The Working Cell

Organisms carry out chemical reactions for the purpose of energy transformation.

Energy is the capacity to perform work

•Energy can only be described and measured by how it affects matter. There are two forms of energy.

Kinetic energy- energy of motion.

*heat is kinetic energy associated with randomly moving molecules.

Potential energy- stored capacity to perform work.

*energy stored in the arrangement of atoms in molecules is called chemical energy.

Two laws govern energy conversion

•Thermodynamics is the study of energy transformations that occur in matter.

First law of thermodynamics (energy conservation). The total amount of energy in the universe is constant; this energy can be transferred or transformed but neither created nor destroyed.

Second law of thermodynamics (entropy increases). Every energy change results in increased disorder, increased entropy.

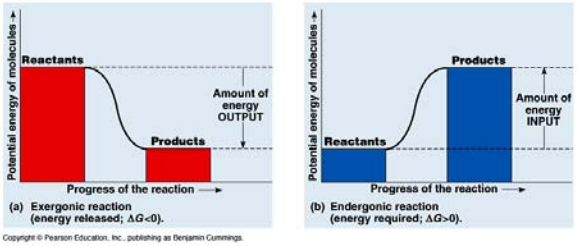
Chemical reactions either store or release energy

Endergonic reactions require an input of energy equal to the difference in the potential energy of the reactants.

i.e.- photosynthesis

Exergonic reactions result in an output of energy equal to the difference in the potential energy of the reactants and products.

i.e.- cellular respiration, burning gasoline



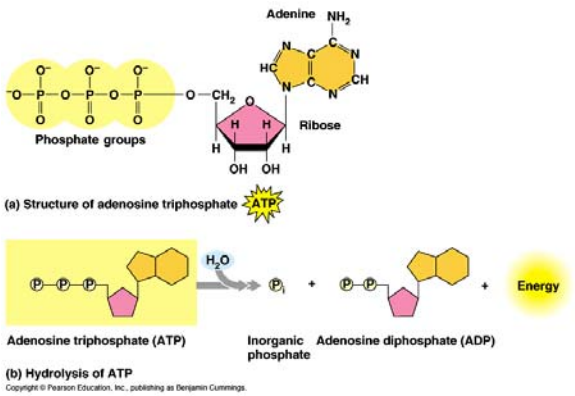
•Cellular metabolism is the sum total of all the endergonic and exergonic reactions in cells.

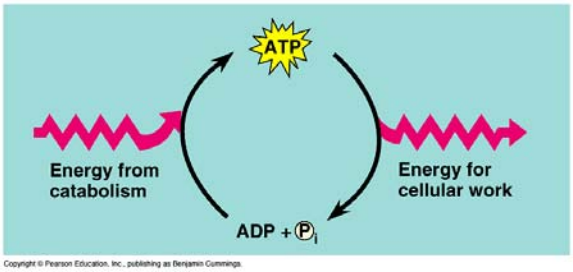
ATP shuttles chemical energy within the cell

•Most endergonic cellular reactions require small amounts of energy, rather than large amounts of energy available in food storage molecules.

•Even a single glucose molecule contains too much energy. It's like a $50 or $100 bill: you want $10s or $1s.

•Adenosine triphosphate (ATP) is the energy-rich, spendable, "energy small change" of cellular reactions.





•ATP is constantly being regenerated and used in a cycle involving endergonic dehydration synthesis and exergonic hydrolysis.