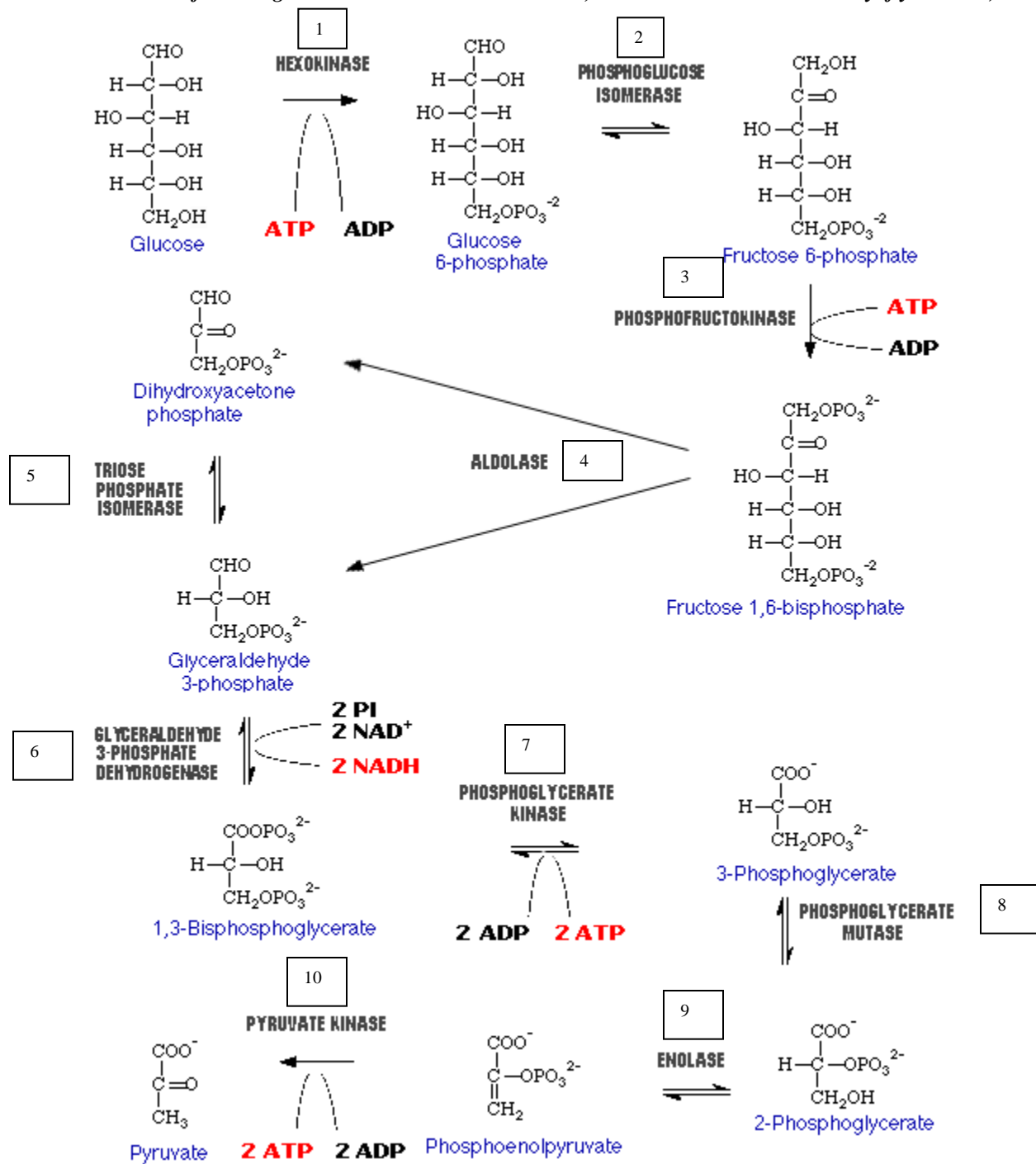


Concept Development 1B: Glycolysis - The Pathway

(In the electronic version of this diagram - the structures are live links, molecular models- Give it a try if you'd like)



The animation below clearly explains each step of the process...

<http://programs.northlandcollege.edu/biology/Biology1111/animations/glycolysis.html>

Glycolysis

The reaction pathway that you see is called glycolysis. Your cells use glycolysis in order to produce some ATP energy and the high energy electron carrying cofactor called NADH. You don't need to memorize the steps of glycolysis, but we are going to use the steps of glycolysis in order to teach you about some difficult concepts which take place during cellular respiration.

Reaction 1

In this step glucose is converted into a new molecule by an ATP. The ATP donates one of its phosphates in order to place a phosphate onto one end of the glucose molecule.

Question:

What is hexokinase and what is its role in this reaction?

Reaction 2

In this step a special enzyme moves an oxygen double bond to another carbon in the glucose molecule. This step is only in preparation for the third reaction of glycolysis. Without this step the third reaction of glycolysis could not occur.

Reaction 3

In this step another ATP donates another phosphate molecule to glucose. Now both end carbons on the glucose molecule contain a phosphate.

Question:

How much energy has been produced at this point of glycolysis? Anything surprise you in terms of energy production or usage so far??

Reaction 4

This step prepares the glucose molecule for energy extraction by breaking it into two separate molecules. Now these two separate molecules are ready to complete glycolysis and create energy for the cell.

Reaction 6

In this step, the molecules NAD⁺ and phosphate are used to place another phosphate onto the ends of the three carbon molecules created by slicing glucose in half. Remember the molecule NADH. It will become very important in later stages of cellular respiration.

Questions:

What are the reactants in this reaction?

What is a cofactor? Is there an example of a cofactor in this reaction? What exactly does this cofactor do in this reaction?

Why is it necessary to have 2 phosphates and 2 NAD⁺ available for this reaction?

What is a redox reaction? What molecule is being reduced in this reaction? What molecule is being oxidized in this reaction? What element carries electrons around the cell?

Reaction 7

In this reaction ATP is produced by the three carbon molecule donating one of its phosphates to ADP.

Questions:

What is the role of phosphoglycerate kinase in this reaction? Why is phosphoglycerate kinase necessary to accomplish this reaction?

Why does the diagram say that 2 ATPs are produced in this reaction? Is this a misprint? If it's correct, can you explain why 2 ATPs are produced here?

Reactions 8 and 9

In these reactions the three carbon molecule has its structure rearranged in order to prepare for and make step 9 easier.

Reaction 10

In this reaction more ATP is produced by the three carbon molecule donating its final phosphate to ADP.

Questions:

What is the role of pyruvate kinase in this reaction? Why is pyruvate kinase necessary to accomplish this reaction?

Why does the diagram say that 2 ATPs are produced in this reaction? Is this a misprint? If it's correct, can you explain why 2 ATPs are produced here?

How many pyruvates are left after glycolysis?

What was the gross production of ATP during glycolysis?

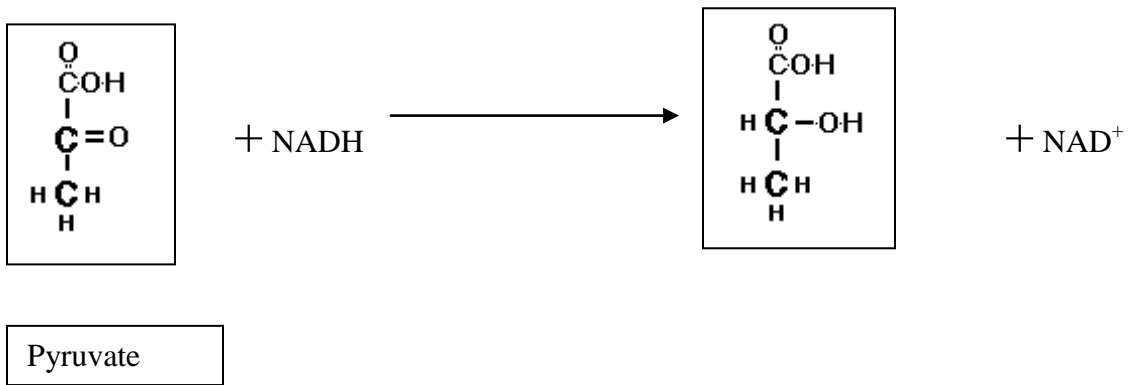
What was the net production of ATP during glycolysis?

Do you need to have oxygen molecules present inside the cell in order for glycolysis to take place?

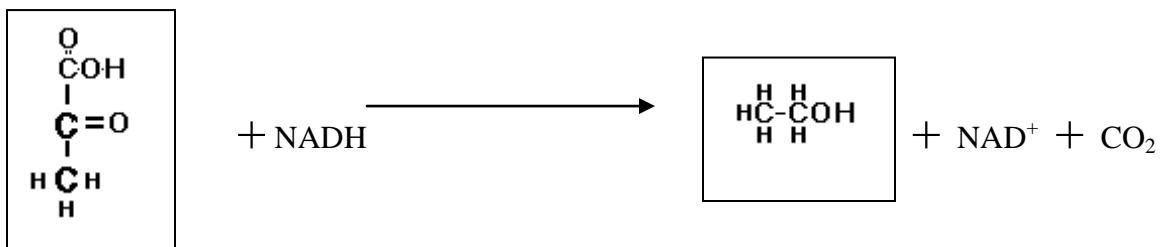
Besides ATP, what are the two other very important products of glycolysis?

We will learn what happens to these two other products soon!!

Lactic Acid Fermentation



Alcohol Fermentation



Questions:

What molecule would have to be absent in order for the processes shown above to occur?

The two processes shown above share a common purpose. What is that purpose? Why is it necessary when no oxygen is present in the cell?

In what types of organisms would lactic acid fermentation take place?

In what types of organisms would alcohol fermentation take place?