GLYCOLYSIS

CC-12
UNIT-4

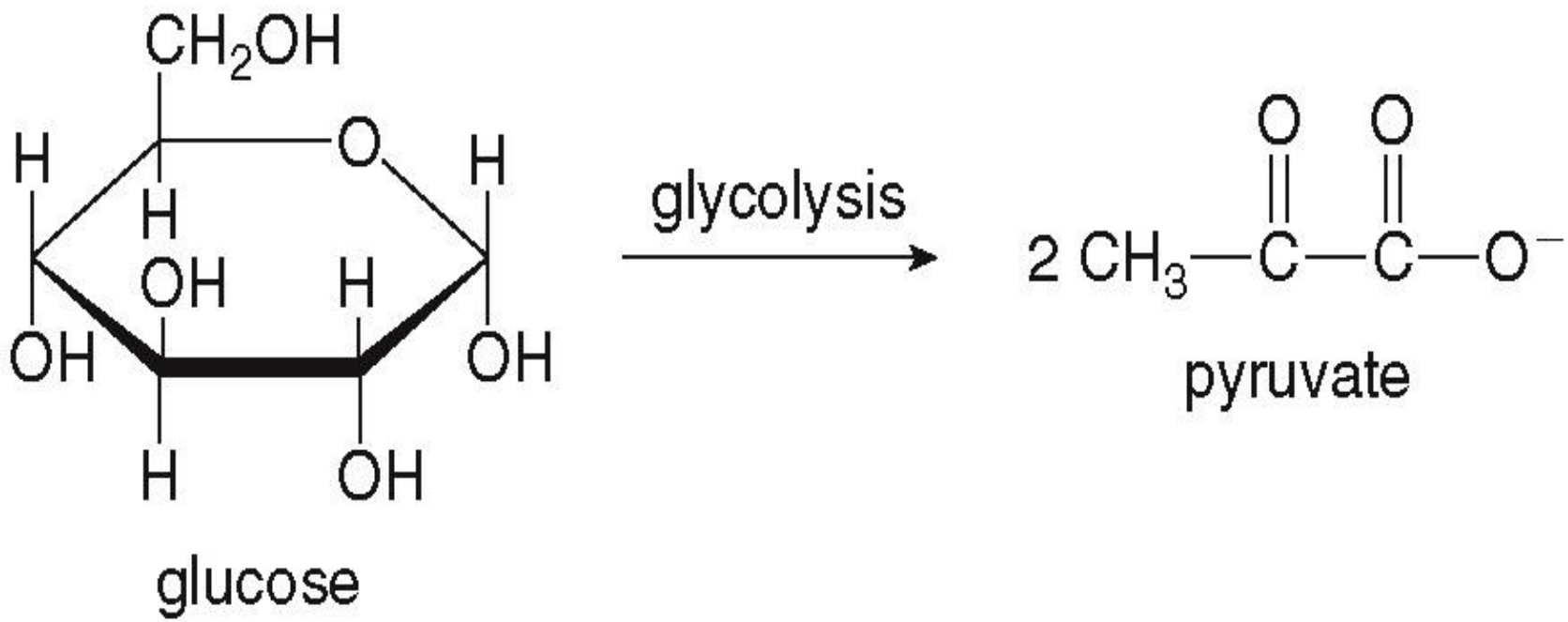
DR. ARINDAM MANDAL
Assistant Professor
Bejoy Narayan Mahavidyalaya
Itachuna, Hooghly
West Bengal

Glycolysis

Glucose is converted to two molecules of pyruvate.

An anaerobic reaction in cytoplasm.

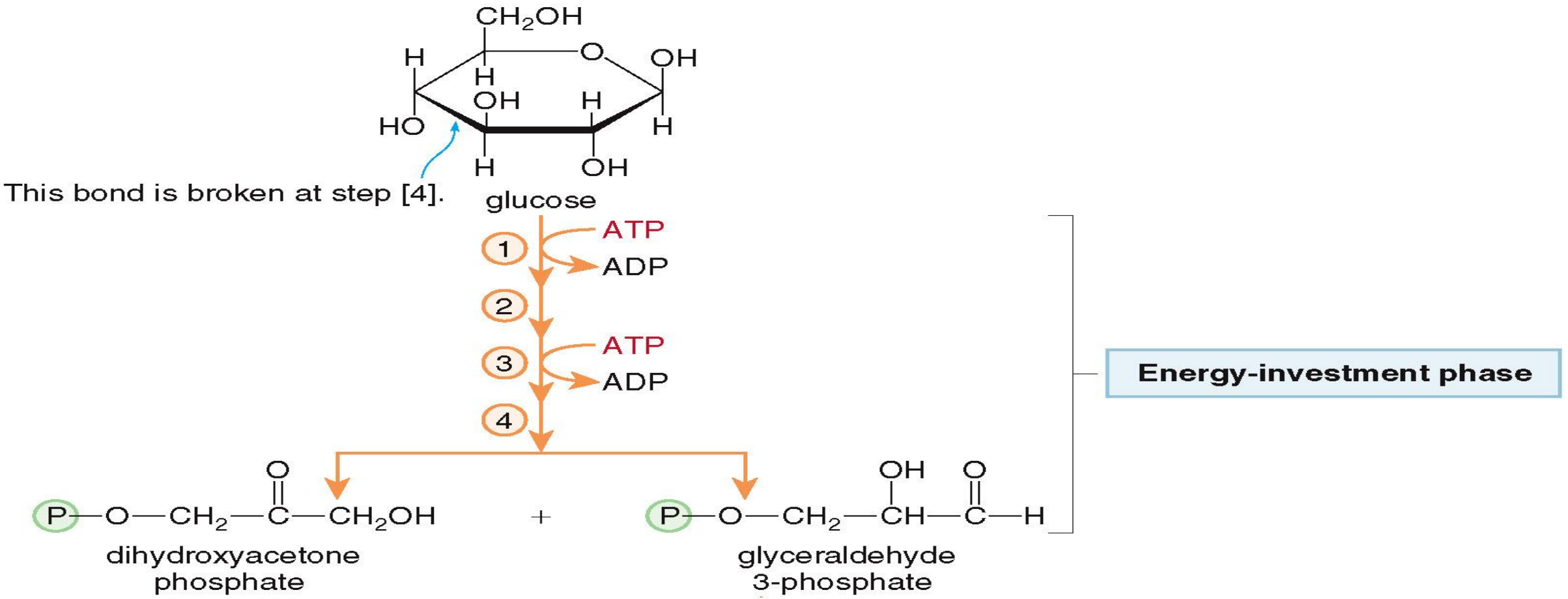
10 Reactions



Preparatory phase

Steps [1] – [5] energy investment phase:

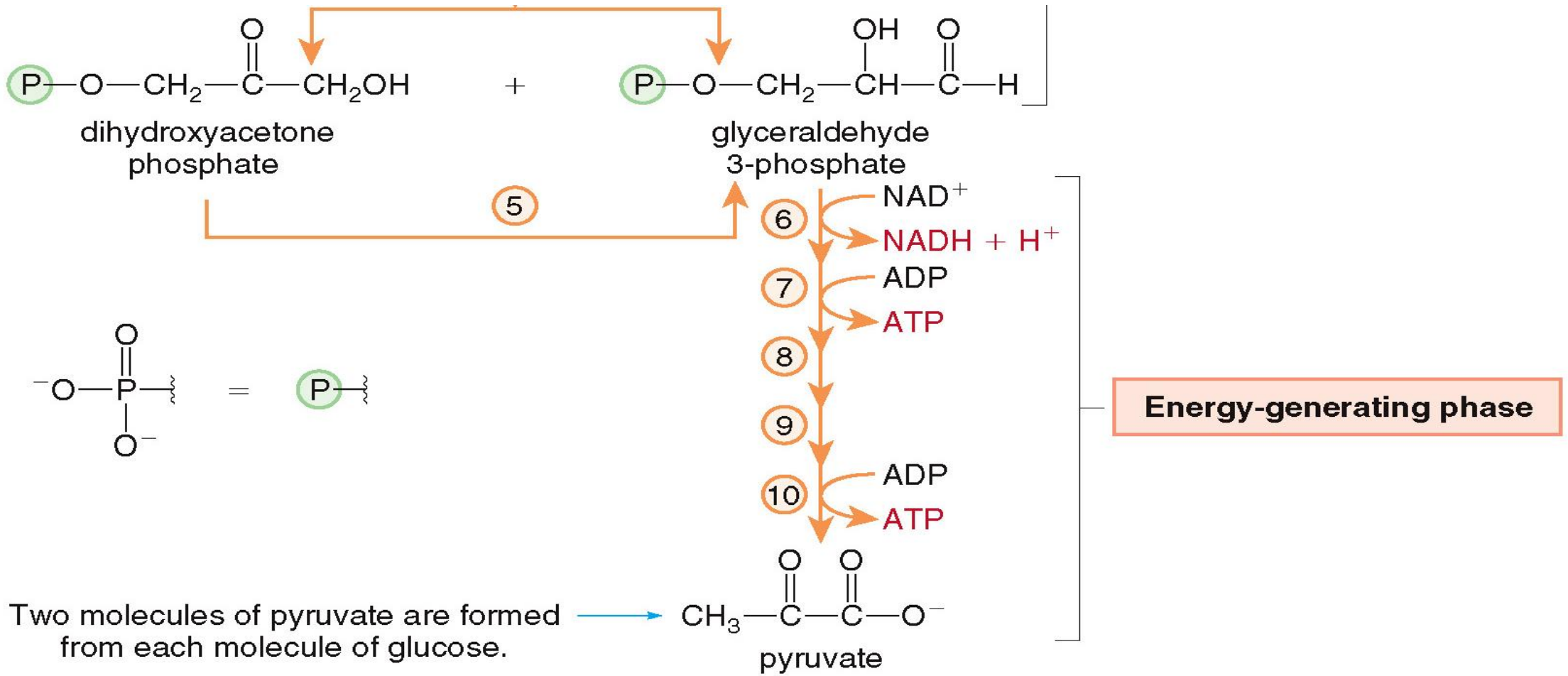
- **2 ATP molecules are hydrolyzed.**
- **The 6-carbon glucose molecule is converted into two 3-carbon segments**



Pay-off phase

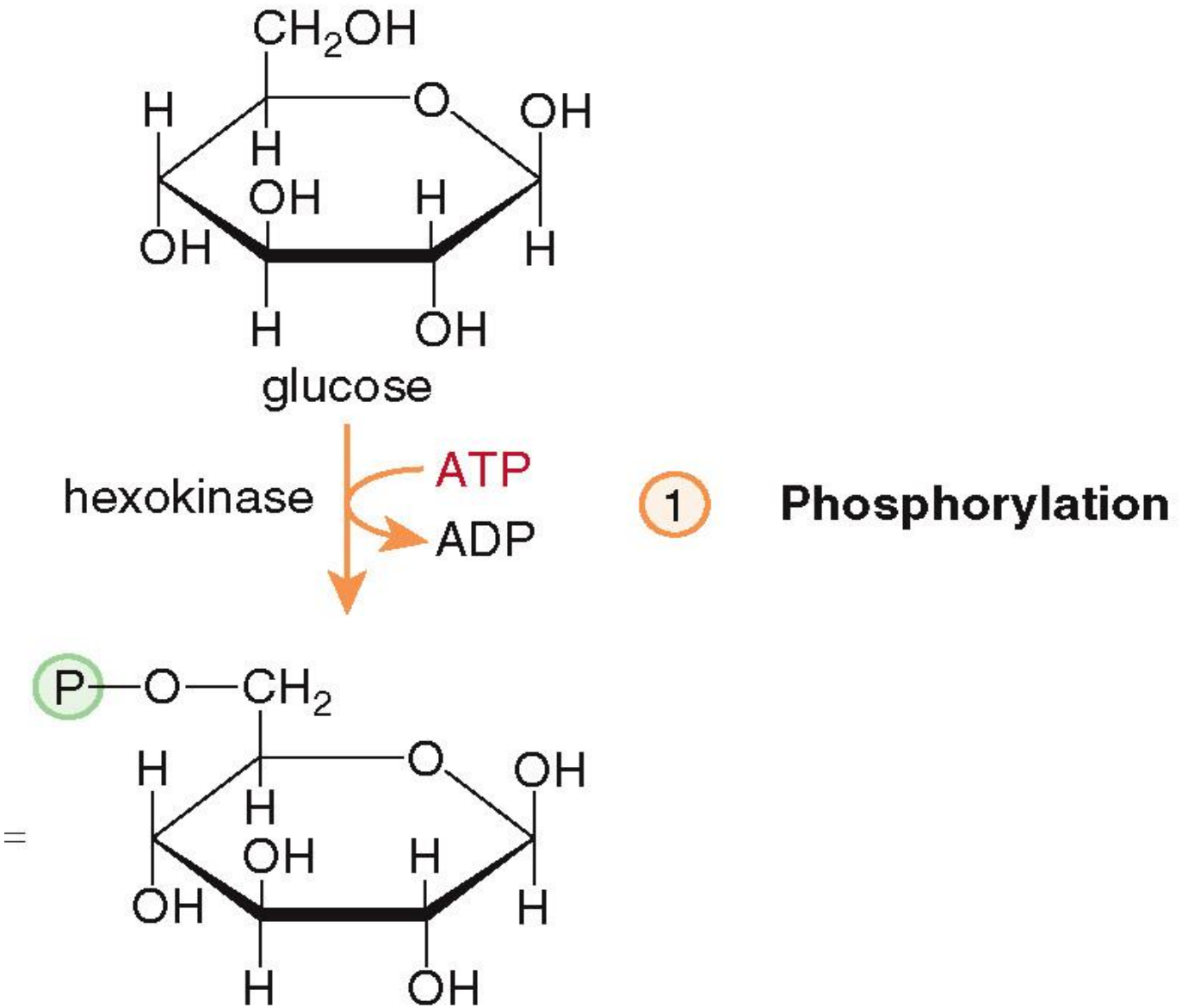
Steps [6] – [10] energy-generating phase:

Producing 1 NADH and 2 ATPs for each pyruvate formed.



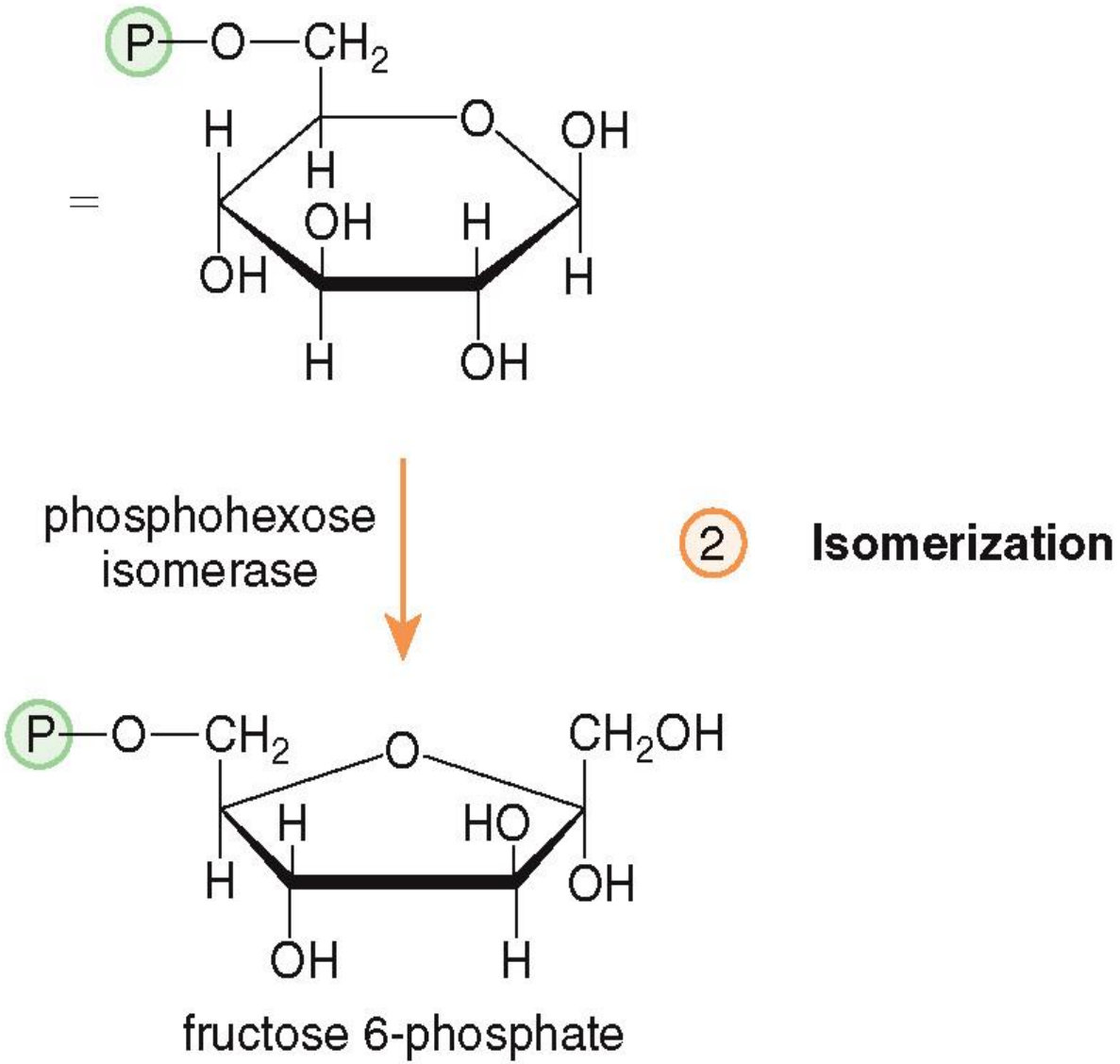
Glycolysis-Step [1]

- **Begins with the phosphorylation of glucose into glucose 6-phosphate, using an ATP and a kinase enzyme.**



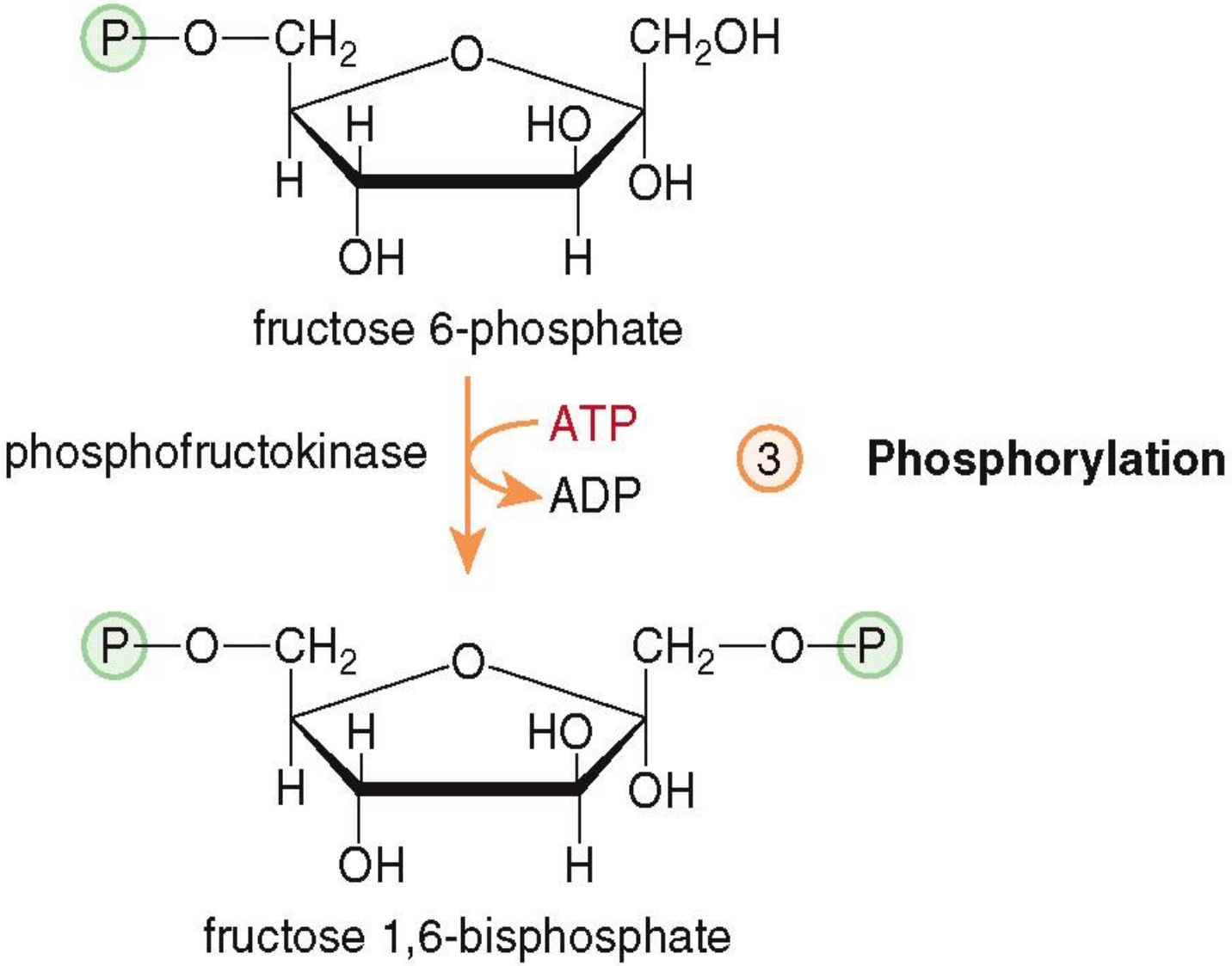
Glycolysis-Step [2]

Step [2] isomerizes glucose 6-phosphate to fructose 6-phosphate with an isomerase enzyme



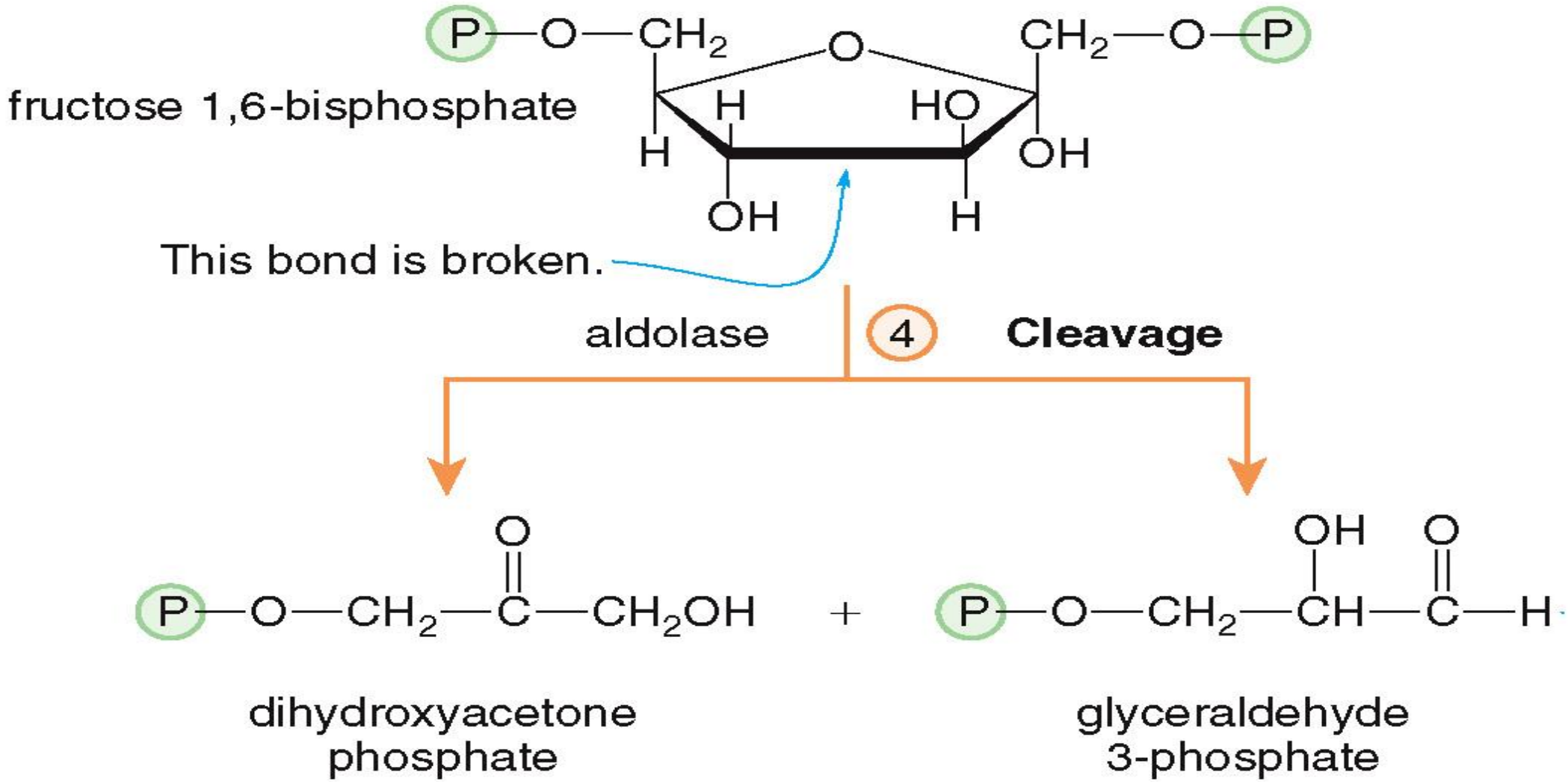
Glycolysis-Step [3]

Phosphorylation of fructose 6-phosphate into fructose 1,6-bisphosphate with a kinase enzyme.



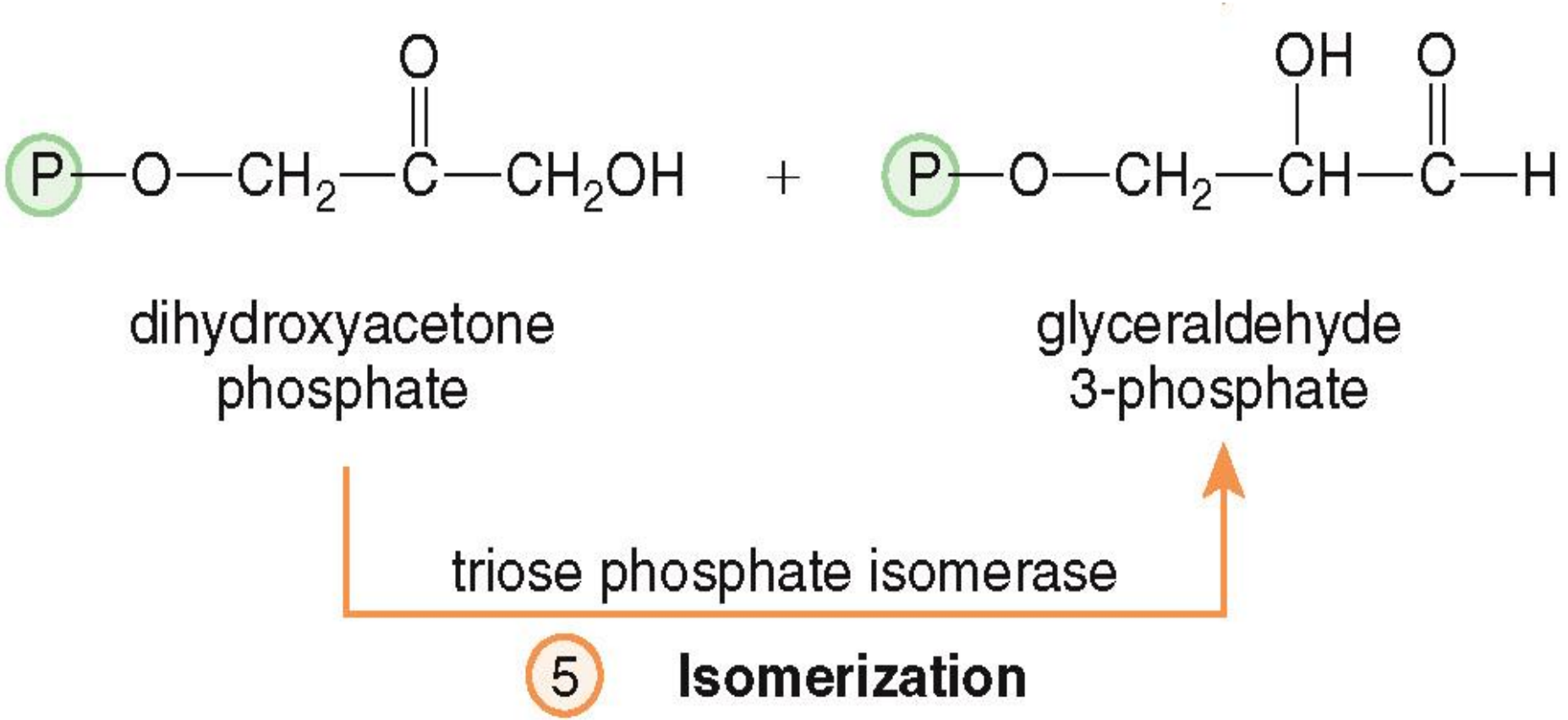
Glycolysis-Step [4]

Cleavage of the fructose ring into a dihydroxy-acetone phosphate and a glyceraldehyde 3-phosphate.



Glycolysis-Step [5]

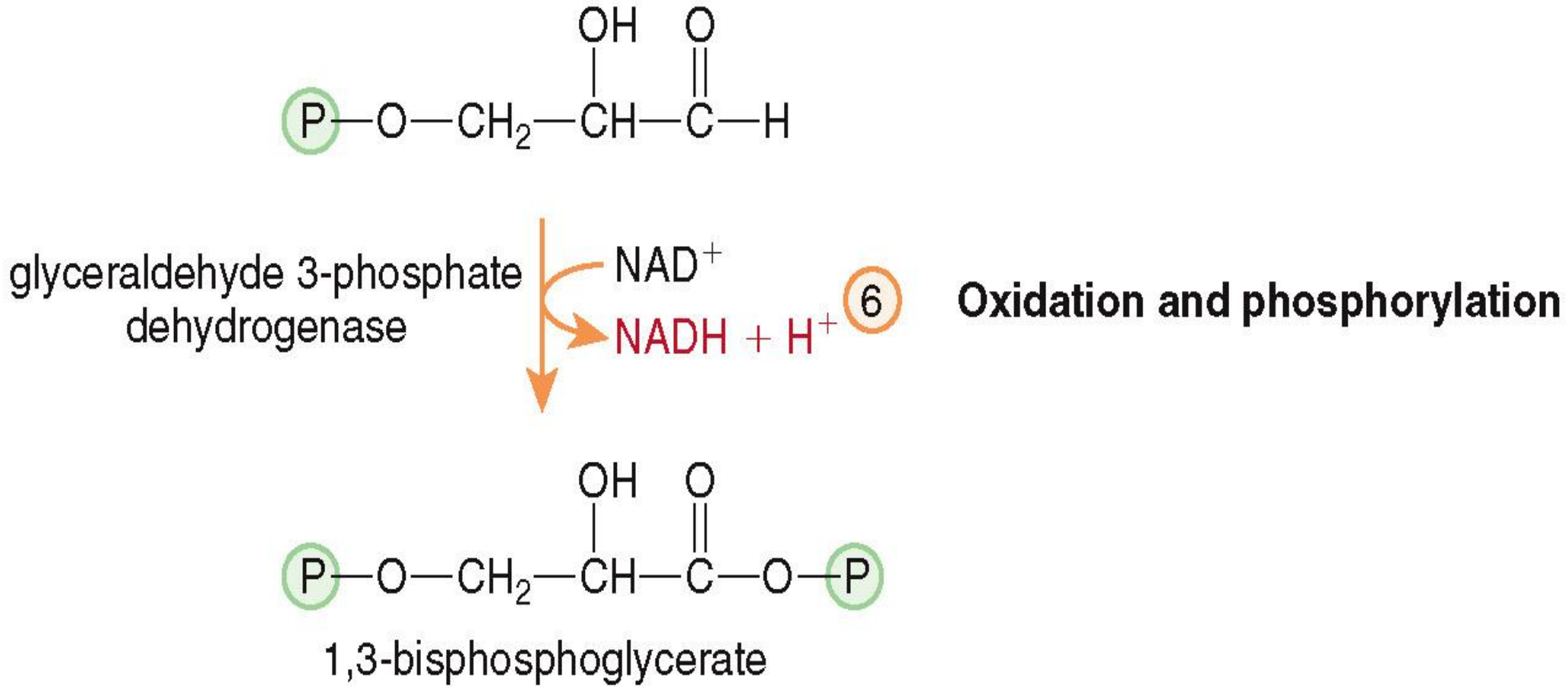
Isomerization of the dihydroxyacetone phosphate into another glyceraldehyde 3-phosphate.



Thus, the first phase of glycolysis converts glucose into 2 glyceraldehyde 3-phosphate units and 2 ATP is used.

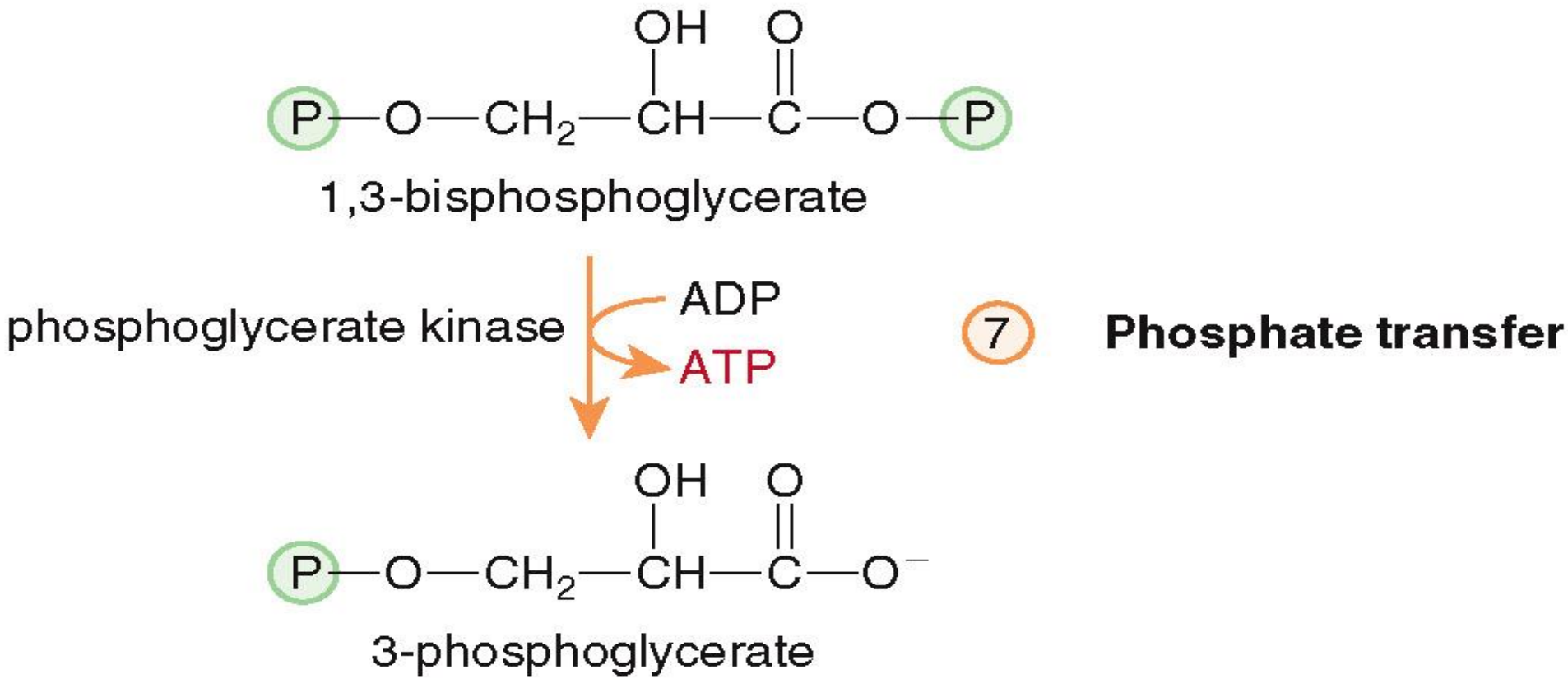
Glycolysis-Step [6]

The aldehyde end of the molecule is oxidized and phosphorylated by a dehydrogenase enzyme and NAD^+; this produces 1,3-bisphospho-glycerate and NADH.



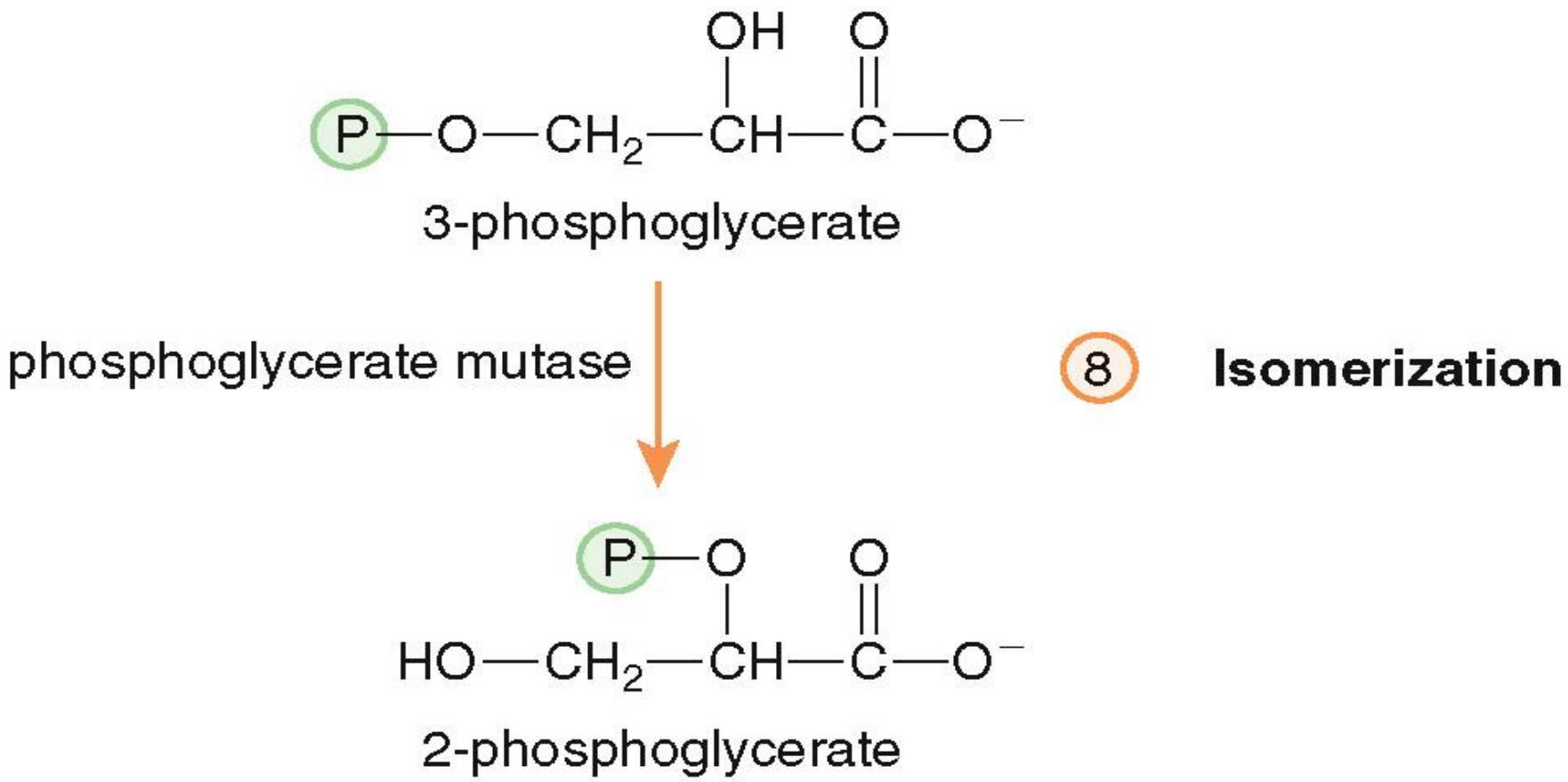
Glycolysis-Step [7]

The phosphate group is transferred onto an ADP with a kinase enzyme, forming 3-phosphoglycerate and ATP.



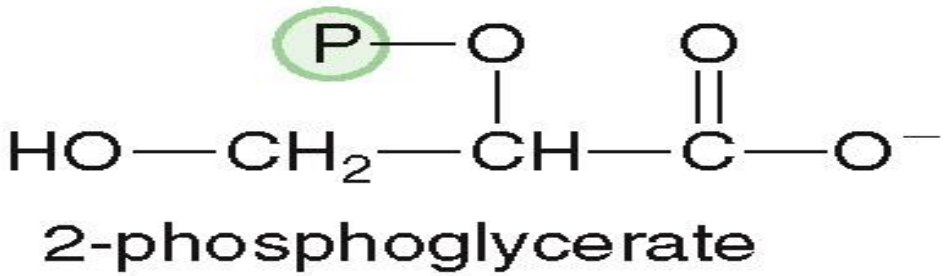
Glycolysis-Step [8]

The phosphate group is isomerized to a new position in 2-phosphoglycerate.



Glycolysis-Step [9]

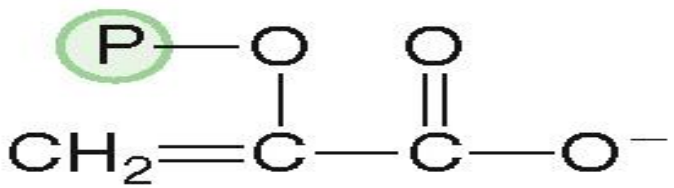
water is lost to form phosphoenol-pyruvate.



2-phosphoglycerate

enolase

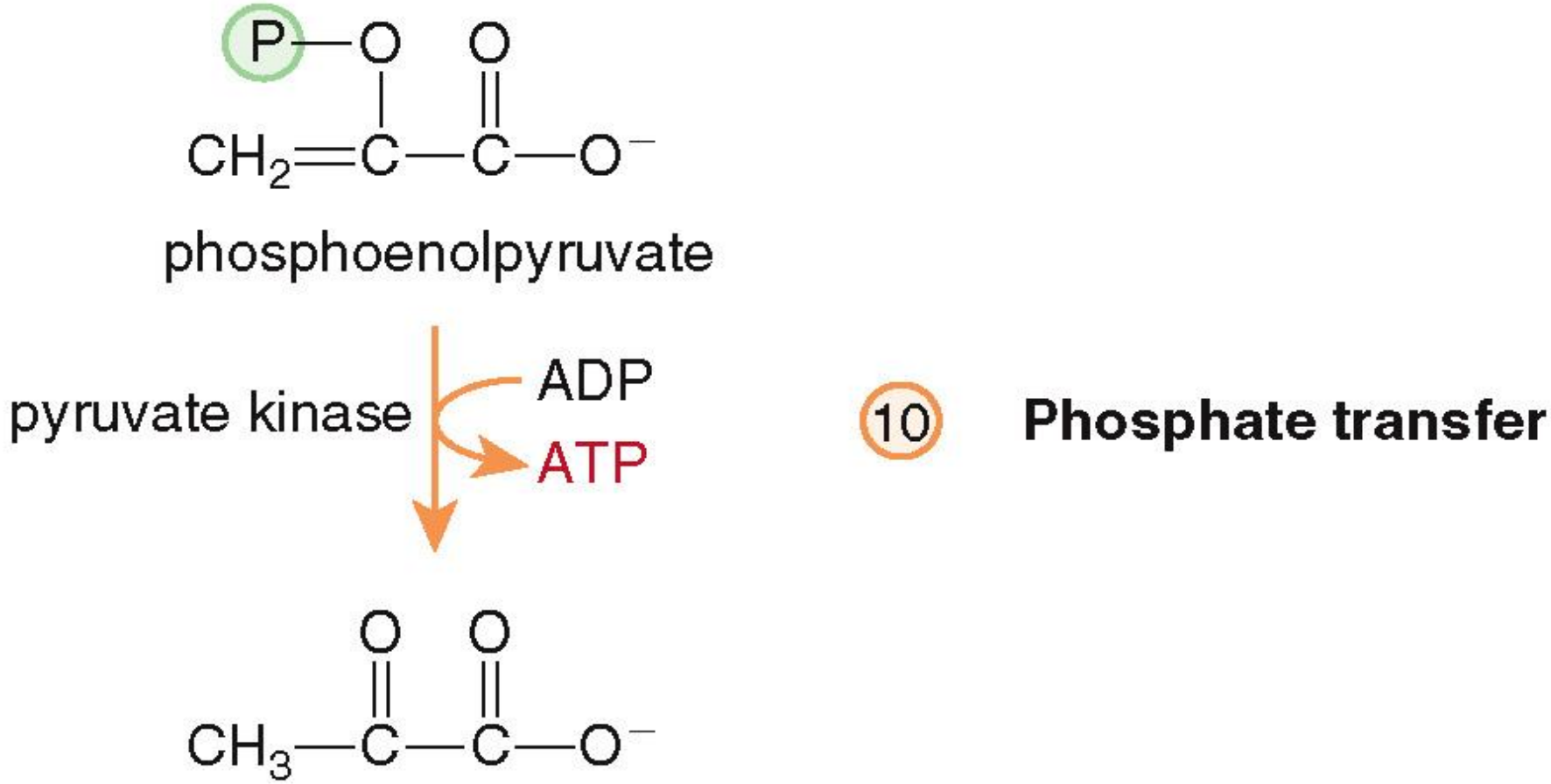
9 **Dehydration**



phosphoenolpyruvate

Glycolysis-Step [10]

The phosphate is transferred to an ADP, yielding pyruvate and ATP with a kinase enzyme.



Significance

- **Although four ATP molecules are produced in the second half, the net gain of glycolysis is only two ATP because two ATP molecules are used in the first half of glycolysis.**
- **Enzymes that catalyze the reactions that produce ATP are rate-limiting steps of glycolysis and must be present in sufficient quantities for glycolysis to complete the production of four ATP, two NADH, and two pyruvate molecules for each glucose molecule that enters the pathway.**
- **Red blood cells require glycolysis as their sole source of ATP in order to survive.**