Glycolysis

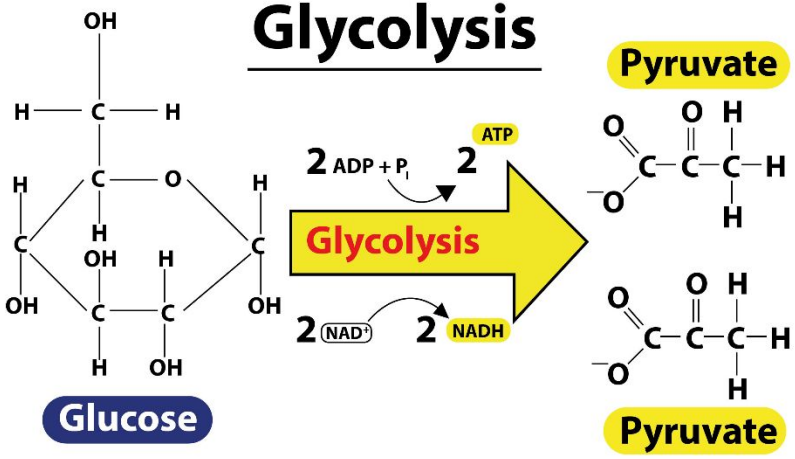
Splitting glucose to jumpstart cellular respiration

Terms to keep in mind:

- Glycolysis
- Pyruvate
- Phosphorylation
- Glucose (hexose)
- Fructose phosphate
- Fructose 1,6 bisphosphate
- Triose phosphate
- Oxidation
- Reduction
- NAD

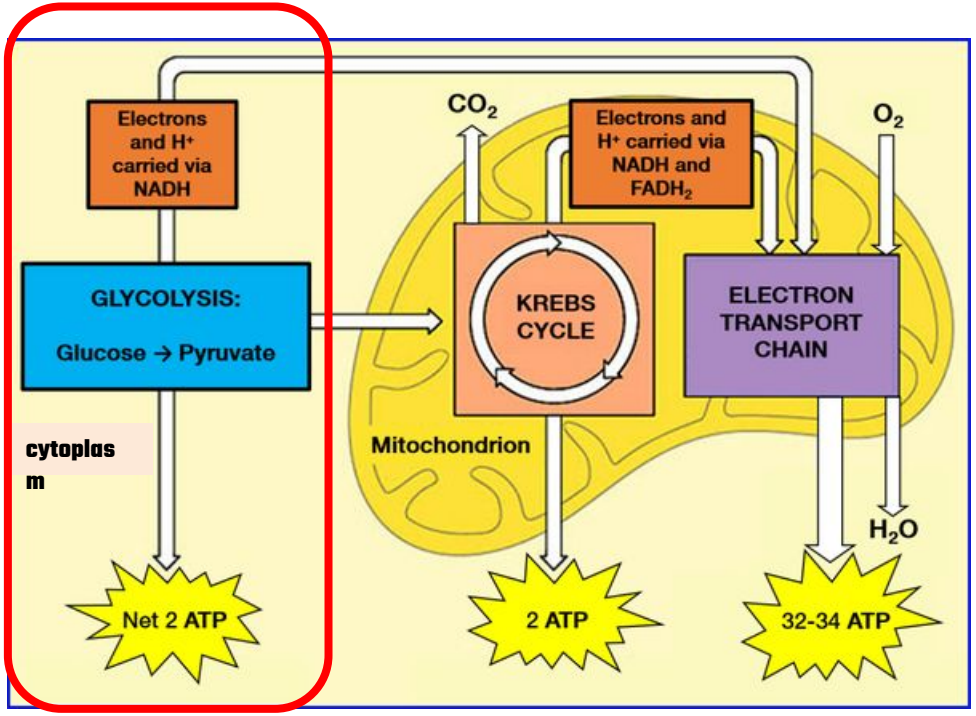
Glycolysis

- The first step in cellular respiration
- The splitting of glucose (with 6 carbons or 6C) into 2 pyruvate molecules (with 3 carbons each or 3C)



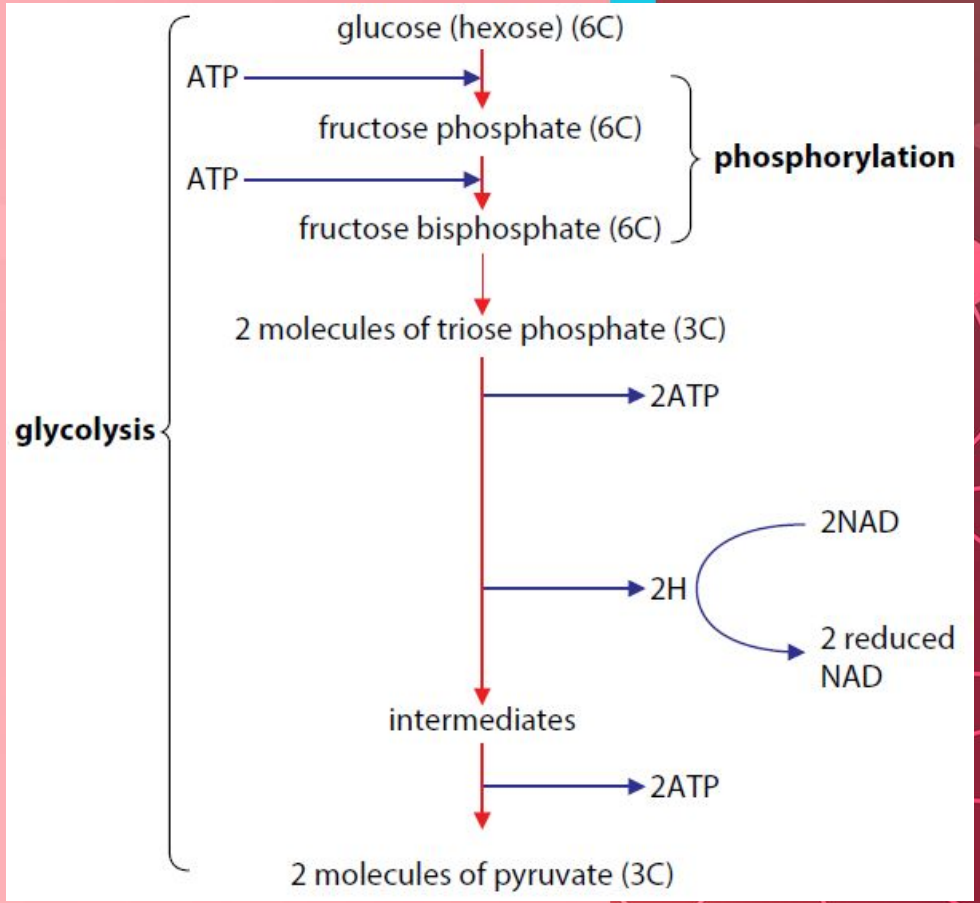
Glycolysis

- Occurs in the ***cytoplasm*** of cells
- Uses ATP but releases ATP as well
- Uses 2 ATP but releases 4 ATP, so a net of 2 ATP in one process.



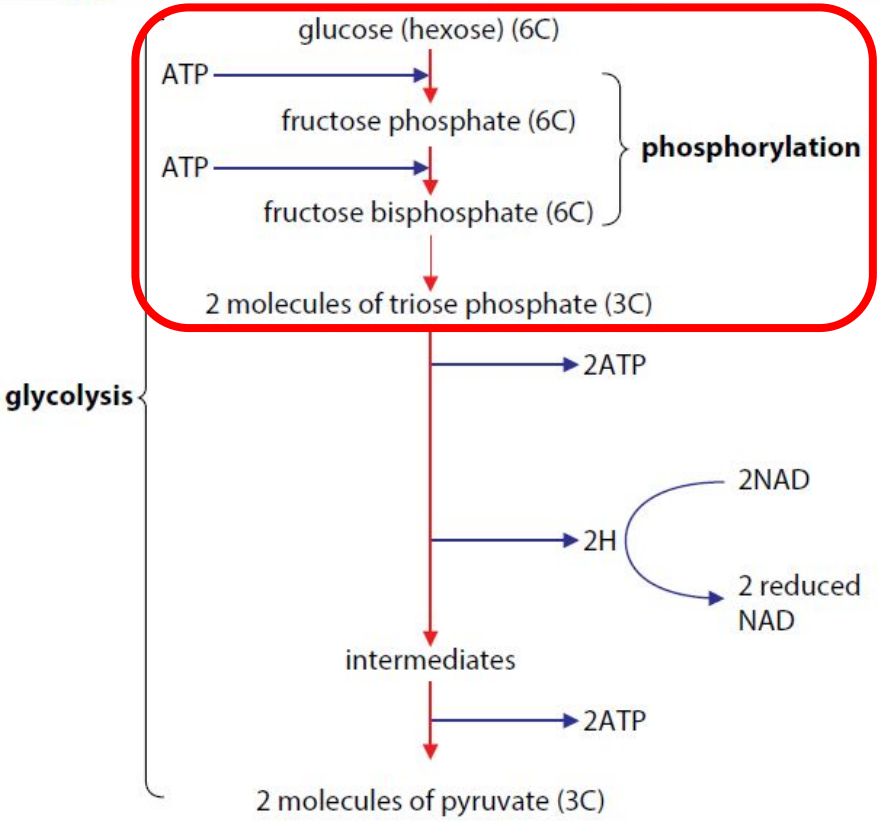
Steps in Glycolysis

- 1. <u>phosphorylation</u>
  - *Splitting of glucose (6C) into 2 triose phosphate (3C) molecules with usage of ATP*
- 2. <u>triose phophate to pyruvate</u>
  - *Transforming triose phosphate (3C) to pyruvate (3C)*
  - *Reduction of NAD*



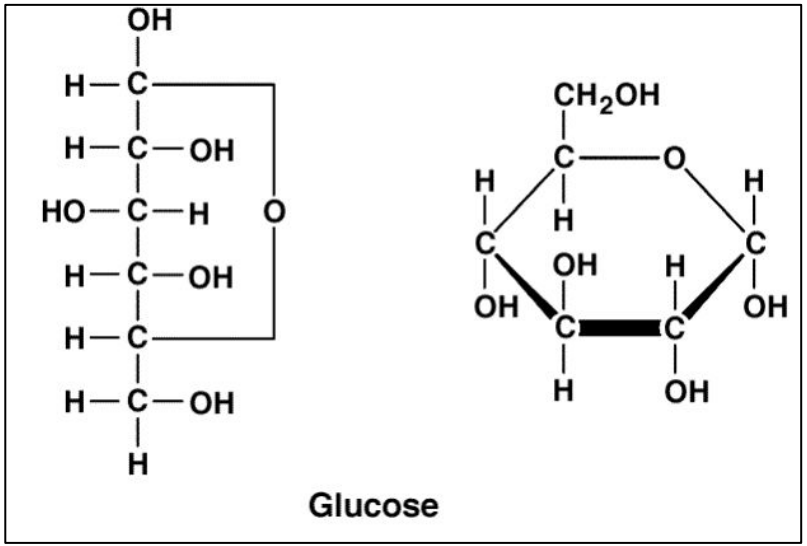
Step 1. Phosphorylation

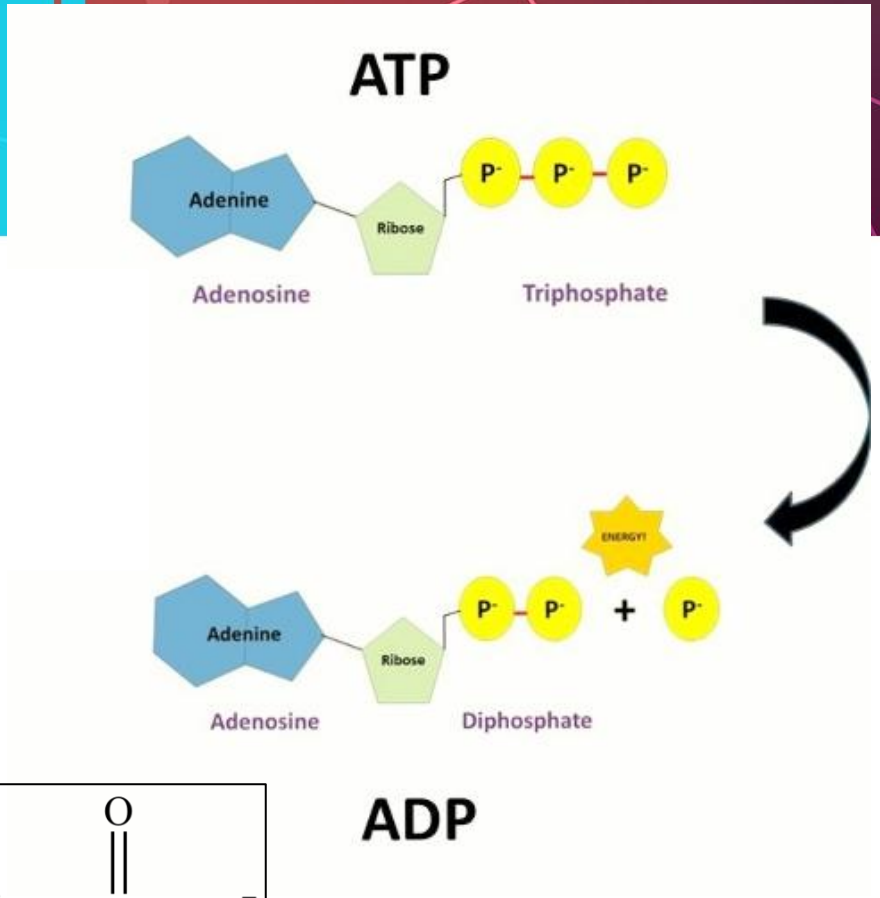
- Adding of phosphate groups to glucose to raise its energy level (make it more reactive – easier to split apart)

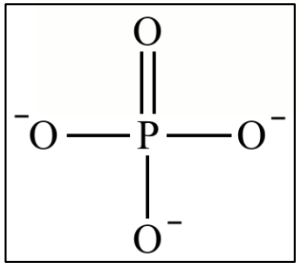


Step 1. Phosphorylation

- Structures & processes involved:



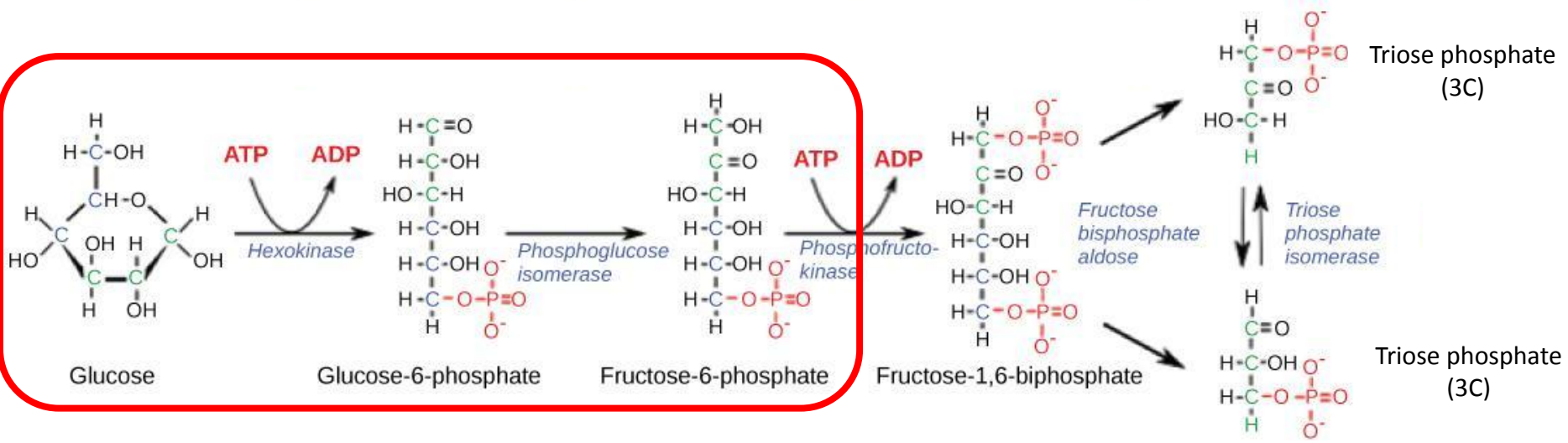




Phosphate group

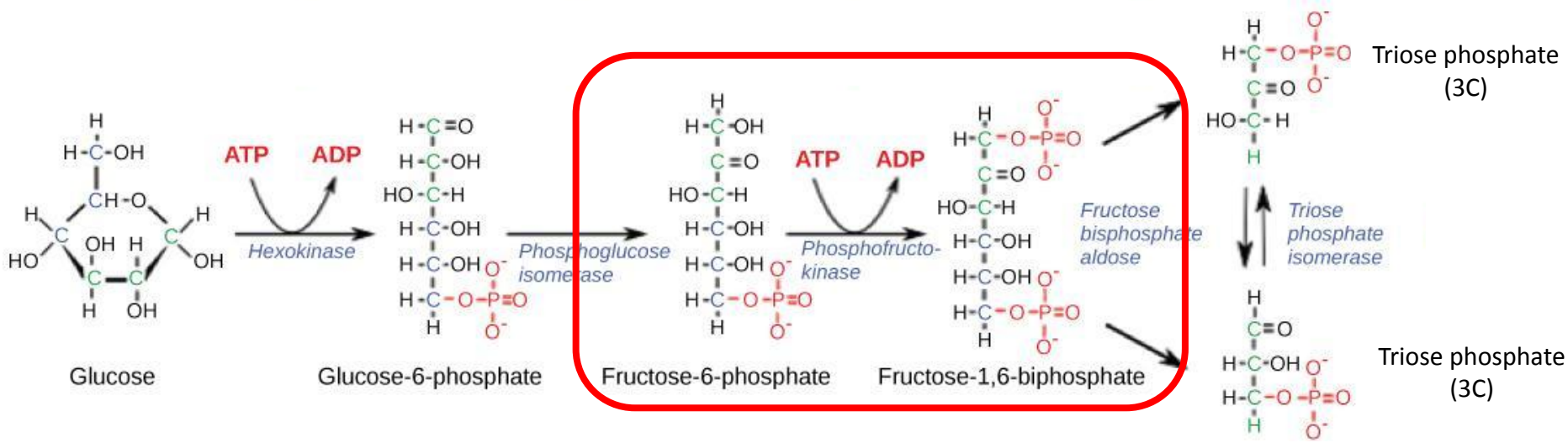
Step 1. Phosphorylation

- 1.a. One phosphate of ATP added to glucose and it becomes fructose-6-phosphate
- *(with the help of enzymes)*



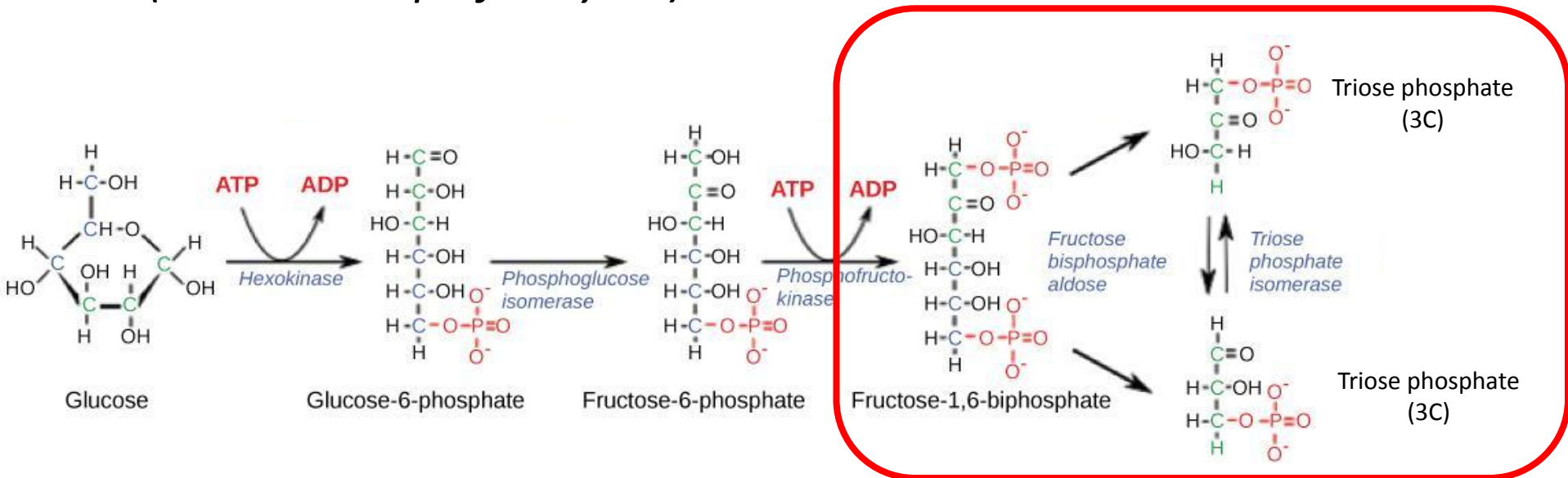
Step 1. Phosphorylation

- 1.b. One phosphate of ATP added to fructose-6-phosphate and it becomes fructose-1,6-bisphosphate
- *(with the help of enzymes)*



Step 1. Phosphorylation

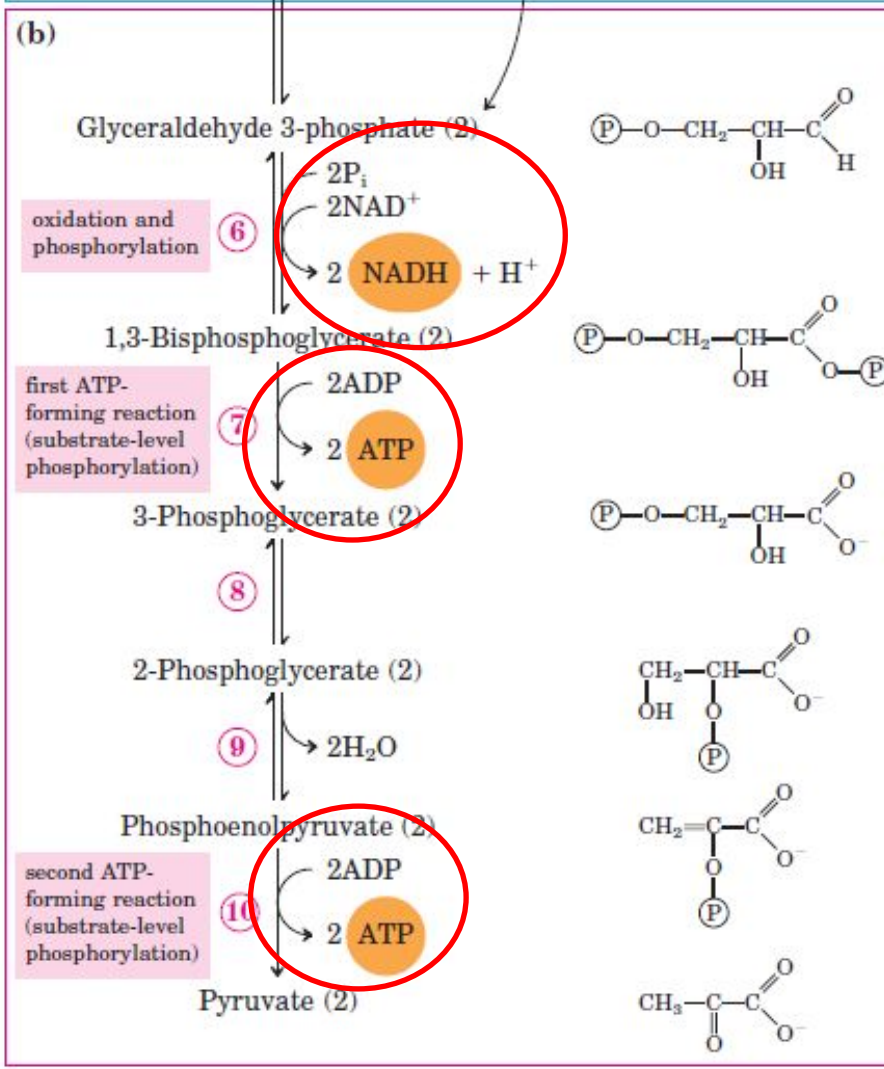
- 1.c. fructose-1,6-bisphosphate is split in the middle to form 2 triose phosphates
- *(with the help of enzyme)*



Step 2. Triose Phosphate to Pyruvate

- Triose phosphate (3C) goes through a series of transformations (intermediates) to become a pyruvate (3C) molecule

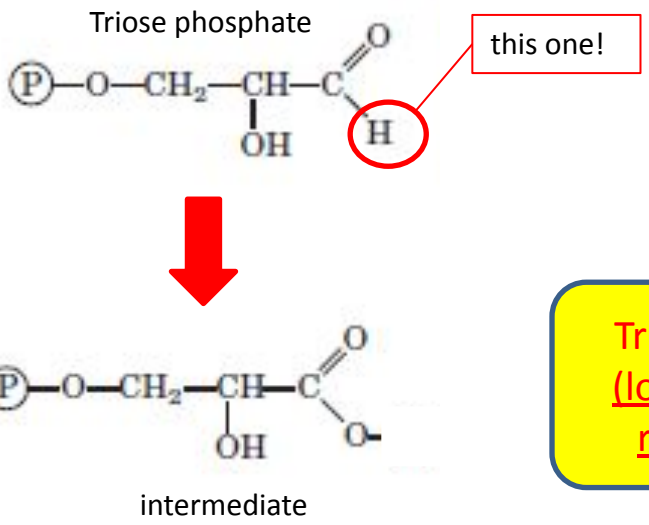
- 2 triose phosphates go through the same process
  - *4 ATP produced (2 for each)*
  - *2 NAD reduced to NADH (1 for each)*
  - *2 pyruvate molecules produced in the end*



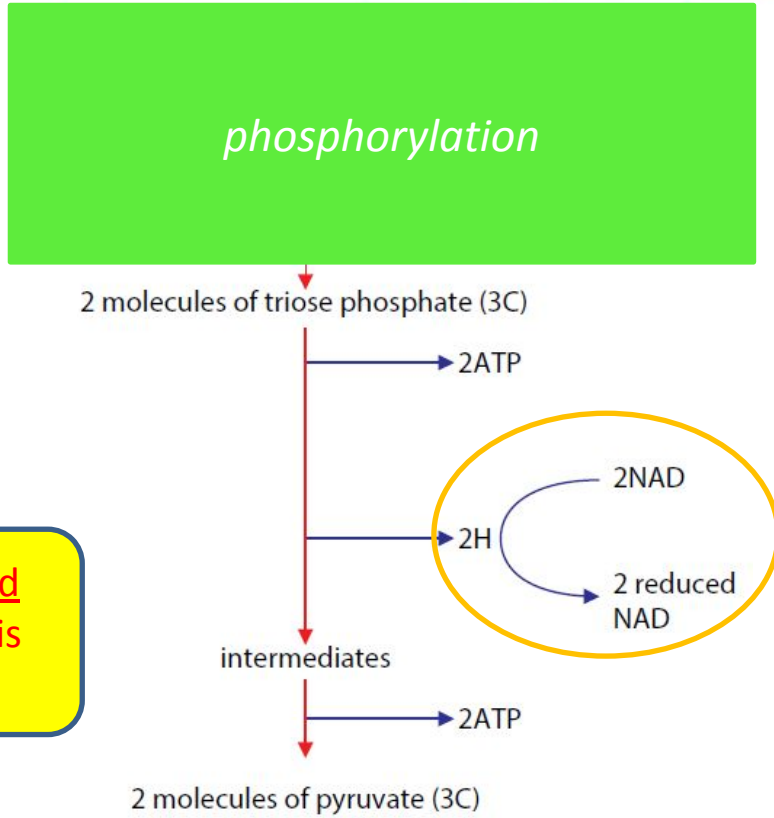
*this is the complete process.
No need to memorize

Step 2. Triose Phosphate to Pyruvate

- *2.a. one hydrogen in triose phosphate is removed and bind to NAD to form NADH*
  - *(2 NADH produced)*



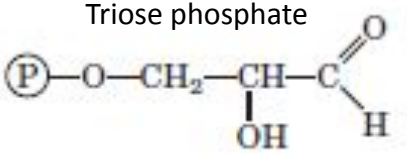
Triose phosphate is <u>oxidised (lost hydrogen)</u> while NAD is <u>reduced (gains hydrogen)</u>

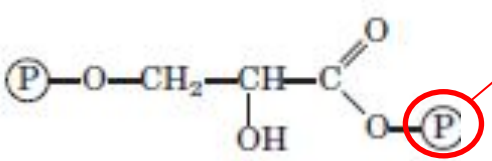


Step 2. Triose Phosphate to Pyruvate

- *2.a. each triose phosphate is phosphorylated again – each will have 2 phosphates in its structure*

Triose phosphate

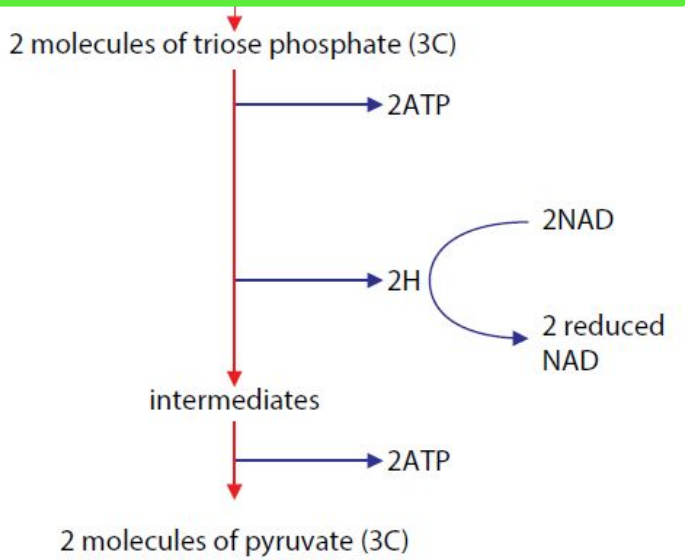




This phosphate is not from an ATP molecule

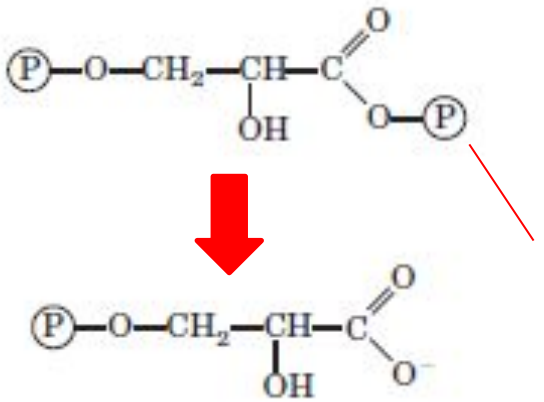
intermediate

phosphorylation



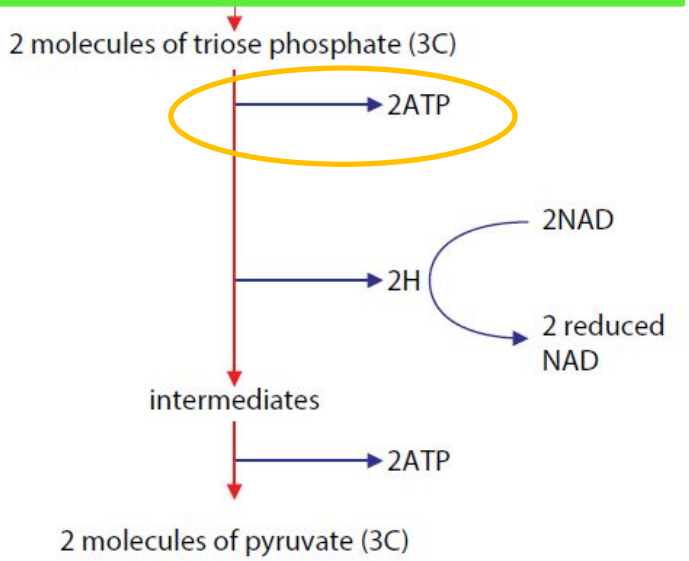
Step 2. Triose Phosphate to Pyruvate

- *2.b. one phosphate group is removed from each intermediate and bind to ADP to form ATP*
  - *(2 ATPs produced)*



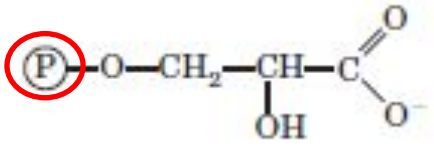
ADP + Pi = ATP

phosphorylation

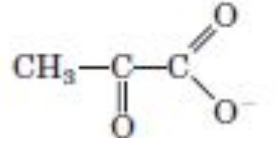


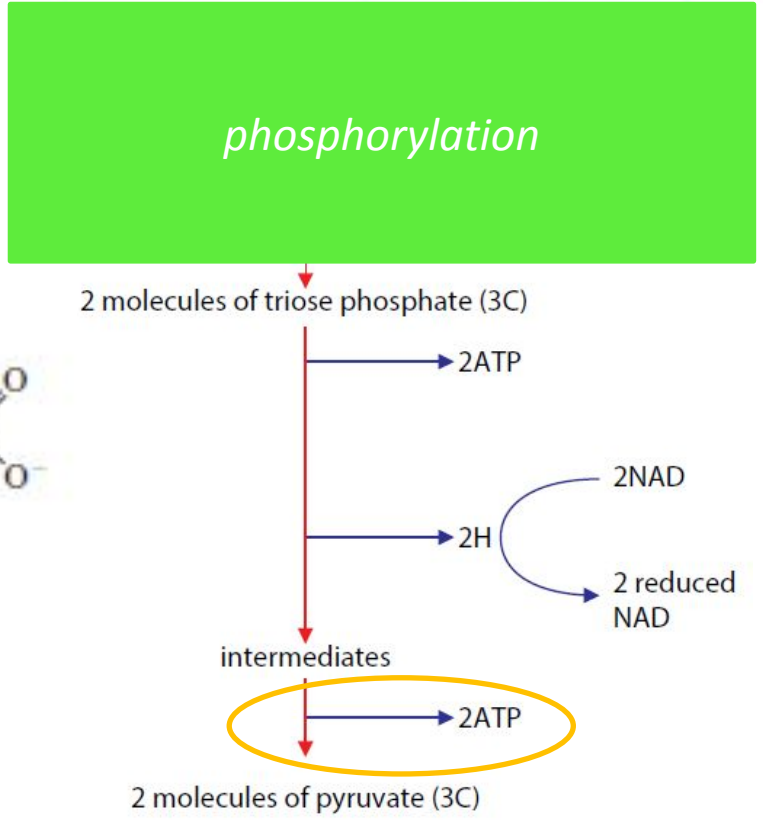
Step 2. Triose Phosphate to Pyruvate

- *2.c. the last phosphate group is removed from the intermediate and bind to ADP to form ATP. Intermediate becomes pyruvate*
  - *(2 ATP produced)*
  - *(2 pyruvates produced)*



ADP + Pi = ATP





Net Energy Gain in GLycolysis

	ATP (gain/loss)
phosphorylation	2 ATP loss
Triose phosphate to pyruvate	4 ATP gain
Net ATP Gain	4 ATP – 2 ATP = **2 ATP**

Products of GLycolysis

	amount
ATP	2
NADH (reduced NAD)	2
Pyruvate (3C)	2

Fate of the pyruvate:

Pyruvate still contains a lot of chemical potential energy. If oxygen is present in the cell, pyruvate will enter mitochondrion for the next stage of aerobic respiration.

Next Stages of Aerobic Respiration:

- Link Reaction
- Kerbs Cycle
- Oxidative Phosphorylation