THE HEXOSE MONO PHOSPHATE (HMP) SHUNT (THE PENTOSE PHOSPHATE PATHWAY)

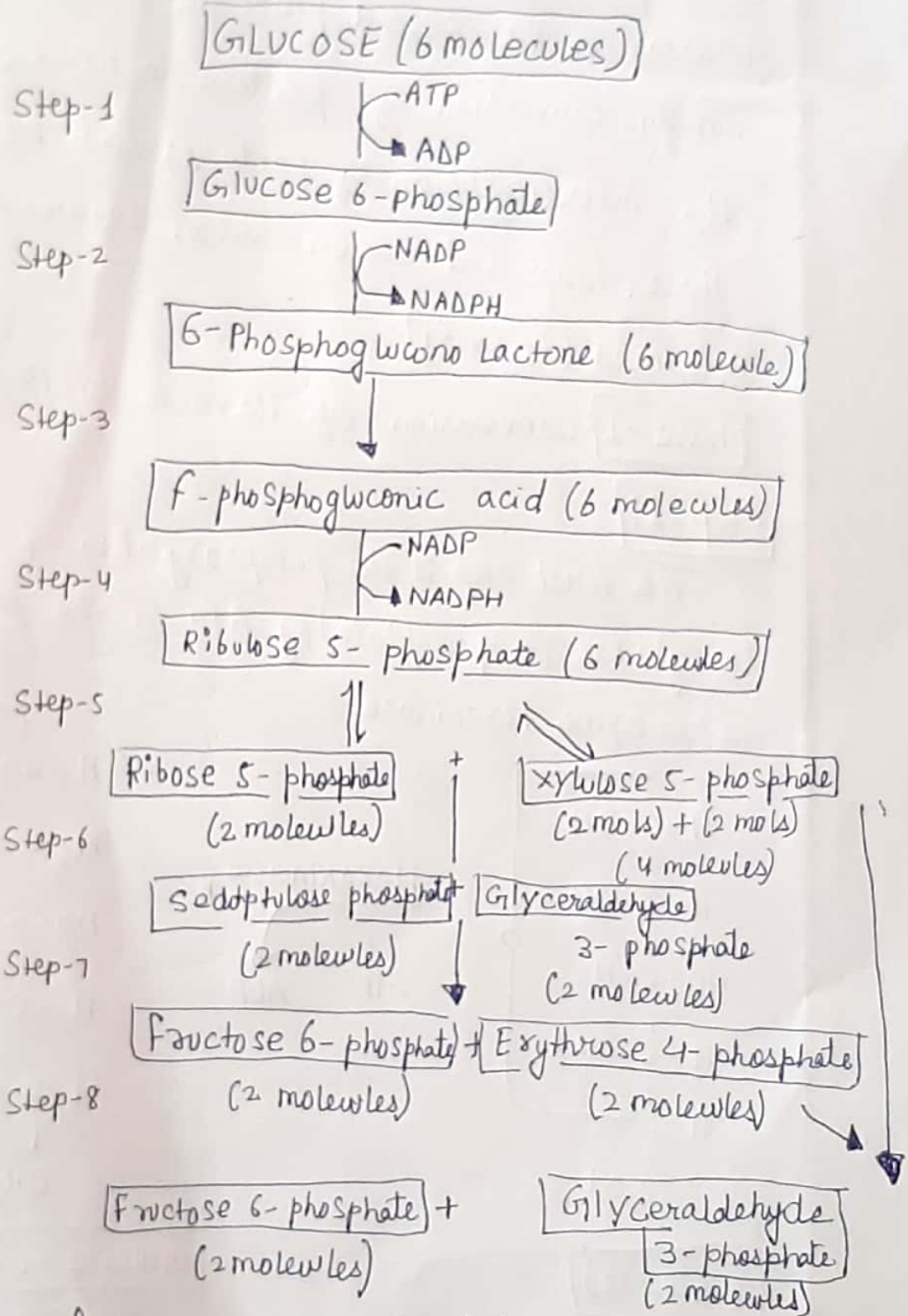


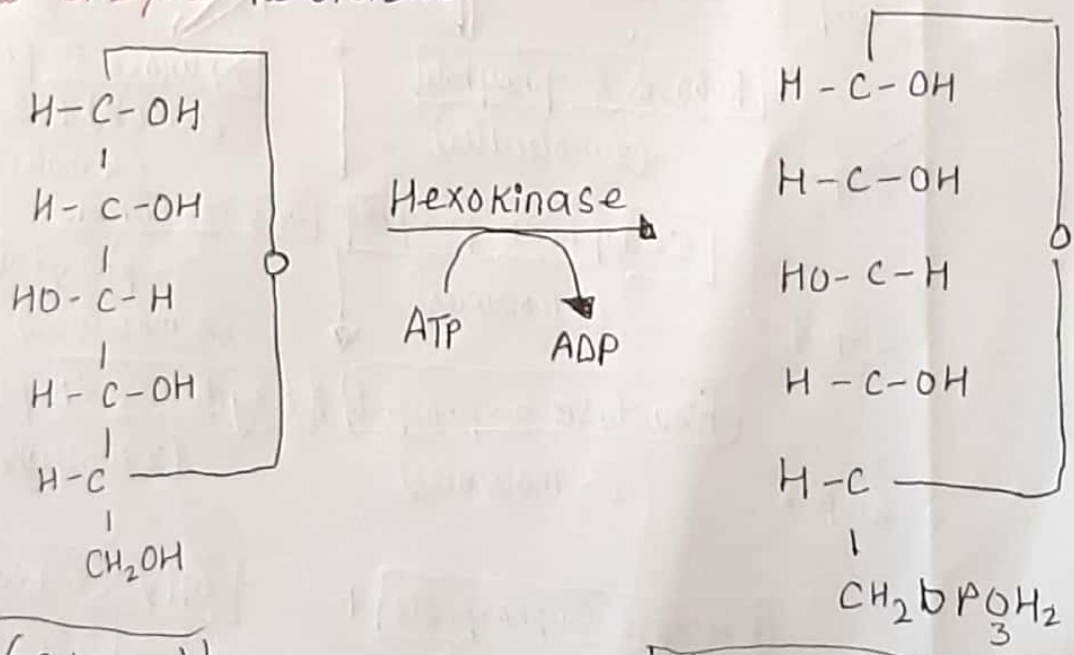
Fig: Hexose monophosphate Shunt

The Pathway consists of two distinct phases. In the first phase, conversion of hexose to pentose occurs whereas in the second phase the reverse occur, namely conversion of pentose to hexose. During the interconversion of pentoses and hexoses, three, four and seven carbon sugars also formed (C_3, C_4, C_7)

phase-1: Conversion of Hexose to Pentose

Step:1:

The first step is the phosphorylation of glucose to glucose (6-phosphate) by ATP in the presence of the enzyme hexokinase

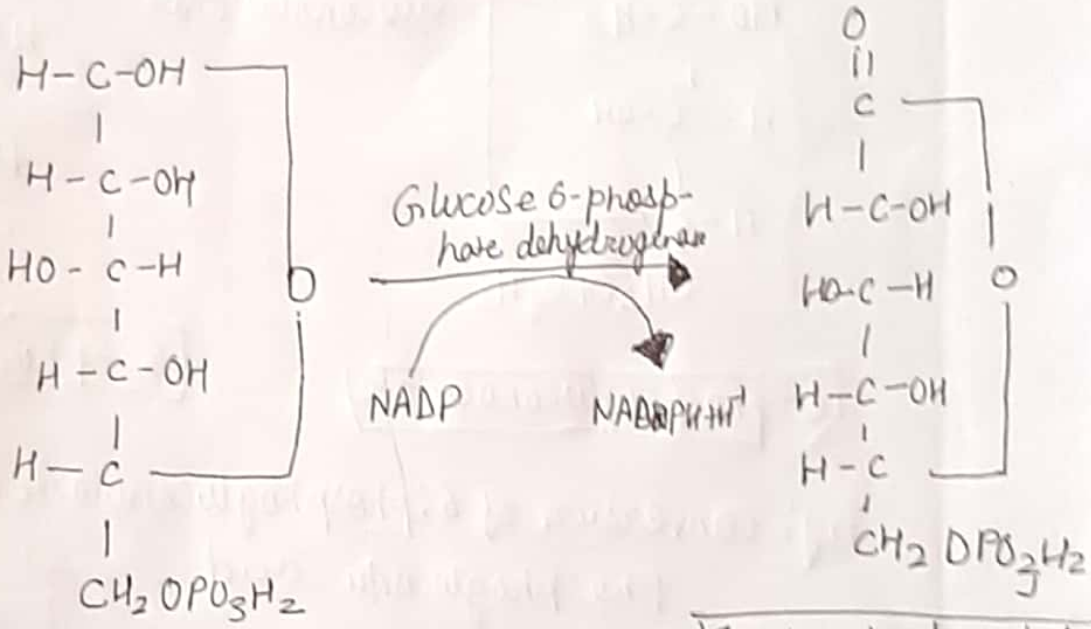


(Glucose) Glucose-6-phosphate

Fig: conversion of glucose into glucose 6-phosphate

Step : 2 :

The second step is the oxidation of glucose 6- phosphate in the presence of NADP and the enzyme



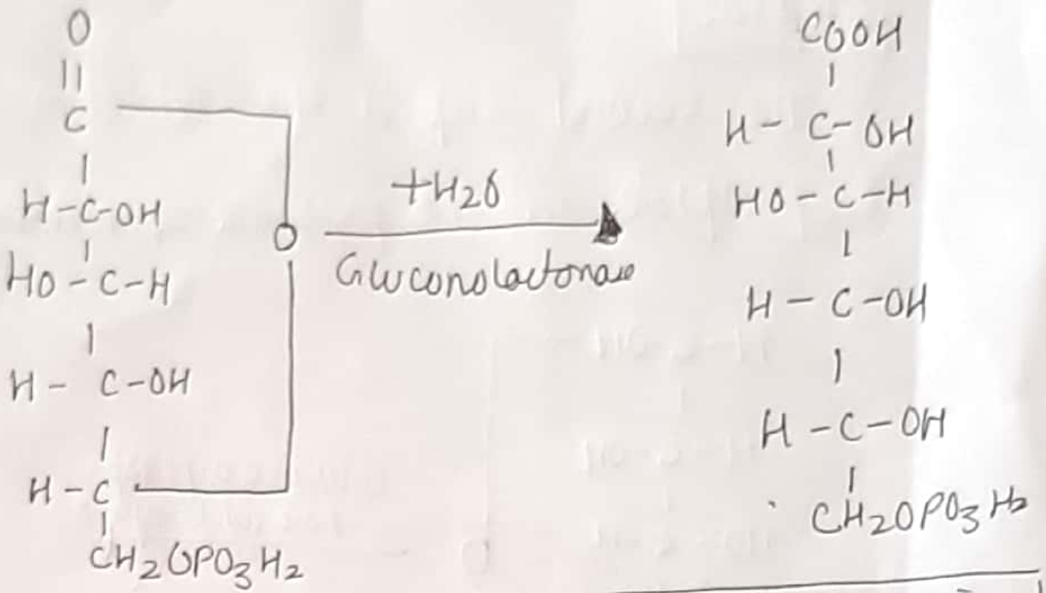
Glucose 6- phosphate

6-phosphoglucono lactone

fig:→ Oxidation of glucose 6-phosphate into 6-phosphoglucono lactone

Step : 3 :

The 6- phosphoglu conolactone is unstable and the ester spotaneously hydrolyses to 6- phosphog luconic acid. The enzyme that catalyses the reaction is gluconolactonase



6-phosphogluconolactone

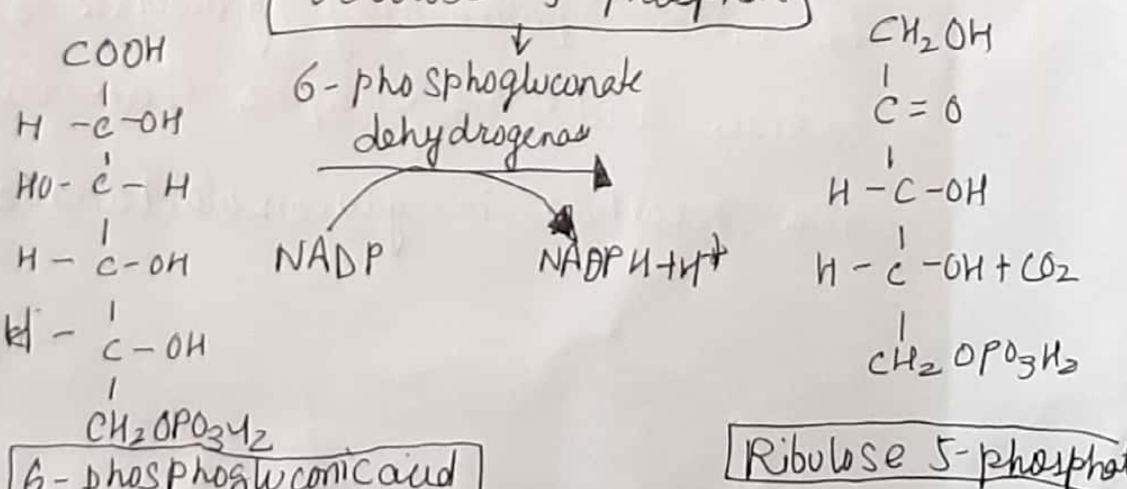
6-phosphogluconic acid

fig: conversion of 6-phosphogluconolactone into 6-phosphogluconic acid

Step: 4:

6-phosphogluconic acid is further oxidized by NADP in the presence of 6-phosphogluconate dehydrogenase to an unstable intermediate which loses CO_2 to give the pentose, ribulose 5-phosphate

∴ fig: conversion of 6-phosphogluconic acid into ribulose 5-phosphate



6-phosphogluconicacid

Ribulose 5-phosphate

Step:5

Ribulose 5-phosphate is acted upon by 2 different enzyme Ribulose 5-phosphate epimerase converts a portion of ribulose 5-phosphate to xylulose 5-phosphate while ribose 5-Phosphate isomerase converts the rest of ribulose 5-phosphate into 5-phosphate

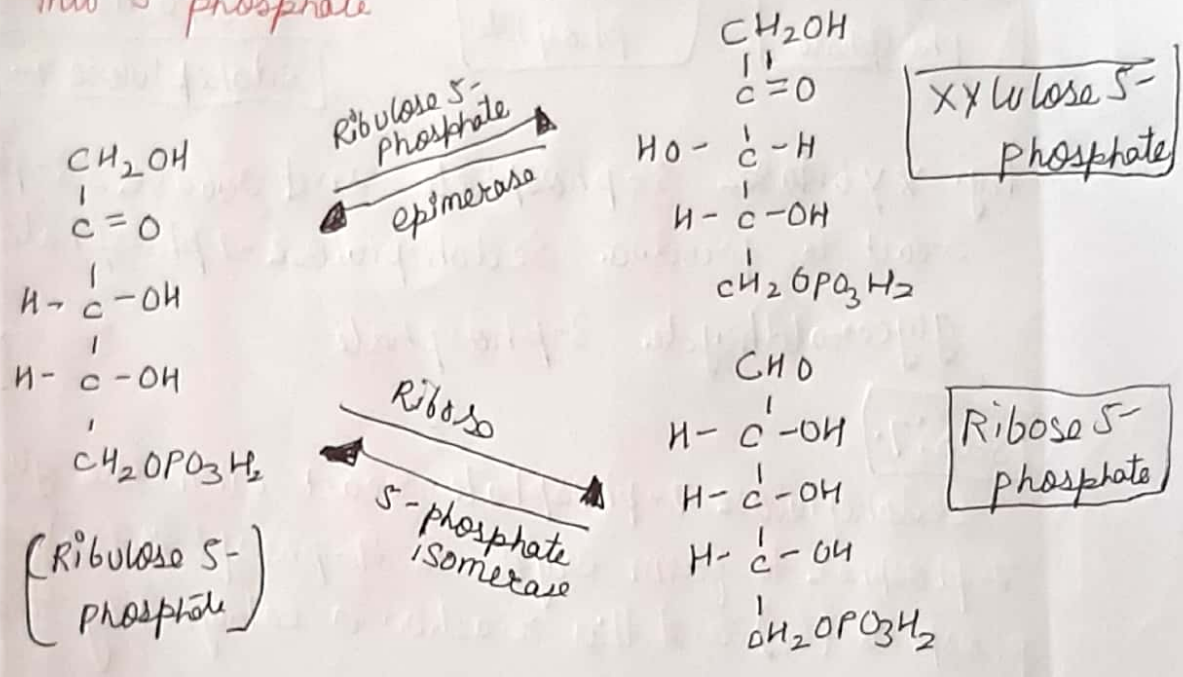


fig:. conversion of ribulose 5-phosphate into xylulose 5-phosphate and ribose 5-phosphate

Phase:2: → conversion of Pentose to Hexose

Step:6

Xylulose-5 phosphate (C_5) and ribose 5-phosphate (C_5) react to form sedoheptulose 7-phosphate (C_7) and glyceraldehyde 3-phosphate (C_3) in the presence of the enzyme transketolase. Thus the two pentose phosphate molecules react to form a heptose phosphate (C_7) and a triose phosphate

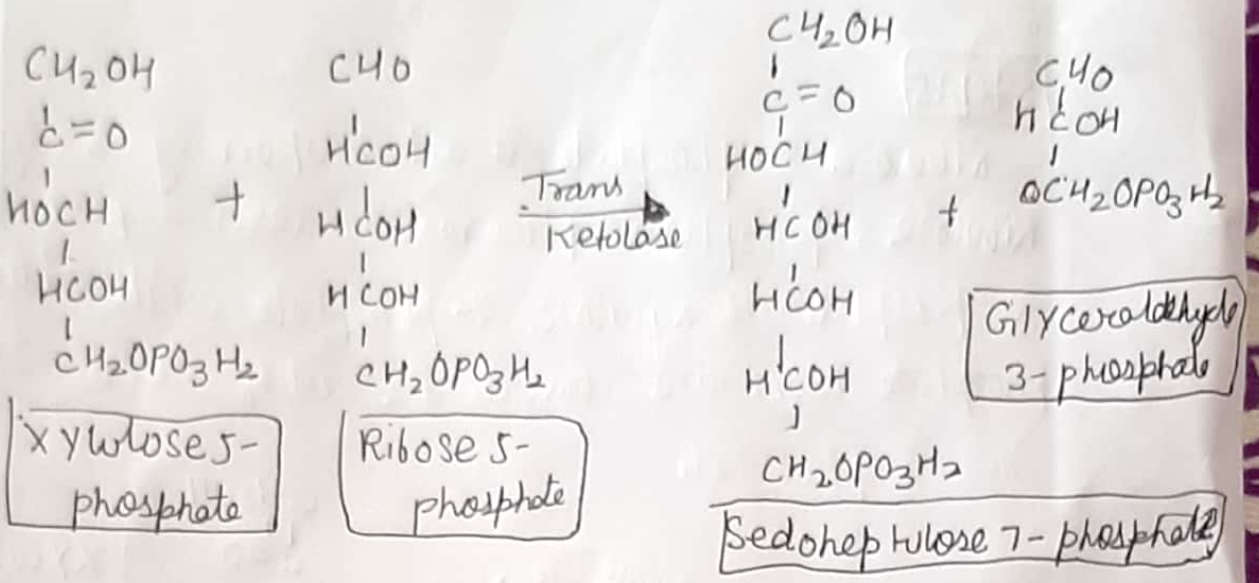


fig: xylulose 5-phosphate and ribose 5-phosphate react to produce Sedoheptulose-7-phosphate and glyceraldehyde 3-phosphate

Step:7.

Sedoheptulose 7-phosphate react with the glyceraldehyde 3-phosphate to form erythrose 4-phosphate (C_4) and fructose 6-phosphate (C_6) and this reaction is catalyzed by transaldolase

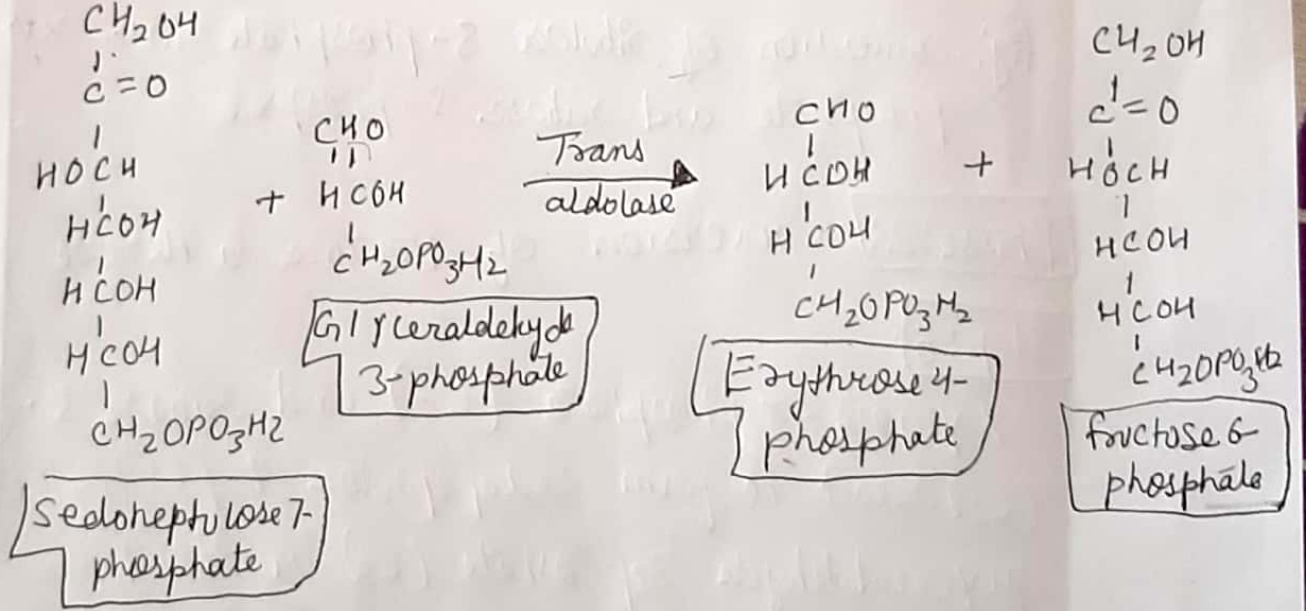


fig: Sedoheptulose reacts with glyceraldehyde 3-phosphate to form erythrose 4-phosphate and fructose 6-phosphate

Step:8

Erythrose 4-phosphate reacts with xylulose 5-phosphate in the presence of transketolase to form fructose 6-phosphate and glyceraldehyde 3-phosphate. These two products of the HMP Shunt link up with the EMP pathway. Fructose 6 phosphate is converted to glucose 6-phosphate in the presence of phosphoglucoisomerase and glyceraldehyde 3-phosphate is also converted to glucose 6-phosphate by the enzymes of the glycolytic pathway working in a reverse direction

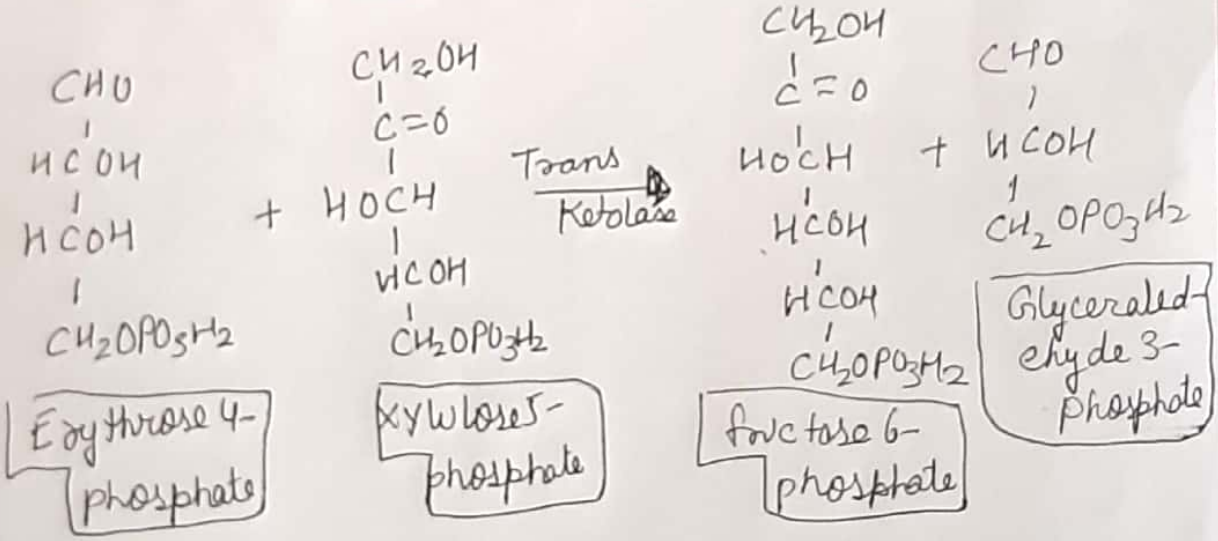


fig: Erythrose 4-phosphate reacts with Xylulose 5-phosphate to form fructose 6-phosphate and glyceraldehyde 3-phosphate