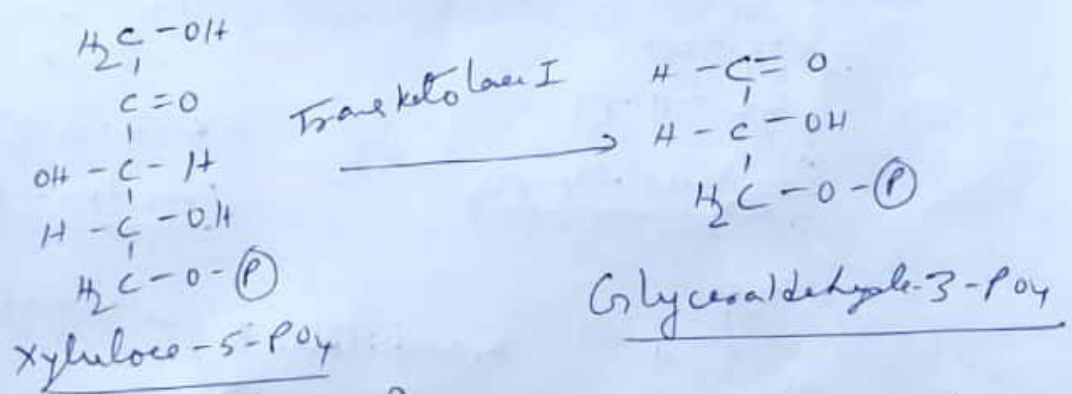
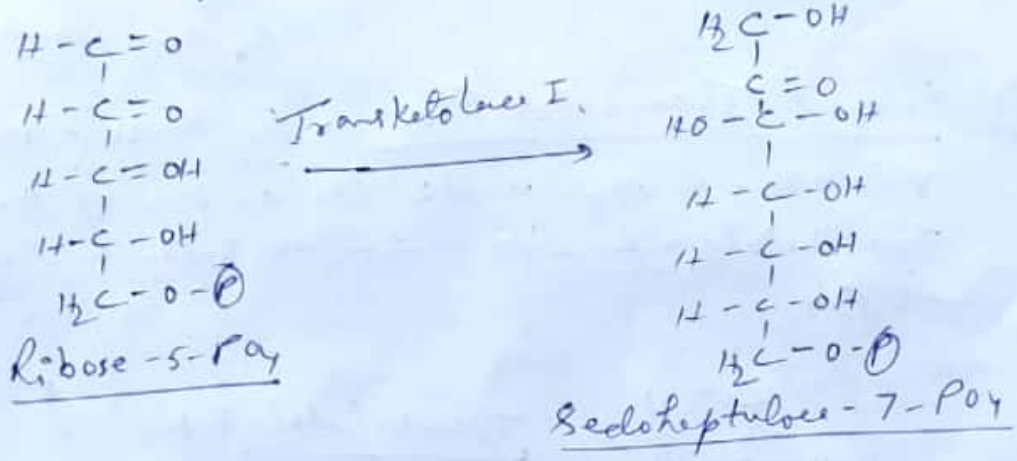
- ② Dehydrogenation of glucose-6-P₄ — Glucose-6-P₄ is oxidised by the enzyme glucose-6-P₄ dehydrogenase. Carbon-1 of glucose-6-P₄ loses the hydrogen pair that goes to coenzyme $NADP^+$ resulting $NADPH_2$ and also 6-phosphogluconolactone.



5) Isomerization and Epimerization of Ribulose-5-P₄ to Ribose-5-P₄ and Xylulose-5-P₄ → Out of these ribulose-5-P₄ one is converted to ribose-5-P₄ by the enzyme ribulose-5-P₄ isomerase and other two are converted to xylulose-5-P₄ epimerase. All these conversions are mediated through enediolate intermediates; 1,2 enediolate formed is epimerase reaction and 2,3-enediolate being formed is isomerase reaction. Ribose-5-P₄ is used for nucleotide synthesis while ~~or~~ xylulose-5-P₄ are used for synthesis of fructose-6-P₄ and glyceraldehyde-3-P₄ through transketolation and transamination reactions.

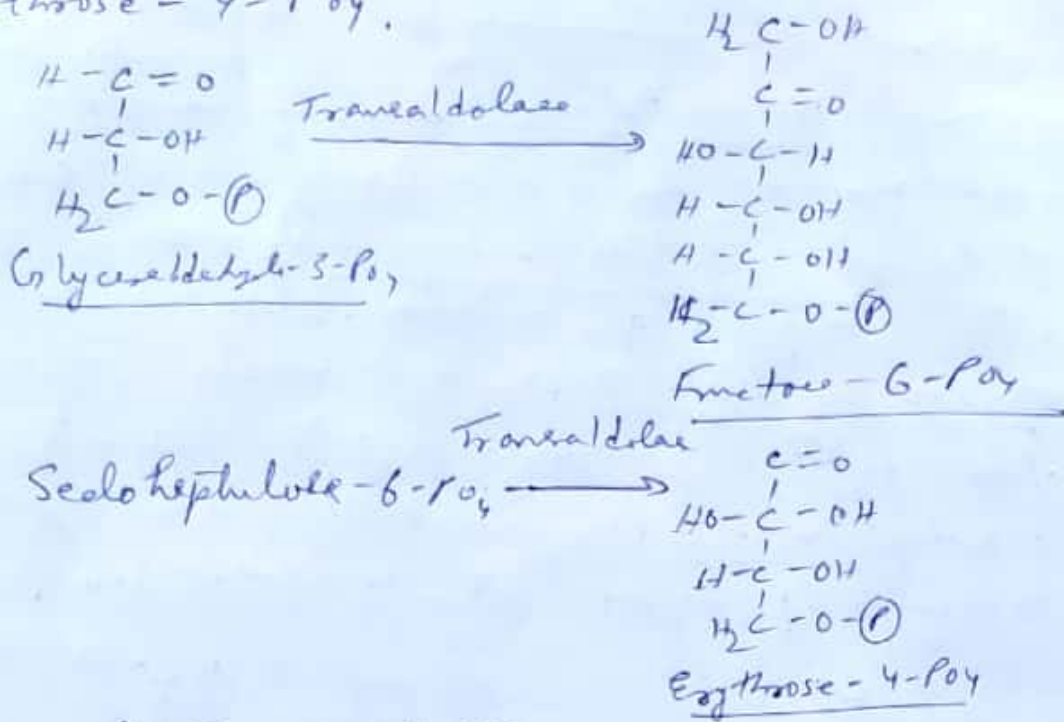


⑥ First Transketolations - The ribose-5-P₄ and one of two molecules of xylulose-5-P₄ are acted upon by the enzyme transketolase removing a 2 carbon moiety from the former and transfers it to the latter. Thus xylulose-5-P₄ after losing two carbons is left out as glyceraldehyde-3-P₄ and ribose-5-P₄ after getting 2 carbons gets converted to sedoheptulose-7-P₄. Transketolase requires thiamine pyrophosphate as coenzyme.

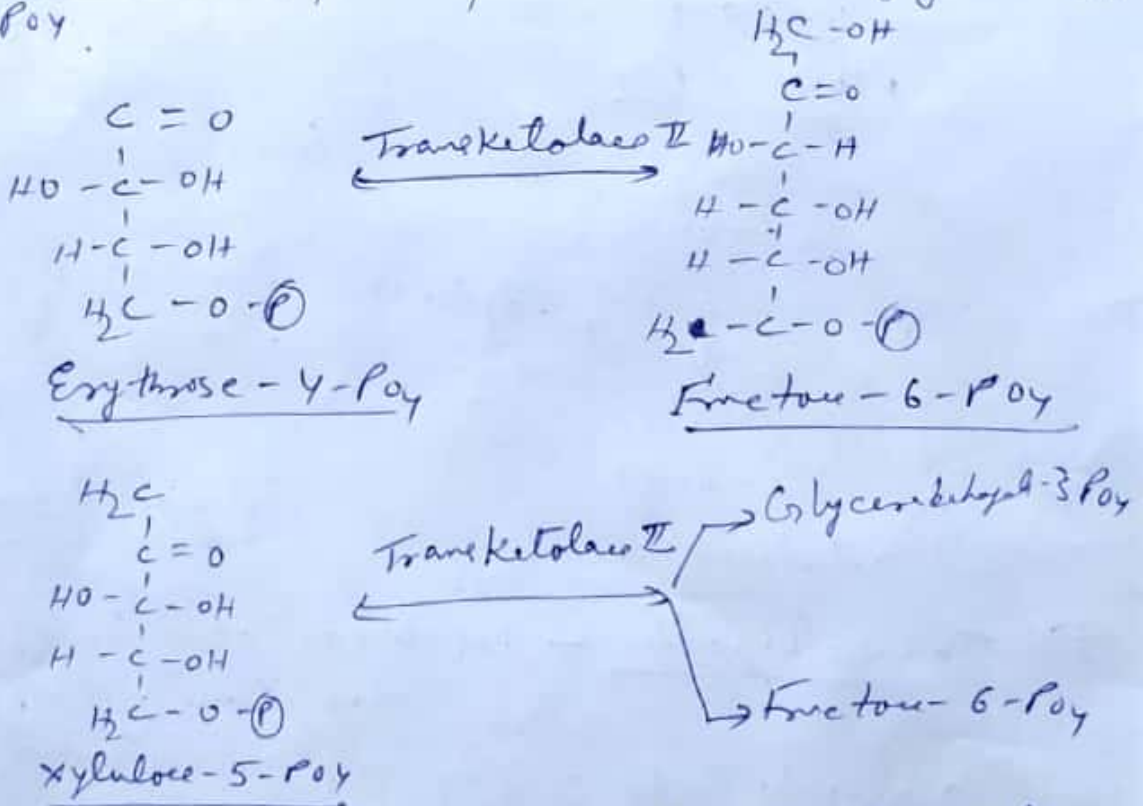


⑦ Transalkylation - Products of transketolations sedoheptulose-7-P₄ and glyceraldehyde-3-P₄ are acted upon by the enzyme transaldolase that removes a 3-carbon moiety from the former and transfers it to the latter, thus forming fructose-6-P₄. The sedoheptulose-7-P₄

after losing 3-carbons moiety is left out as erythrose - 4-P₄.



⑧ Second Transketolation - Erythrose - 4-P₄ & xylulose - 5-P₄ under the action of enzyme Transketolase II forms fructose-6-P₄ and glyceraldehyde-3-P₄.



Hence, In this pathway, 3 molecules of glucose generate two molecules of fructose-6-P₄, one molecule of glyceraldehyde-3-P₄ and two molecules of NADP, besides releasing one CO₂.