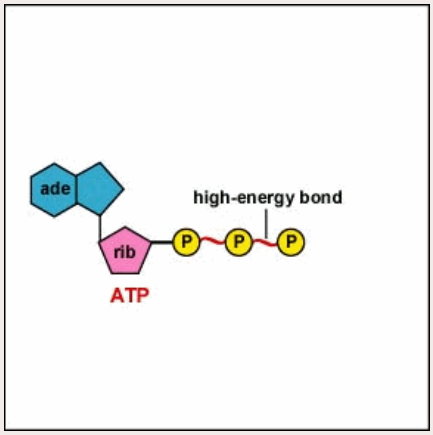
Cellular Respiration

… the process cells use to harvest the energy in organic compounds particularly glucose.

All cells break down food (organic compounds) into simpler molecules that release ATP (energy) to power cellular activity.

Why do we need cell respiration?
REMEMBER THIS?
Energy is released chemically from ATP in order to power a cell's chemical reactions.



11. (aerobic implied) Cellular respiration converts energy from food into a usable form called ATP. (In other words, breaks down food to release its energy.)

enzymes

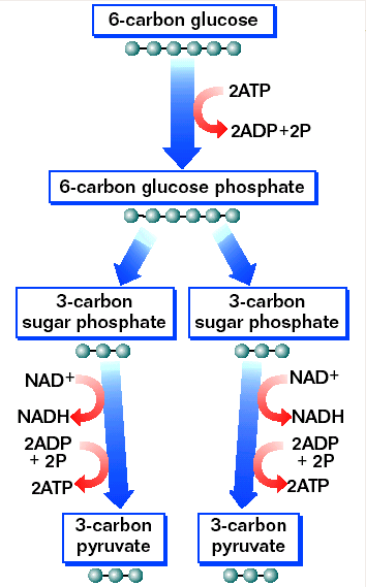
$$C_6H_{12}O_6 + 6O_2 \text{ ----------> } 6CO_2 + 6H_2O + \text{energy}$$

Glucose Oxygen carbon dioxide water ATP

12. Glycolysis -the breakdown of glucose.

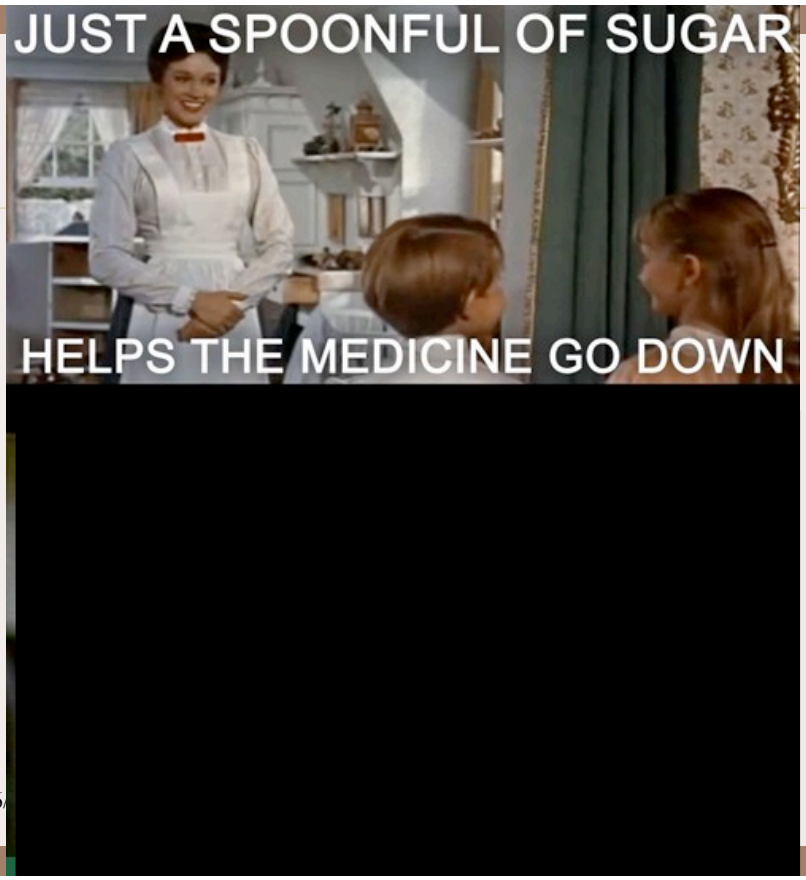
a) occurs in Cytoplasm
b) 2ATPs used but 4 are made (remember reactions need a push to get started?)

Overview of Glycolysis

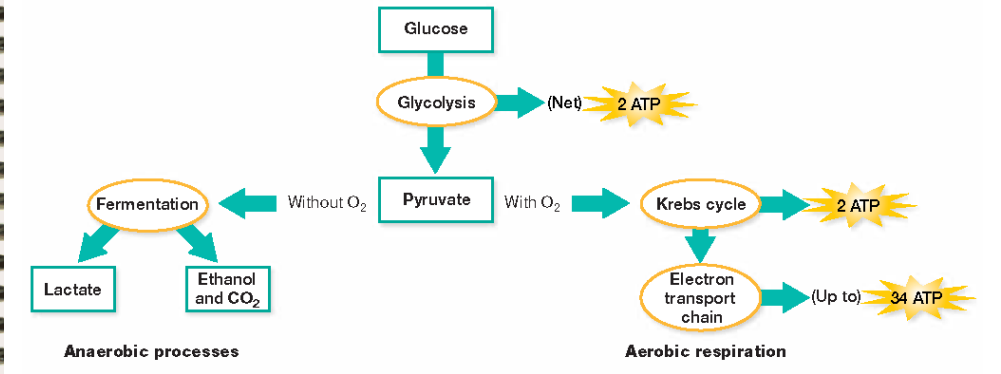


Aerobic or Anaerobic?

After glycolysis, it can go aerobic or anaerobic.



13. After glycolysis if oxygen is NOT present, <u>anaerobic respiration (fermentation)</u> must take place



14. <u>Lactic Acid Fermentation</u>

a) Lactic acid byproduct - causes muscle soreness in humans OR is a byproduct of fermentation in food

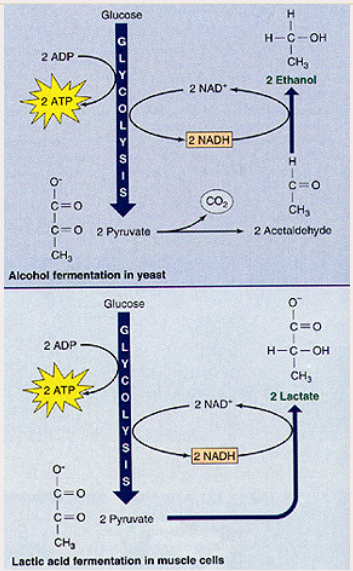
15. Alcoholic fermentation

a) Occurs in yeast & produces ethyl alcohol and CO_2 as waste products

FYI, it's the CO_2 bubbles that make bread rise or beer –carbonated.

- FYI…Ethanol kills yeast when present in high levels, so there is a limit to the strength of certain alcoholic beverages (12%).

Fermentation Cycles



Beer Brewing Tanks

No need to write Question: If bread dough rises because of Alcoholic fermentation, why doesn't eating bread make you become intoxicated?

Answer: Because baking the bread causes the evaporation of the small amount of alcohol that was produced.

16. After Glycolysis, if oxygen <u>IS</u> present, (aerobic) <u>cellular respiration</u> occurs

A. In eukaryotes- mitochondrion, prokaryotes cytosol (cytoplasm)

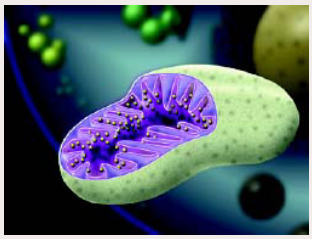
B. Prokaryotes have no mitochondria!

C. Glucose too big for mitochondria so… glycolysis produces a smaller 3 carbon molecule first

Then Diffusion happens…

What diffuses where?

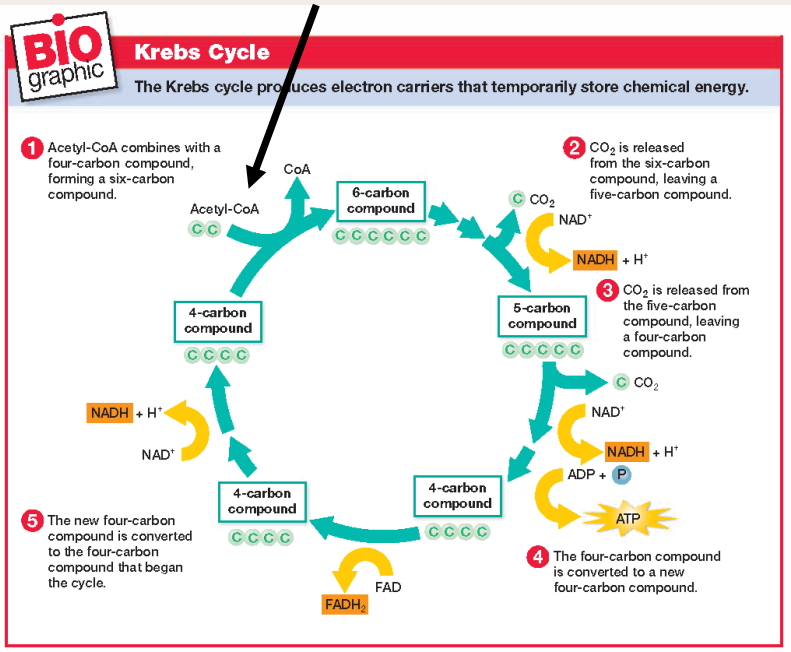
Do all organisms use (aerobic) cellular respiration?



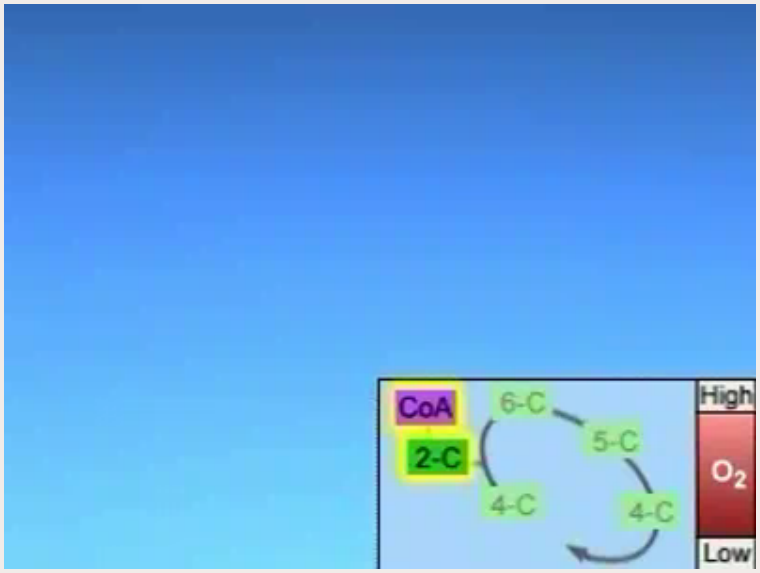
17. 2 steps in Cellular Respiration.

- NO NEED TO WRITE THEM YET
- Kreb's Cycle-Citric Acid Cycle
- The Electron Transport Chain

18. Step 1 Kreb's cycle aka Citric Acid Cycle



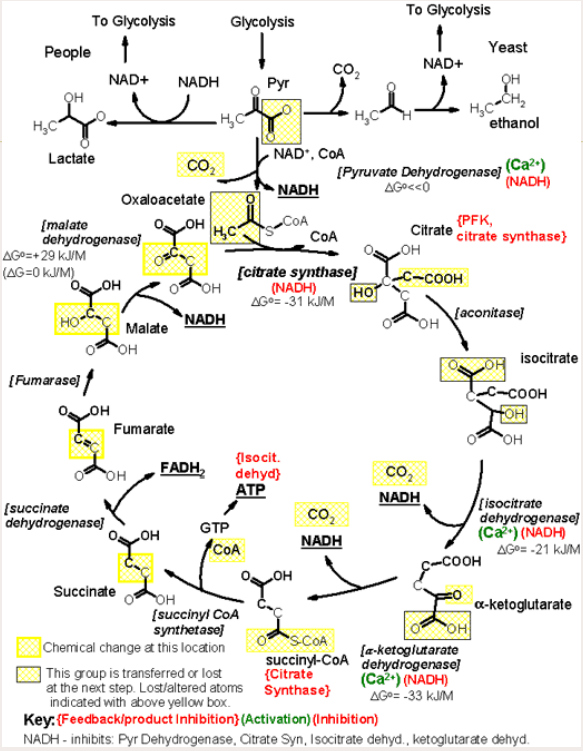
18. Step 1. Kreb's cycle aka Citric Acid Cycle



18. Step 1. Kreb's cycle aka Citric Acid Cycle

a) Happens in mitochondrial matrix
b) Electron carriers are produced – NADH and $FADH_2$

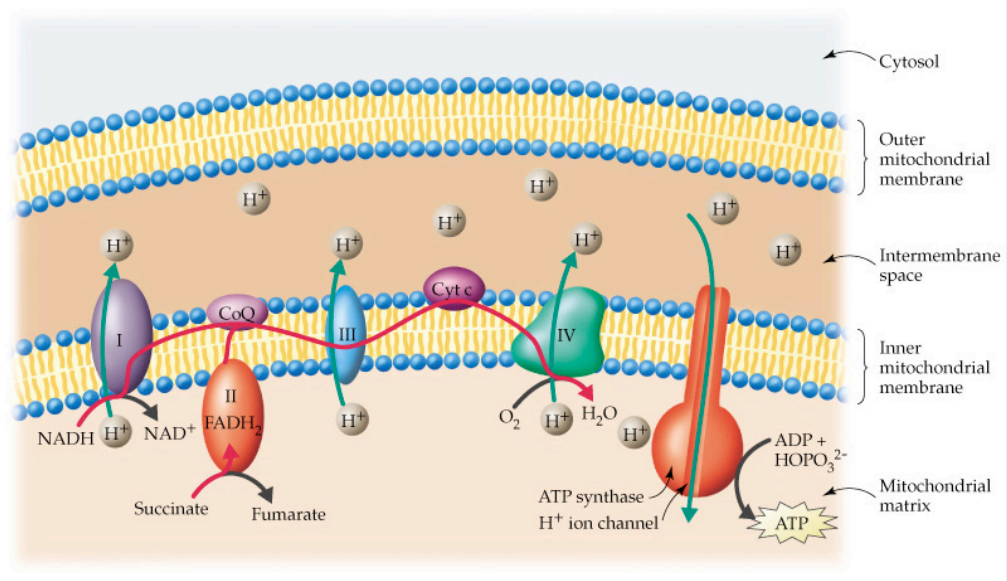
The Kreb's Cycle (Citric Acid Cycle) in full detail- you don't need to know this until college! ☺



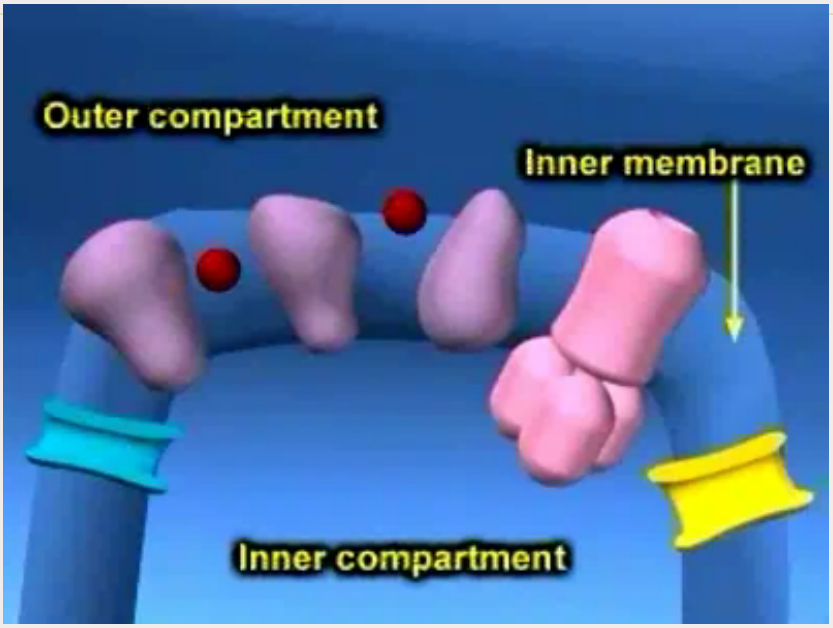
19. Step 2-- Electron Transport Chain

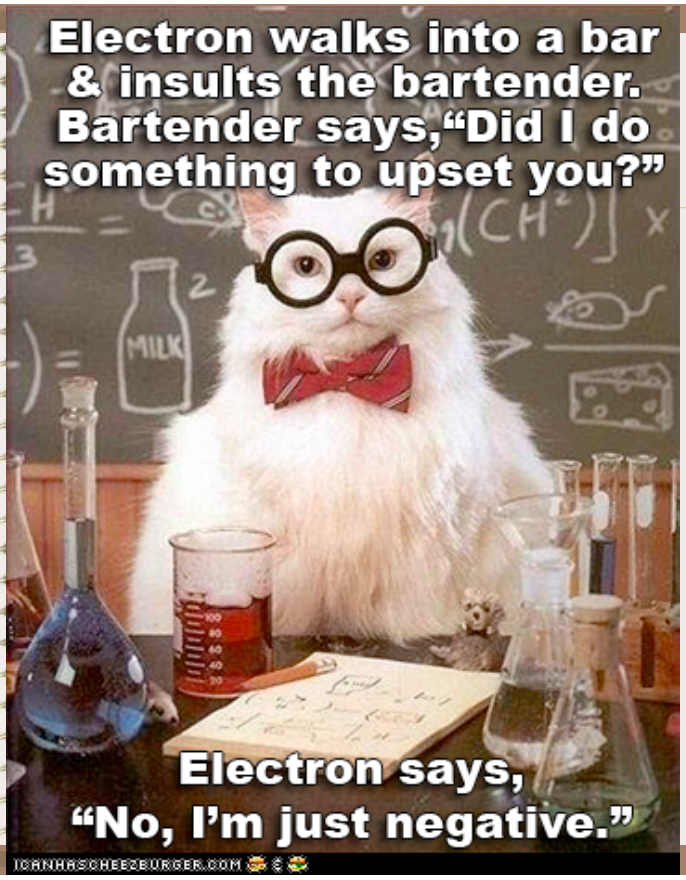
a) Happens in inner mitochondrial membrane
b) Oxygen needed- this is why you breathe
c) Electron carriers from Krebs produce ATP
d) Many ATP- used for cell work

The Mitochondrial Electron Transport Chain

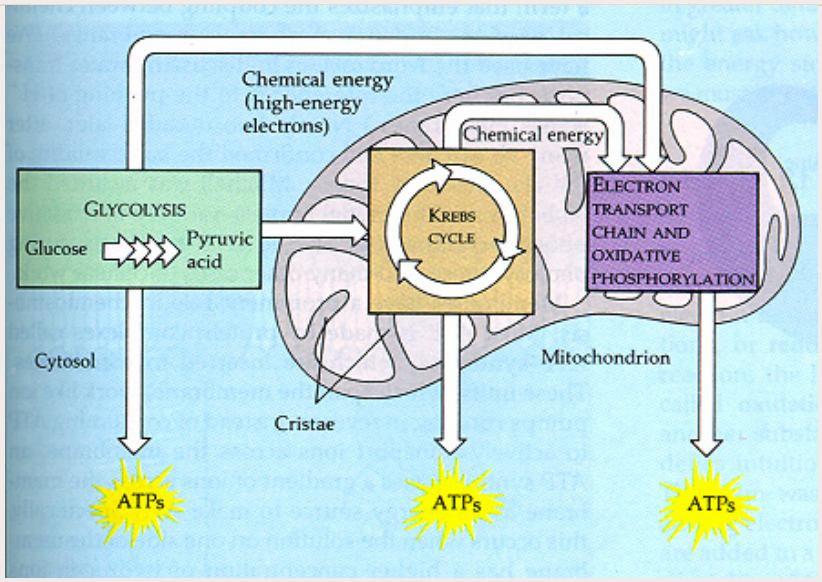


Electron Transport Chain





Aerobic Respiration Overview

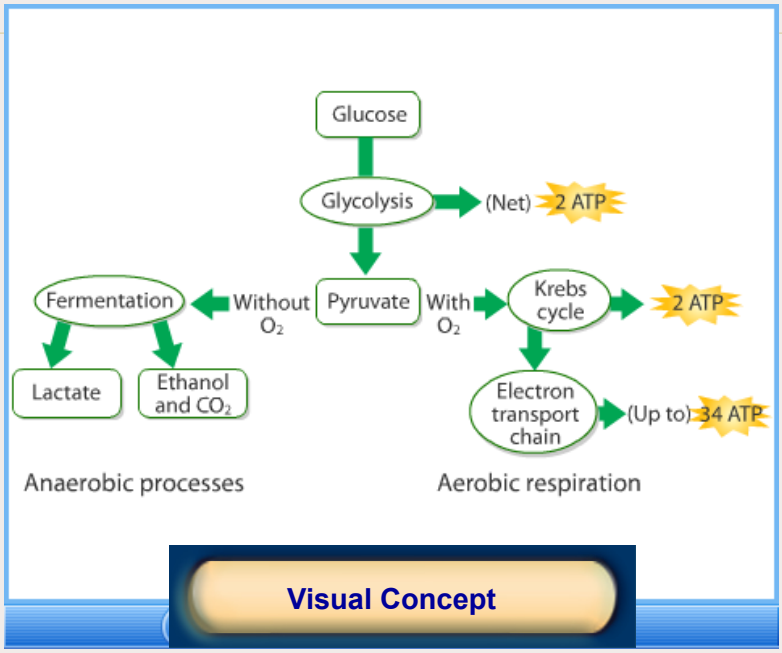


20. Aerobic respiration allows Glucose to be used more efficiently.

a) Glycolysis + Aerobic respiration= up to 38 ATP

b) Glycolysis + Fermentation = 2 ATP

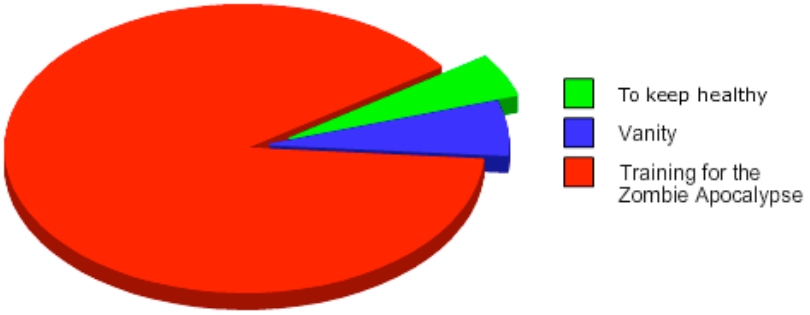
Aerobic and Anaerobic Comparison



21. Aerobic exercise (see also page 933)

A. Increased breathing & efficient use of glucose

(There is plenty of oxygen to act as the final electron acceptor)



Why people exercise……..NOT

22. Anaerobic exercise (resistance exercise)

a) Glycolysis / only source of ATP

b) Lactic acid causes soreness

- Uptake of oxygen to muscles is insufficient
- (Why does Lance Armstrong always win?)

No need to write: Question: Why do you get so tired during and after Anaerobic exercise?

Answer: Your body is using energy inefficiently, and you quickly run out of energy to burn.

You are consuming more ATP than you are producing.

The "ins" and "outs" of cellular respiration

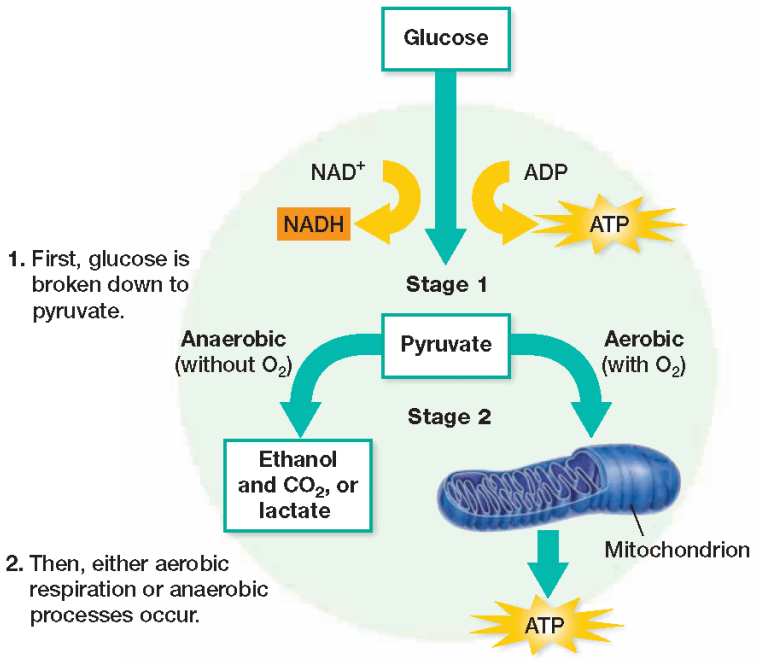
In what part of the process are each of these molecules important?

enzymes

$$C_6H_{12}O_6 + 6O_2 \text{ ----------> } 6CO_2 + 6H_2O + \text{energy}$$

Glycolysis ETC Kreb's Cycle ETC ETC

A summary of Cellular Respiration



1. First, glucose is broken down to pyruvate.

2. Then, either aerobic respiration or anaerobic processes occur.