AP Bio Unit 3: Cellular Energetics Cheat Sheet

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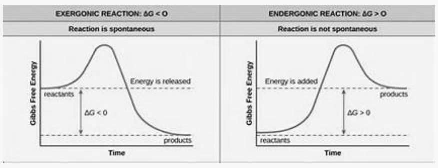
Enzymes

Enzymes: biological catalysts that facilitate chemical rxns in cells by lowering the activation energy
Structure:
-Active site that specifically interacts with substrate molecules
-Shape and charge of the substrate must be compatible with the active site of
the enzyme
Environmental Impacts:
Denaturation: protein structure is disrupted, eliminating the ability to catalyze rxns
-Environmental temperatures and pH outside the optimal range will cause structural changes
a. pH change can alter H-bonds that provide enzyme structure
b. H temp increases speed of molecules in a solution, increasing frequency of collisions between enzymes and substrates (increase rate of rxn)
-Relative concentrations of substrates and products determine how efficient rxn is
Inhibitors:
-Competitive inhibitor molecules can bind reversibly or irreversibly to the active site of enzyme
-Noncompetitive inhibitors can bind allosteric sites, changing the activity of the enzyme

Endergonic vs. Exergonic



Thermodynamics

1st Law	Nrg cannot be created nor destroyed only transferred
2nd Law	every nrg transfer increases entropy (S) of universe; process must increase entropy to be spontaneous

-Energy input must exceed energy loss to maintain order and to power cellular processes
-Cellular processes that release energy may be coupled with cellular processes that require energy
a. Often sequential; product of rxn is reactant for next step
-Loss of order or energy flow results in death
-Living systems require constant nrg input

Cofactor vs. Coenzyme

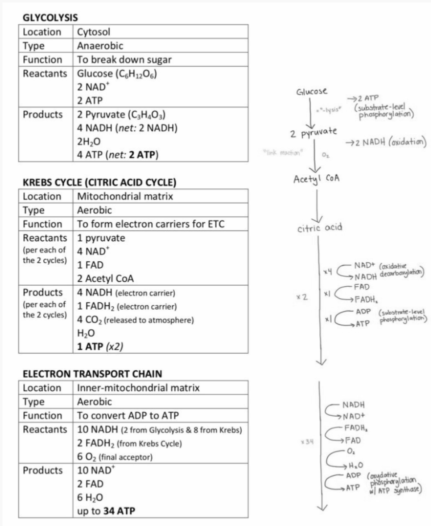
Cofactor	Inorganic; Cu, Zn, Mg, Fe, Ca ions; Remove electrons, protons or chemical groups from substrate
Coenzyme	Organic (non-protein); NAD+, FAD+, vitamin complexes; Remove electrons from substrate and transfer to other molecules

Both aid in proper functioning of enzyme

Fitness

-Variation at the molecular level provides organisms with ability to respond to various environmental stimuli
-Variation in the number and types of molecules within cells provide organisms with greater ability to survive and/or reproduce in different environments

Cellular Respiration



GLYCOLYSIS

Location	Cytosol
Type	Anaerobic
Function	To break down sugar
Reactants	Glucose ($C_6H_{12}O_6$) 2 NAD^+ 2 ATP
Products	2 Pyruvate ($C_3H_4O_3$) 4 NADH (*net:* 2 NADH) $2H_2O$ 4 ATP (*net:* **2 ATP**)

KREBS CYCLE (CITRIC ACID CYCLE)

Location	Mitochondrial matrix
Type	Aerobic
Function	To form electron carriers for ETC
Reactants (per each of the 2 cycles)	1 pyruvate 4 NAD^+ 1 FAD 2 Acetyl CoA
Products (per each of the 2 cycles)	4 NADH (electron carrier) 1 $FADH_2$ (electron carrier) 4 CO_2 (released to atmosphere) H_2O **1 ATP** *(x2)*

ELECTRON TRANSPORT CHAIN

Location	Inner-mitochondrial matrix
Type	Aerobic
Function	To convert ADP to ATP
Reactants	10 NADH (2 from Glycolysis & 8 from Krebs) 2 $FADH_2$ (from Krebs Cycle) 6 O_2 (final acceptor)
Products	10 NAD^+ 2 FAD 6 H_2O **up to 34 ATP**

Photosynthesis