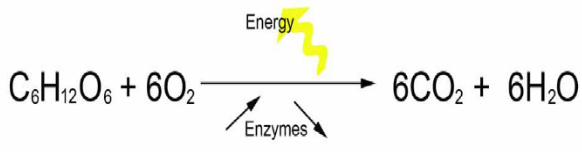
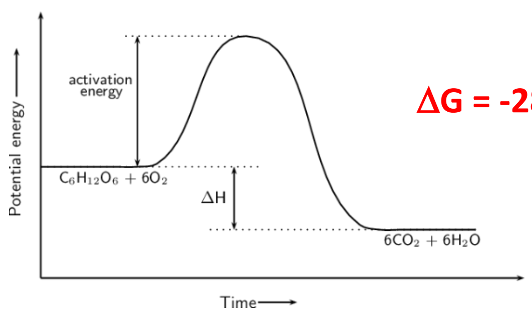
AEROBIC CELLULAR RESPIRATION

BACKGROUND INFORMATION:

Aerobic cellular respiration involves **harvesting energy from organic compounds** using oxygen. A series of reactions involving enzymes and input/output of energy occur in order to produce CO_2 and H_2O.

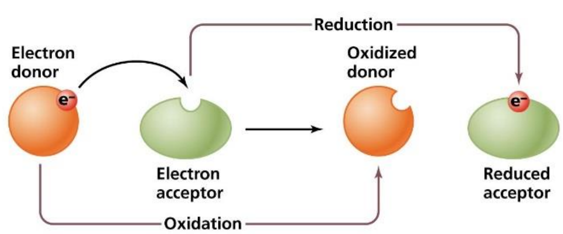


The process of cellular respiration is an **exothermic reaction** and creates two stable products (CO_2 and H_2O). The decrease in potential energy from the reactants occurs in a series of small exothermic reactions.



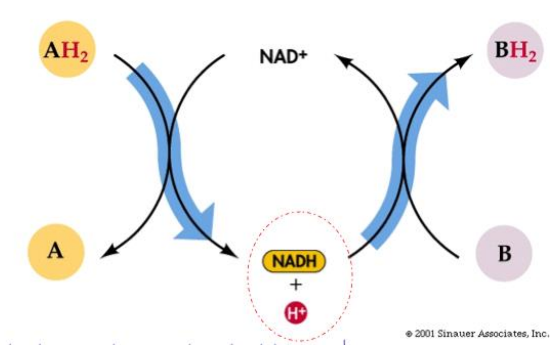
ΔG = -2870 kJ/mol

In cellular respiration, many of the exothermic reactions taking place are **<u>REDOX reactions.</u>** As discussed in the previous unit, REDOX reactions involve the transfer of electrons between two molecules.



*The electron donor is a **HIGH ENERGY** molecule that is highly unstable. A redox reaction will allow it to transfer its electron to a more electronegative molecule and reduce the amount of free energy. Therefore, stabilizing the electron*

In cellular respiration there are two electron carriers that help oxidize certain molecules by removing the electron and releasing free energy into the cell. These molecules are **<u>NAD+ and FAD+.</u>** When NAD+ and FAD+ captures an electron they become NADH and $FADH_2$ respectively.



Three main goals of cellular respiration:

1) To break the bond in glucose (6 C molecule) to create 6 CO_2 molecules.
2) To move hydrogen atoms from glucose to oxygen to create 6 H_2O molecules.
3) To trap a large quantity of free energy so that it can be used to create ATP.

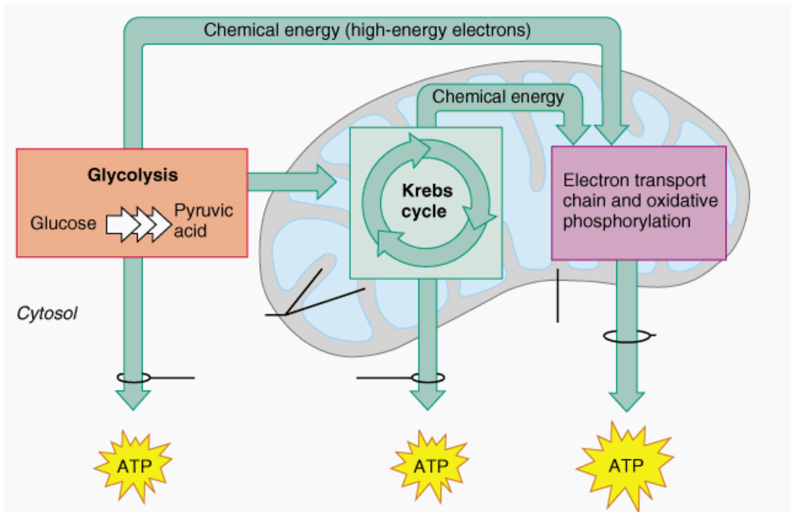
The process of aerobic cellular respiration occurs in 4 main stages:

Stage 1: Glycolysis

Stage 2: Pyruvate Oxidation

Stage 3: Krebs Cycle

Stage 4: Electron Transport Chain and Chemiosmosis



STEP 1: GLYCOLYSIS – 'THE SPLITTING OF SUGAR'

THE INVESTMENT PHASE:

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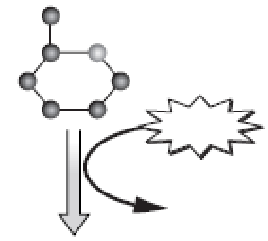

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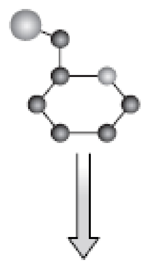

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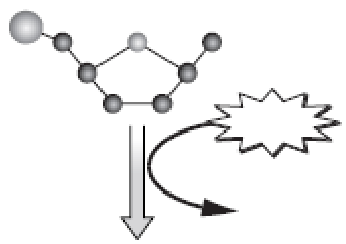

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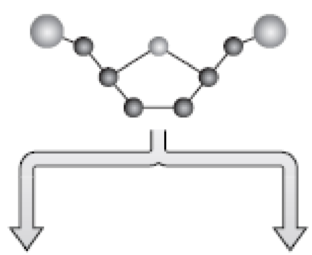

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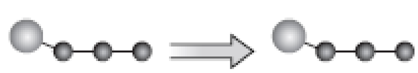
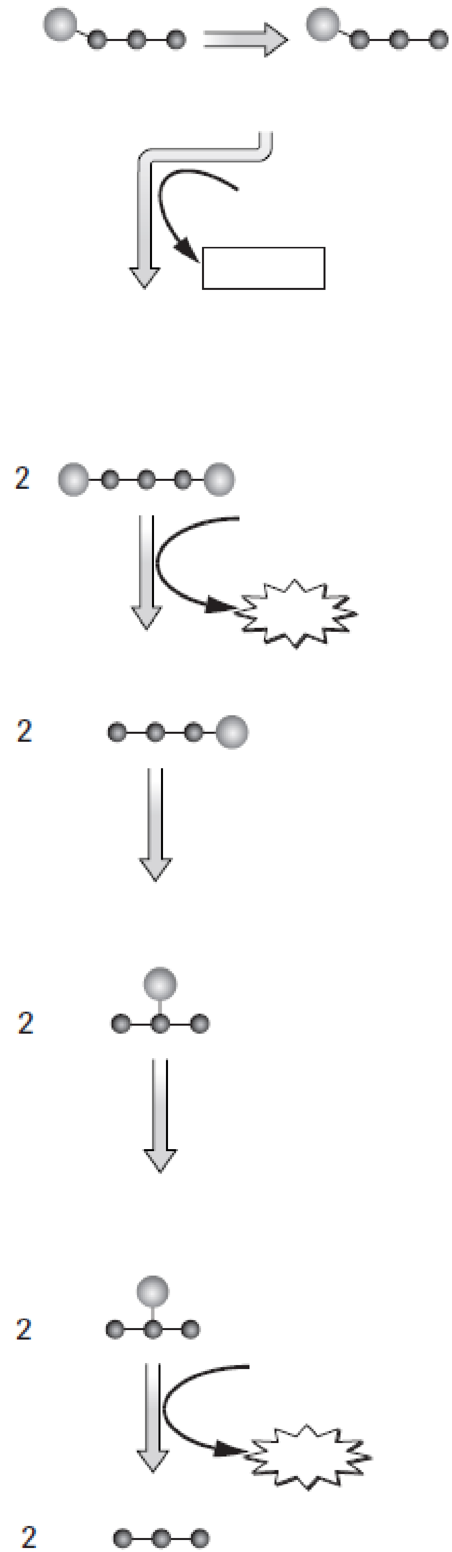


THE PAYOFF PHASE:



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NET YIELD OF PRODUCTS:

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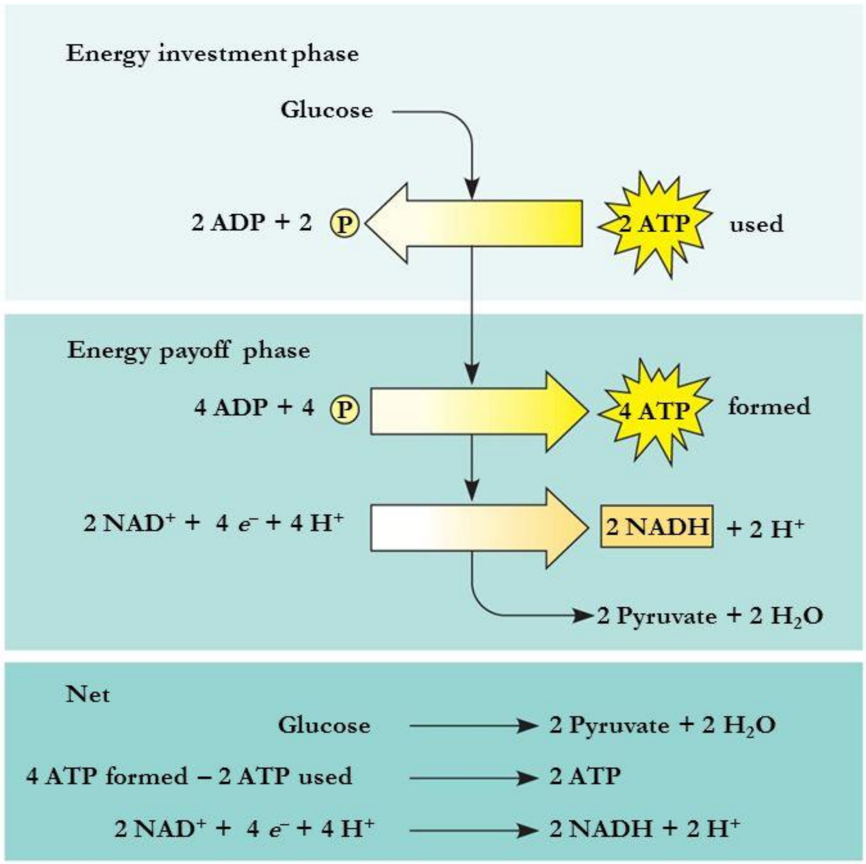
-
-

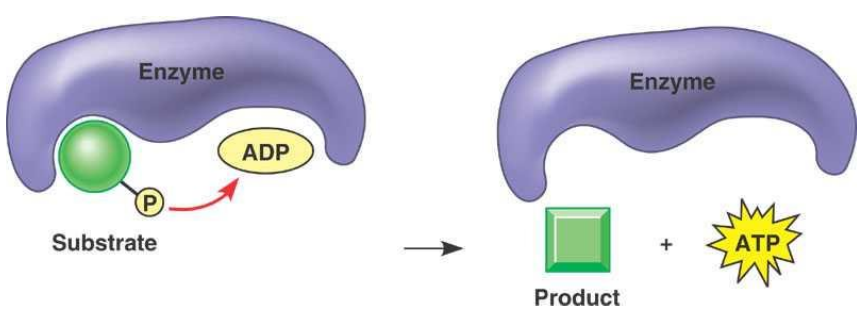
Homework: pg. 124 # 9 - 12

SUMMARY OF NET PRODUCTION OF ATP AND NADH:



HOW IS ATP MADE DURING GLYCOLYSIS AND KREBS CYCLE:

ATP is made through substrate level phosphorylation. This is a process that requires an enzyme that is able to remove a phosphate group from a substrate through an exergonic reaction. Once the phosphate group is acquired, the enzyme is able to attach the phosphate group to an ADP molecule (endergonic reaction) to create ATP. The enzyme is always recycled when the process is completed.



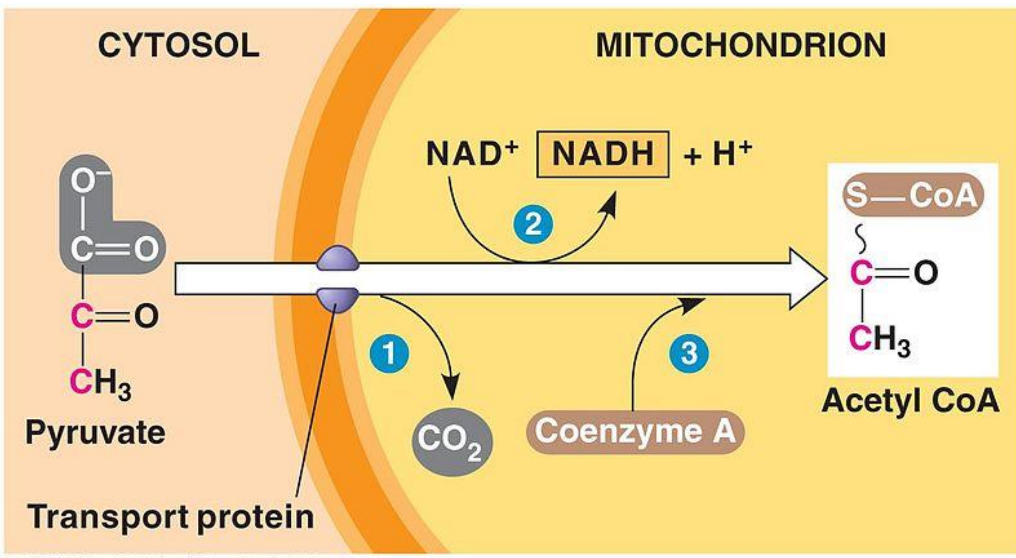
STEP 2: PYRUVATE OXIDATION

The two pyruvate molecules will enter the mitochondria through active transport. Once inside the mitochondria (in the mitochondrial matrix), three main reactions will take place:

1) **Decarboxilation:**

2) **REDOX reaction:**

3) **Production of Acetyl-CoA:**



STEP 3: KREBS CYCLE (CITRIC ACID CYCLE)

The main goal of the **Krebs Cycle** is to produce energy. This is done by the two molecules of Acetyl-CoA that is made during pyruvate oxidation. The energy produced during the Krebs cycle comes in the form of NADH and FADH2. These molecules donate their electrons to the electron transport chain (step 4), which ultimately drives oxidative phosphorylation. The small amount of ATP produced during the Krebs cycle is created through substrate-level phosphorylation.

There are four main reactions that occur during the Krebs Cycle:

1) Dehydration:
2) Decarboxilation:
3) REDOX:
4) Substrate-level Phosphorilation:

The Krebs Cycle

NET YIELD OF PRODUCTS:

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-
-
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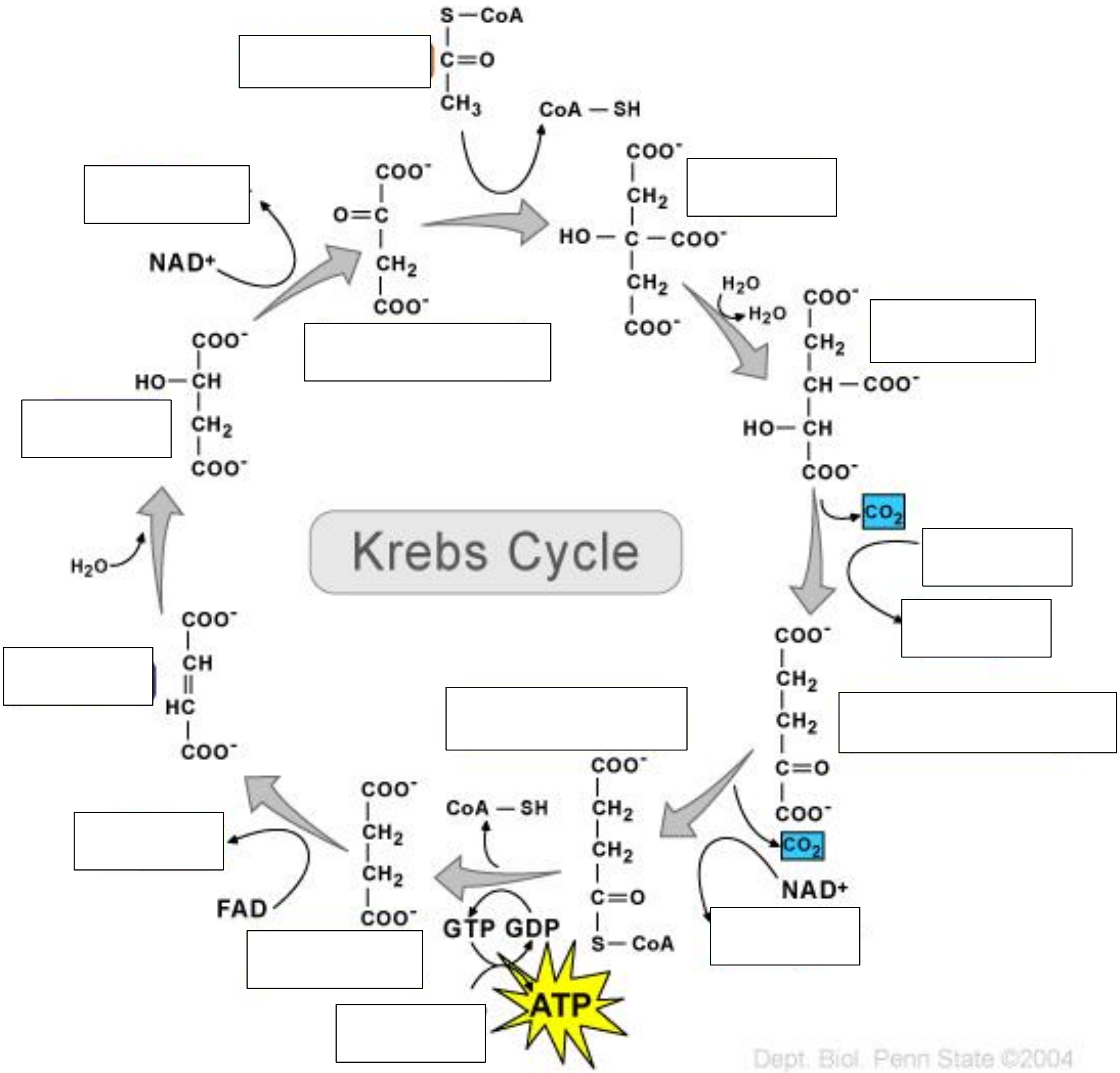
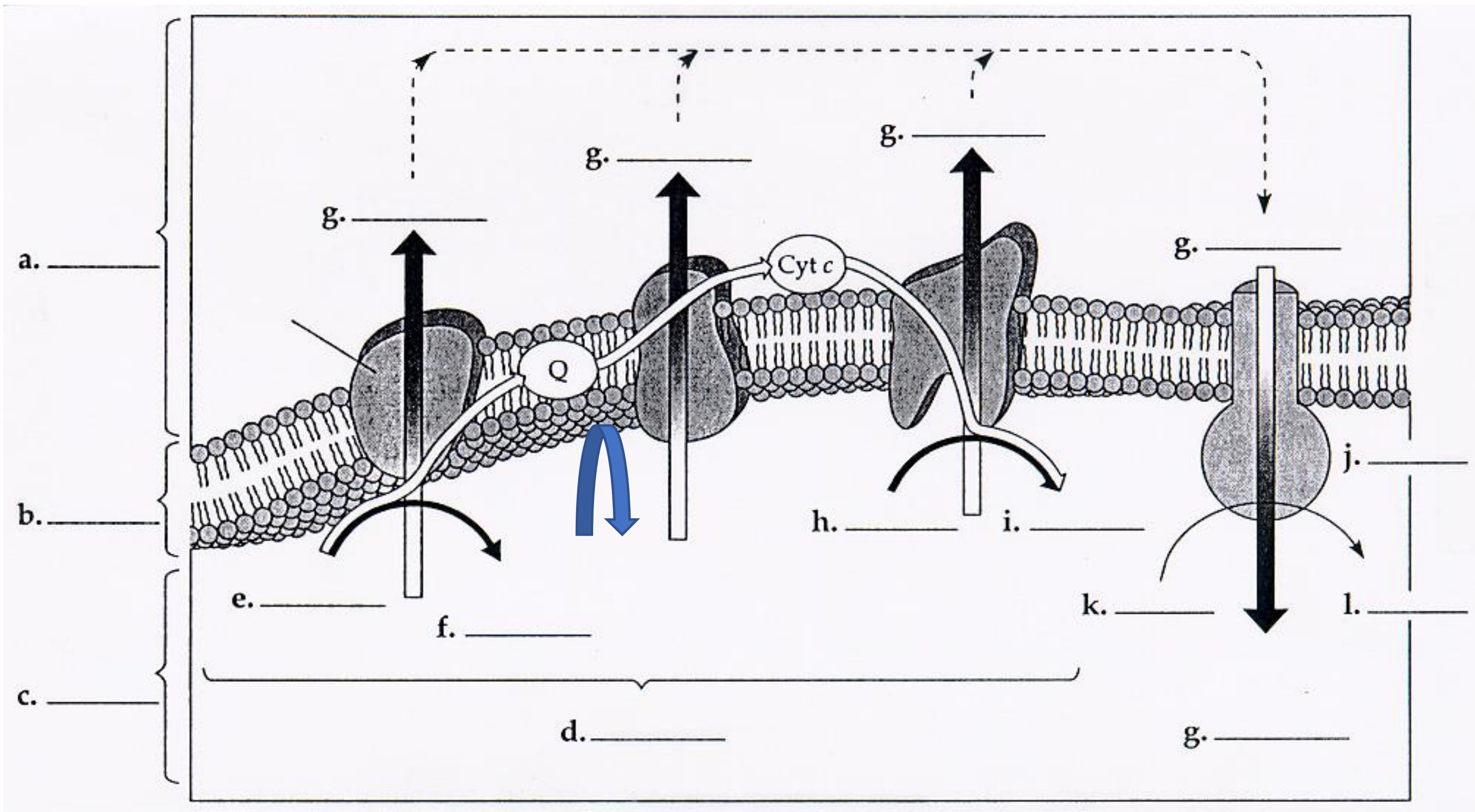


Homework: pg. 128 # 13 - 18

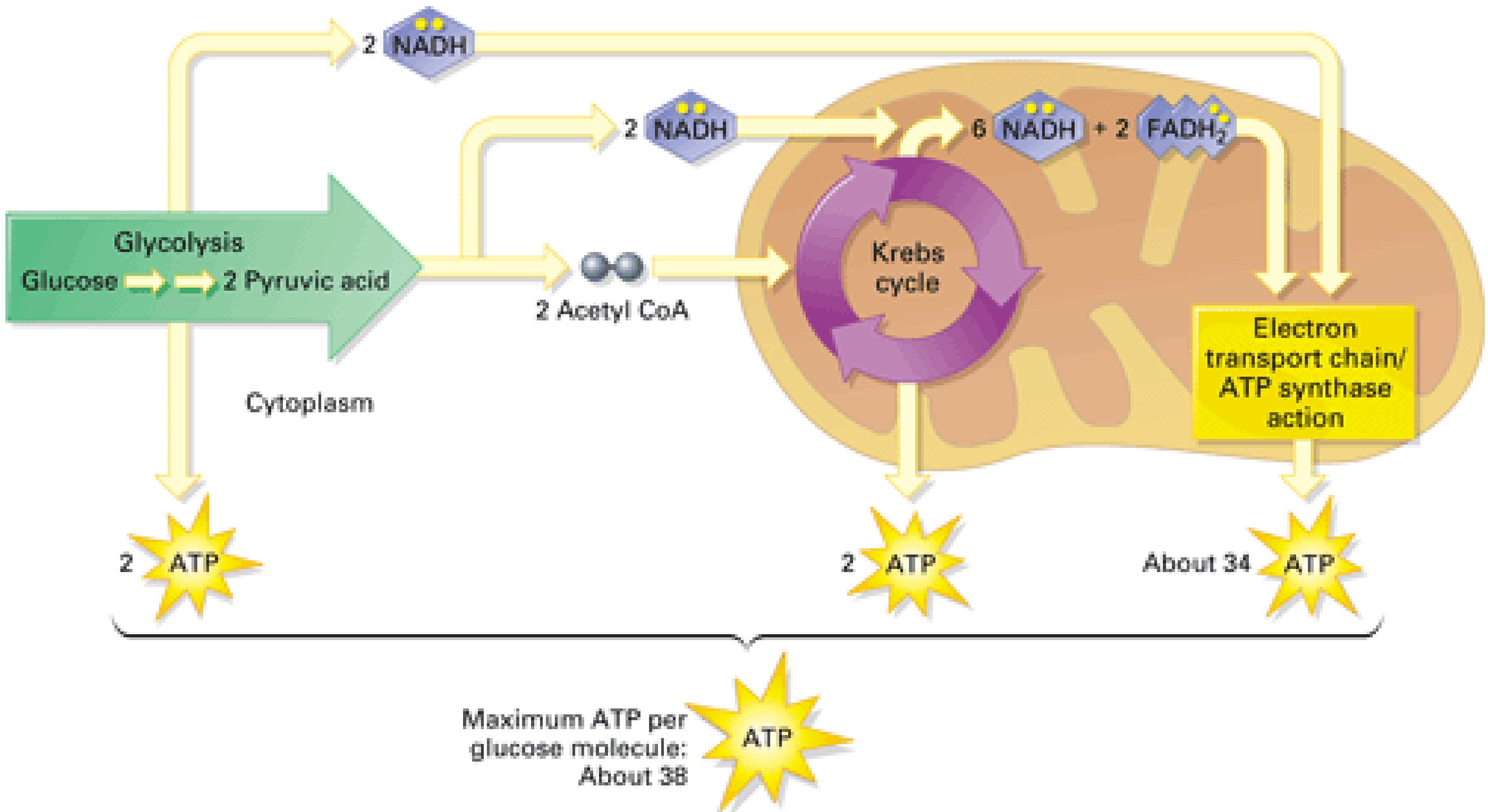
STEP 4: THE ELECTRON TRANSPORT CHAIN

The electron Transport Chain (ETC) is used to remove energy from the electron carriers (NADH, FADH2) through redox reactions. All of this is possible due to the oxidation of sugar molecules in the first three steps of cellular respiration.



**Refer to the Electron Transport Chain ppt for more detailed information*

SUMMARY OF AEROBIC CELLULAR RESPIRATION



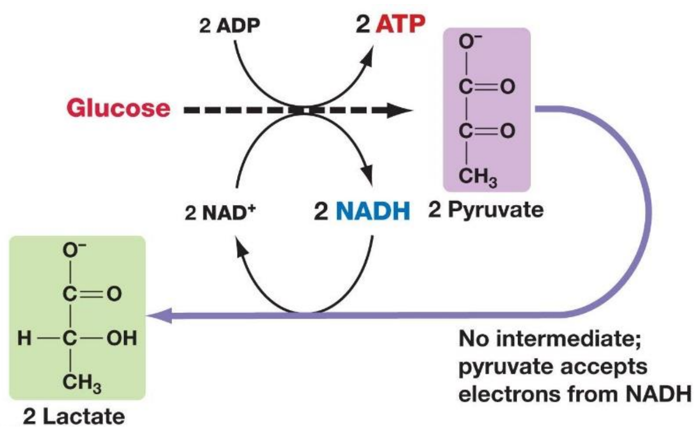
ANAEROBIC CELLULAR RESPIRATION

What is anaerobic respiration? And why does it occur?

What is fermentation?

TYPES OF FERMENTATION:

1) Lactate Fermentation:



2) Ethanol Fermentation: