Section 3.1 – Cellular Respiration

SUMMARIZED OVERVIEW

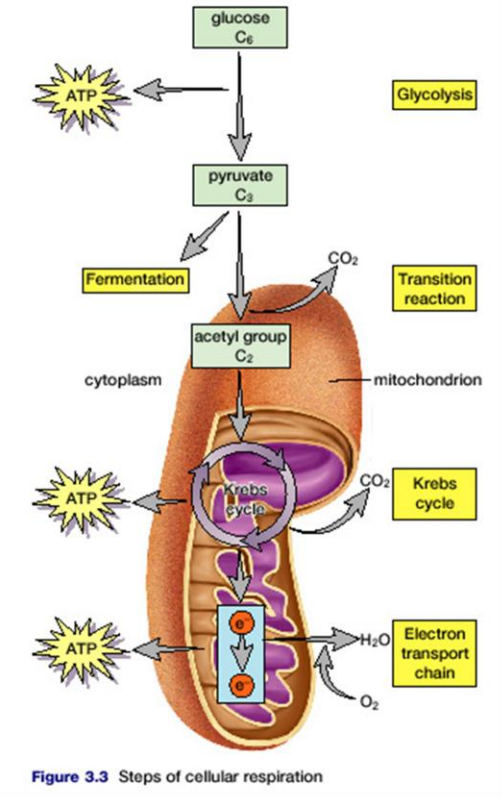


Figure 3.3 Steps of cellular respiration

1. **Glycolysis**
   - Anaerobic
   - In cytosol
   - breaks glucose (6C) into 2 pyruvate molecules (3C)
   - releases ATP

2. **Transition reaction**
   (oxidative decarboxylation)
   - Pyruvate converted to acetyl CoA releasing CO_2

3. **Kreb's Cycle**
   - Within mitochondrial matrix
   - Oxidize each acetyl CoA to CO_2
   - Releases ATP and co-enzymes (NADH, $FADH_2$)

4. **Electron Transport Chain**
   - Along the inner mitochondrial membrane
   - Uses high energy electrons from NADH and $FADH_2$ to create an electrochemical proton (H^+) gradient which powers ATP synthesis

RECALL: What is the general formula for Cellular respiration?

GLYCOLYSIS

Glycolysis is the first step in the process of cellular respiration. Once glucose enters a cell, the process of glycolysis begins immediately in the _____ where enzymes are waiting.

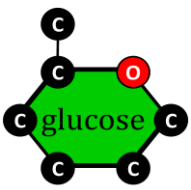
GLYCOLYSIS I – the **Investment** phase

Why is glycolysis I called the investment phase?

_____

In glycolysis (I) glucose is active by the addition of phosphate groups from ATP in an enzyme mediate process called _____

In order to keep track of how glucose is modified and rearranged during glycolysis we number each carbon



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GLYCOLYSIS II – the **Pay-off** phase

Why is glycolysis II called the pay-off phase?

_____

_____

By the end of glycolysis II, glucose has been broken down from _____ carbons to a ____ carbon compound called _____ (also known as _____).

*see glycolysis diagram for details of the process, names of intermediates and types of reactions at each step

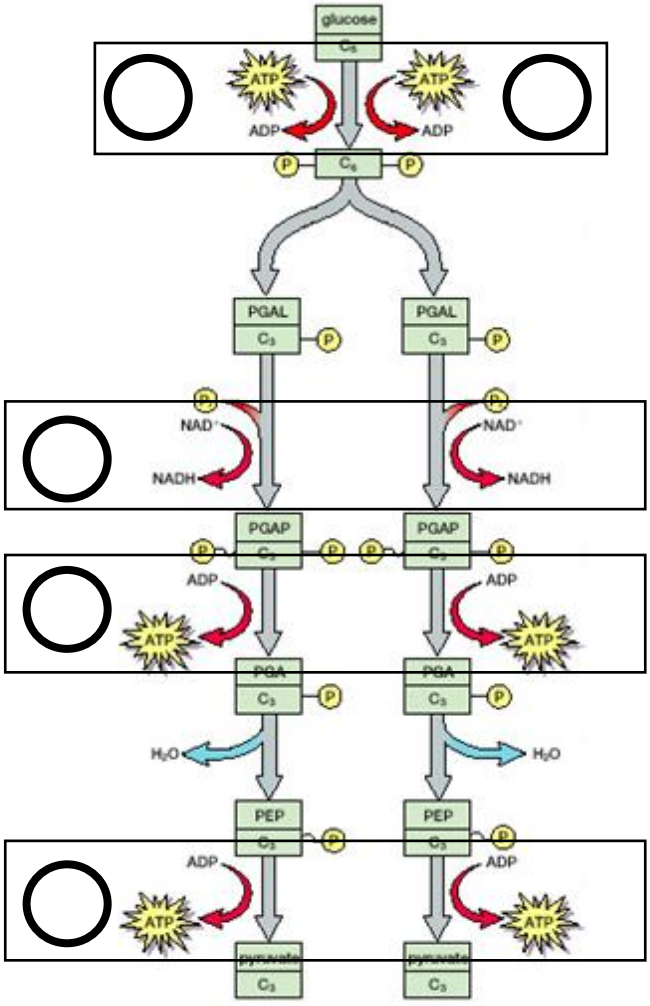
THE END RESULT

Overall reaction for glycolysis:

Energy in Glycolysis

-
-

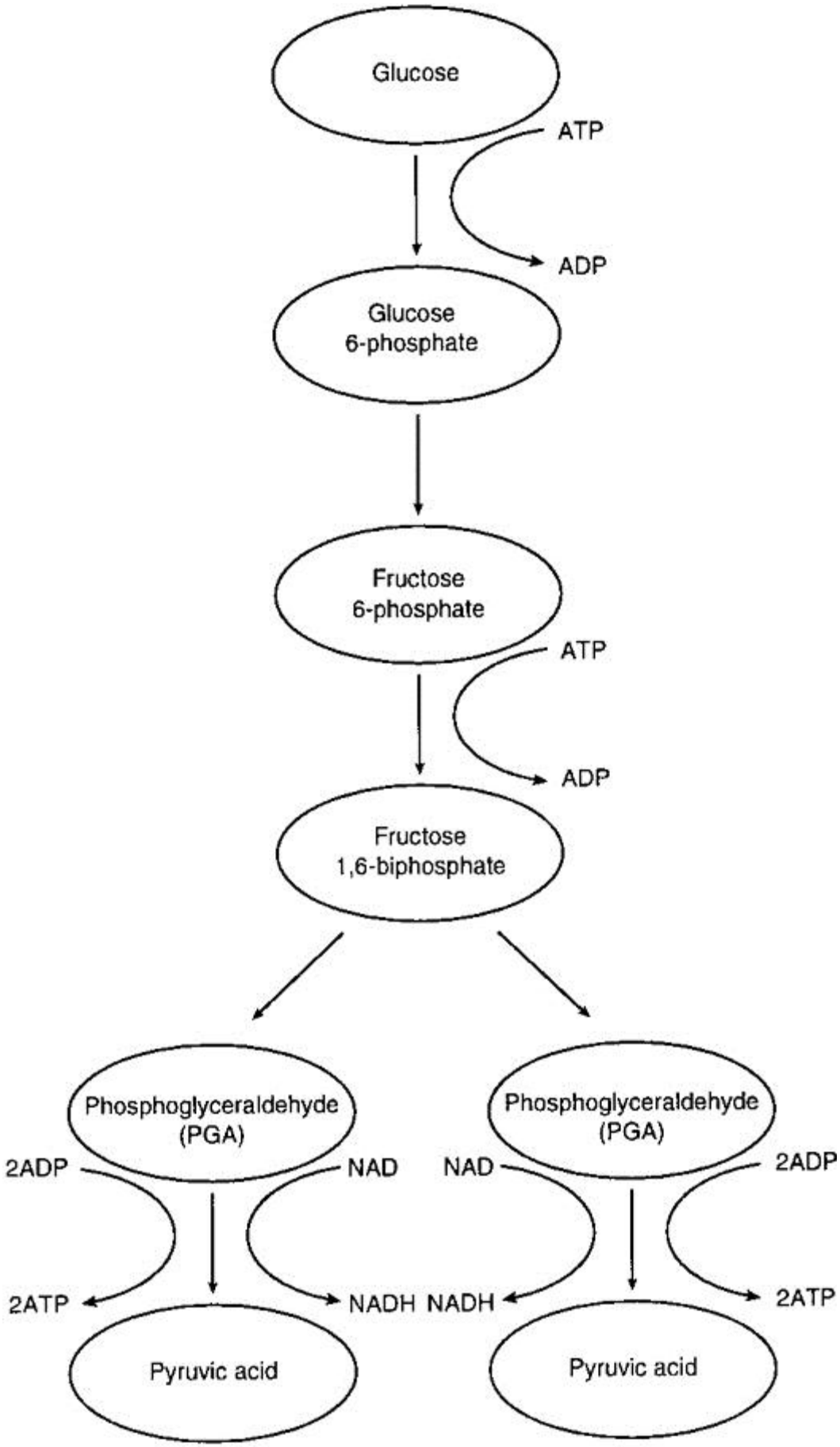
Net gain:



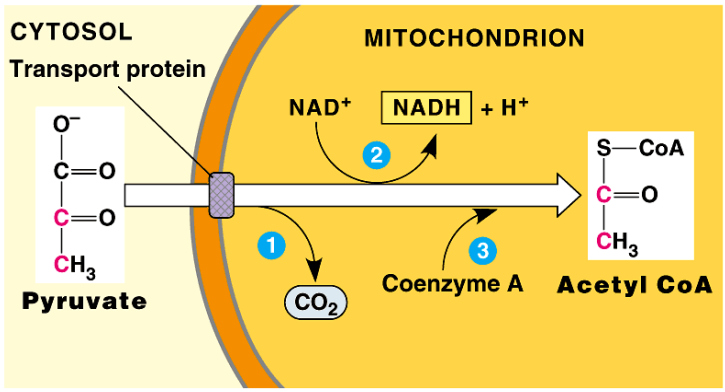
What has happened to Glucose?

Overall reaction for glycolysis:

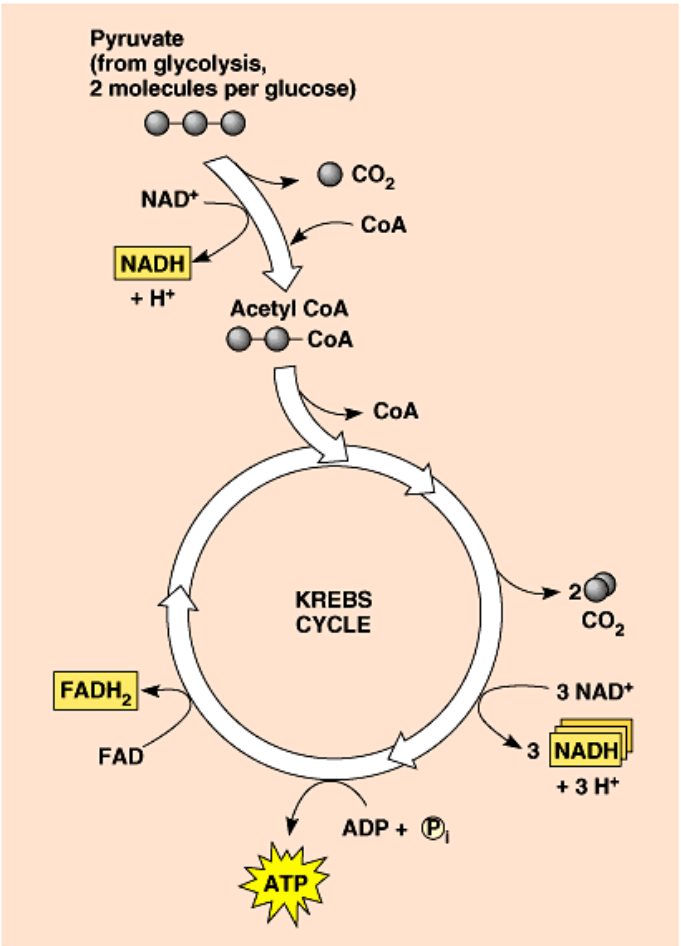
- In the cytosol, for each glucose molecule consumed, only 2 ATP were produced
- **This means that _____ more ATP are made in the mitochondria! Wowza!** (to be continued…)

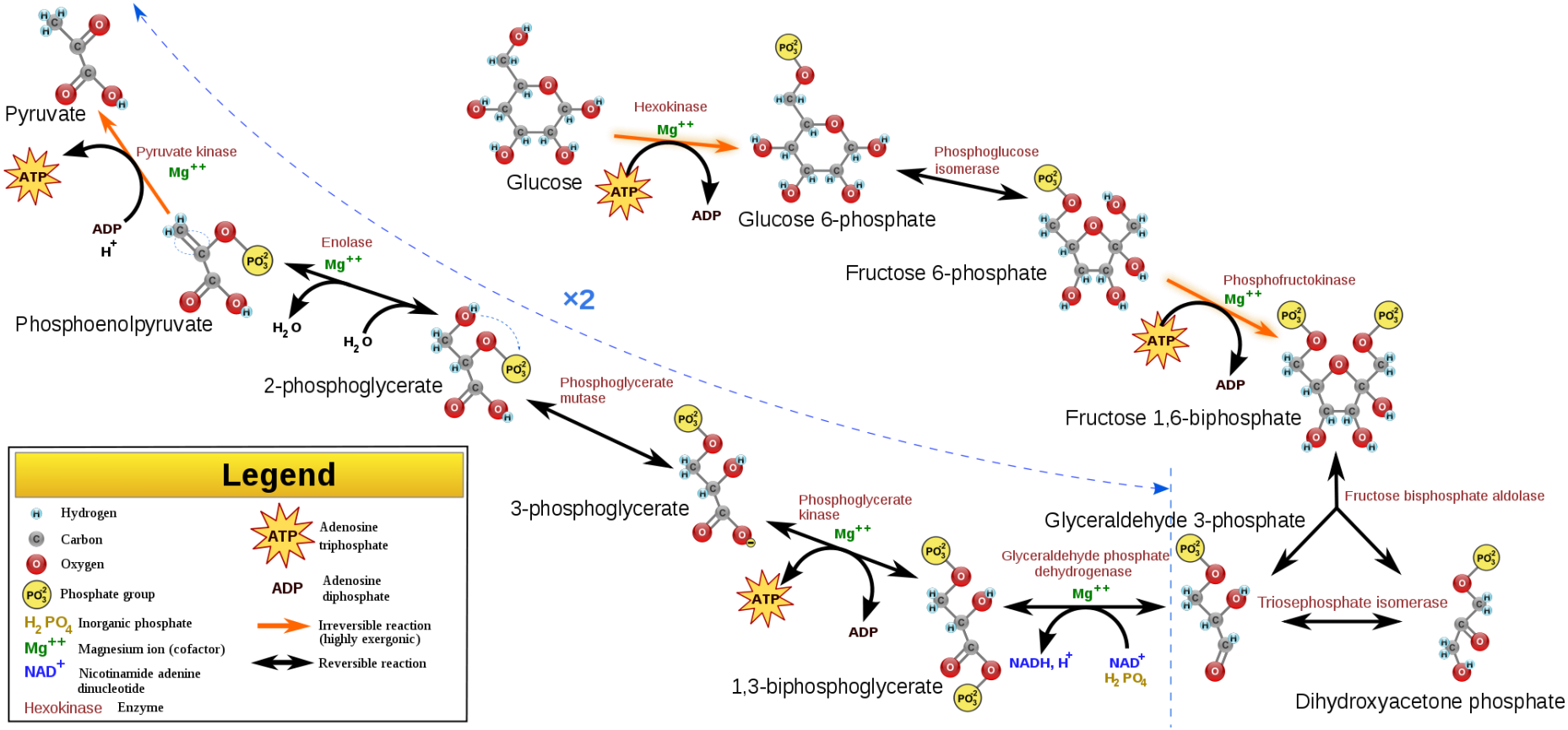

Glucose
ATP
ADP
Glucose
6-phosphate
Fructose
6-phosphate
ATP
ADP
Fructose
1,6-biphosphate
Phosphoglyceraldehyde
(PGA)
2ADP
NAD
2ATP
NADH
Pyruvic acid
Phosphoglyceraldehyde
(PGA)
NAD
2ADP
NADH
2ATP
Pyruvic acid

The Transition Reaction:



The Krebs Cycle:




Pyruvate
ATP
Pyruvate kinase
Mg++
ADP
H+
Phosphoenolpyruvate
Enolase
Mg++
H2O
H2O
2-phosphoglycerate
×2
Glucose
Hexokinase
Mg++
ATP
ADP
Glucose 6-phosphate
Phosphoglucose isomerase
Fructose 6-phosphate
Phosphofructokinase
Mg++
ATP
ADP
Fructose 1,6-biphosphate
Phosphoglycerate mutase
3-phosphoglycerate
Phosphoglycerate kinase
Mg++
ATP
ADP
1,3-biphosphoglycerate
Glyceraldehyde phosphate dehydrogenase
Mg++
NADH, H+
NAD+
H2PO4
Glyceraldehyde 3-phosphate
Fructose bisphosphate aldolase
Triosephosphate isomerase
Dihydroxyacetone phosphate
Legend
Hydrogen
Carbon
Oxygen
Phosphate group
H2PO4 Inorganic phosphate
Mg++ Magnesium ion (cofactor)
NAD+ Nicotinamide adenine dinucleotide
Hexokinase Enzyme
ATP Adenosine triphosphate
ADP Adenosine diphosphate
Irreversible reaction (highly exergonic)
Reversible reaction