Unit 7 Part II Notes: Cellular Respiration

Cellular Respiration

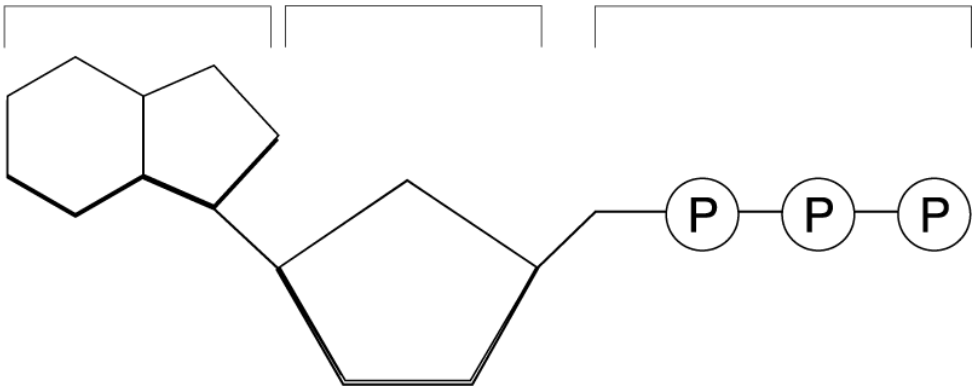
*Overview of Cellular Respiration (Know sequence of events)

Cell Respiration - The process that releases energy (ATP) by breaking down _____and other food molecules in the presence of _____ (_____). This is an _____ reaction.

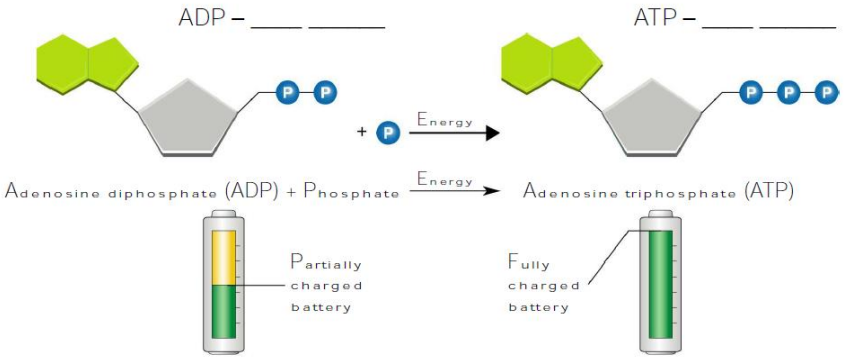
- NAD+ acts as the electron carrier (NAD –Nicotinamide adenine dinucleotide)
- Occurs in _____ eukaryotic cells, plants included!

$$6O_2 + C_6H_{12}O_6 \longrightarrow 6\,CO_2 + 6\,H_2O + \text{Energy (36 ATP)}$$

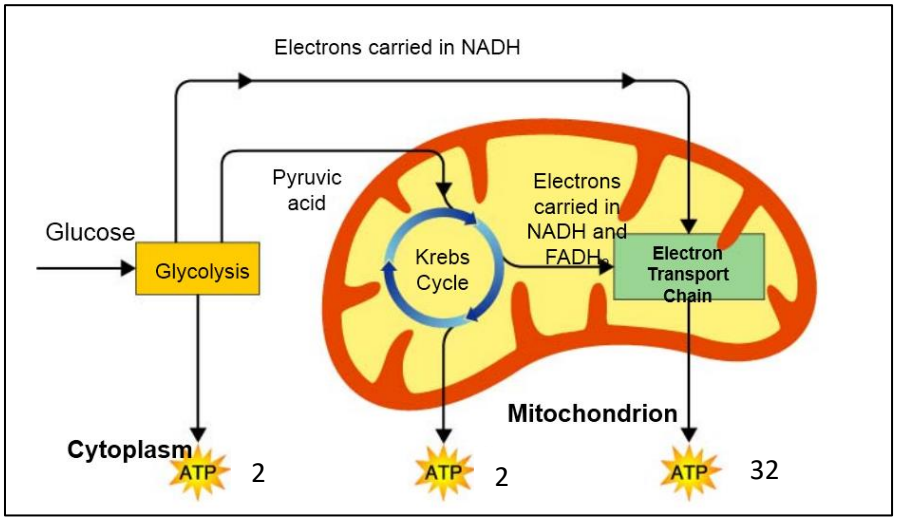
ATP –_____ _____ Supplies energy for all cellular processes



Comparison of ATP/ADP to a Battery:

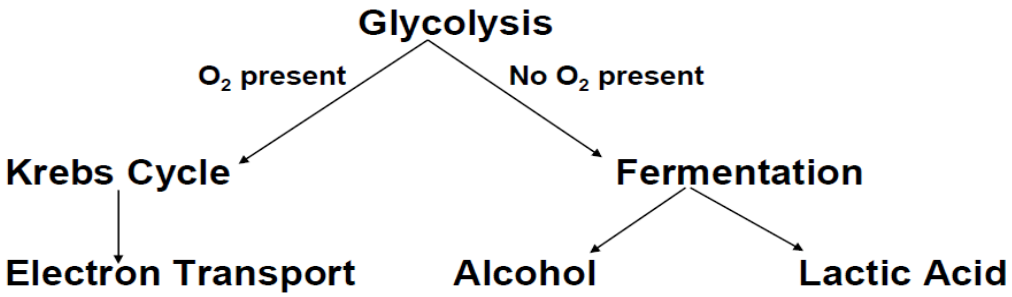


Overview:



1st step – Glycolysis is when one molecule of _____ is broken in _____, producing two molecules of _____ acid a 3-C compound.

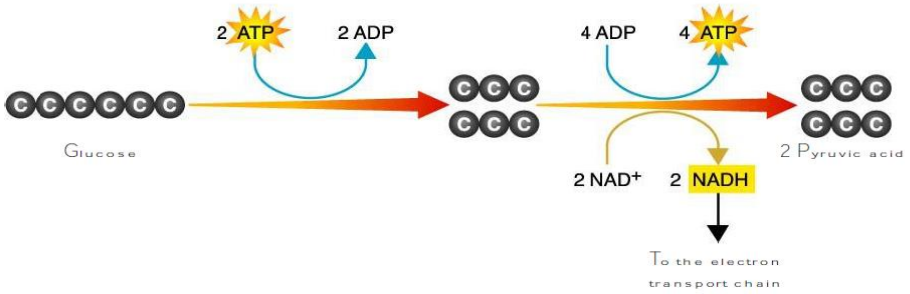
- If oxygen is present then pyruvic acid enters _____ Cycle
- If **no** oxygen then pyruvic acid enters _____ process



Glycolysis – Occurs in the cytoplasm

A. Starting molecule is glucose
B. ATP Production –__ ATPs are needed at beginning, but 4 are produced, total of 2 net gain for the cell.
C. _____ is a carrier for electrons to the electron transport chain (_____).
D. 1 glucose = 2 pyruvic acid + 2 ATP = 2 NADH
E. Total ATP = _____

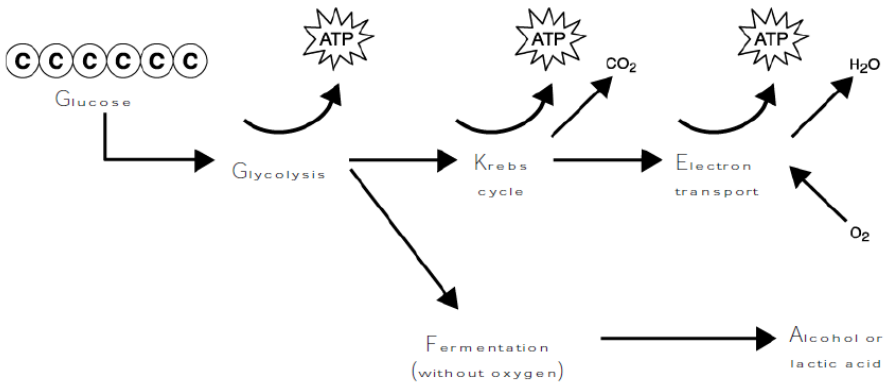
Glycolysis



Fermentation

A. Anaerobic –_____ _____ _____
B. Types:
   1. Alcoholic fermentation by yeast and some bacteria
      Pyruvic acid + _____ → alcohol + CO_2 + _____
      - _____ dioxide causes bread to rise, heat in baking evaporates any alcohol.
      - Used to produce beer and wine
   2. Lactic acid fermentation
      _____ acid + NADH → Lactic acid + NAD+
      - Produced in muscles during _____ exercise when the body cannot supply enough _____. Leads to soreness.
      - Unicellular organisms ferment food and beverages. Ex: yogurt, _____, buttermilk, sour cream, pickles, sauerkraut

Chemical Pathways



2nd step - Krebs Cycle

- 2nd step, occurs in _____
- Starts with pyruvic acid and gives off _____ dioxide
- Energizes NAD+ to form NADH (_____ carriers) high energy

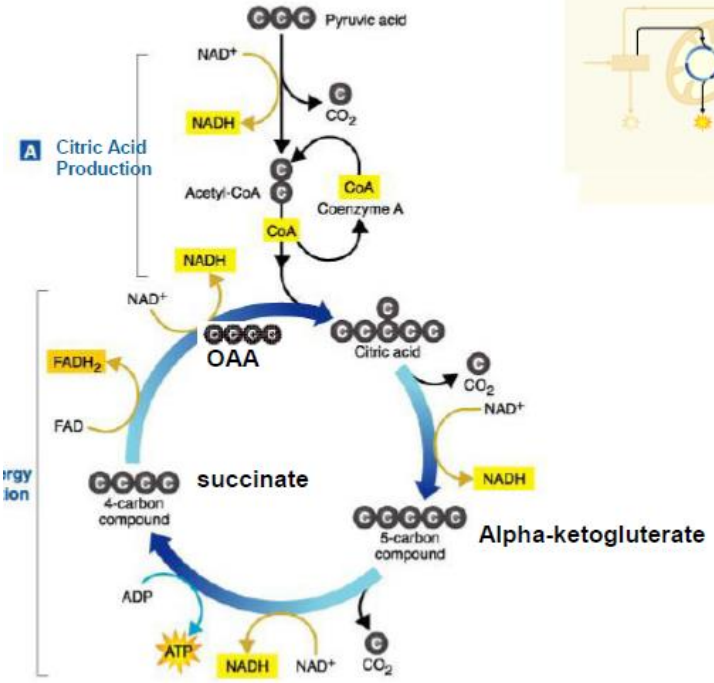
Results:

– High energy carriers (NADH and FADH2) take _____ to ETC
– Carbon dioxide is breathed out
– 2 _____ formed

The Krebs Cycle

OAA – Oxaloacetate is a 4 Carbon molecule with low energy

$FADH_2$ – Flavin adenine dinucleotide + hydrogen



Succinate – 4 carbon compound with energy

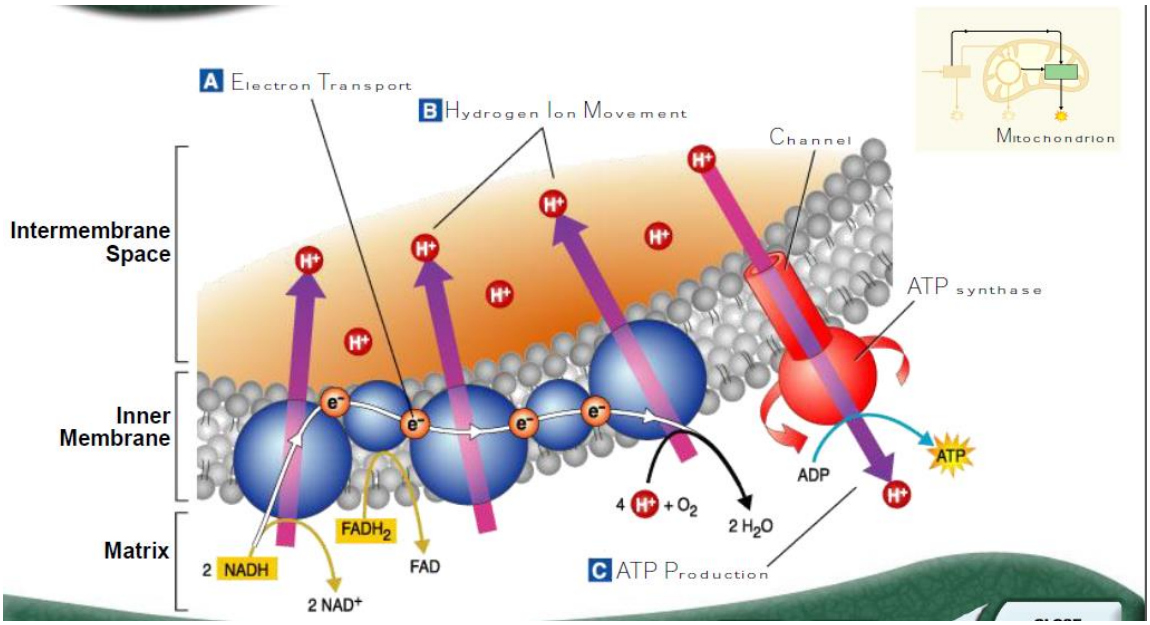
NADH – Nicotinamide adenine dinucleotide + hydrogen

3rd step- Electron Transport Chain (ETC) – 3rd step Occurs between _____ in the mitochondria in all animals, plants and _____

- Uses high energy electrons (stored in NADH and _____) from Krebs to convert _____ to ATP.
- Carrier proteins _____ in the mitochondrial membrane pass high-energy _____ along and _____ H+ into the intermembrane space
- Oxygen is the final electron _____ and combines with hydrogen to form water

- As the amount of H+ builds in the _____ space, one H+ rushes back across the _____ membrane causes ATP synthase to spin, re-energizing ADP to _____.
- Each pair of e-generate enough energy to _____ 3 ADP to 3 ATP.
- Total ATP = _____
- Total ATP generated in all steps of _____ = 36

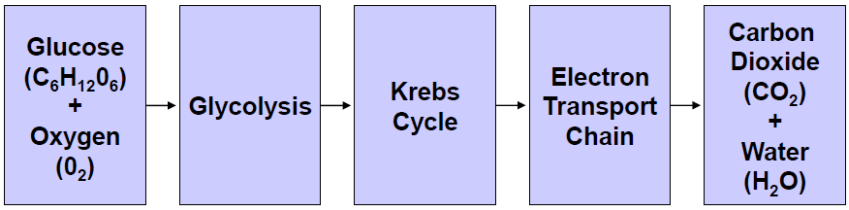
Electron Transport Chain



Energy and Exercise

- Cells normally contain enough _____ for a few seconds of intense activity.
- After 90 seconds, cellular respiration supplies ATP
- For long-term activity, _____ stored in the muscle is burned and lasts 15-20 minutes. After that, other _____ such as fat are burned for energy (aerobics, running & swimming)
- Need to breathe _____ after exercise to repay oxygen debt and rid body of _____ acid

Cellular Respiration



Comparing Photosynthesis and Cellular Respiration

- Photosynthesis does not release energy from glucose
- _____ removes CO2 and _____ returns it.
- _____ in photosynthesis are _____ in respiration.
- Cellular Respiration RELEASES energy through glucose, Photosynthesis STORES energy through glucose

Photosynthesis *makes* the glucose, cellular respiration *breaks* the glucose!