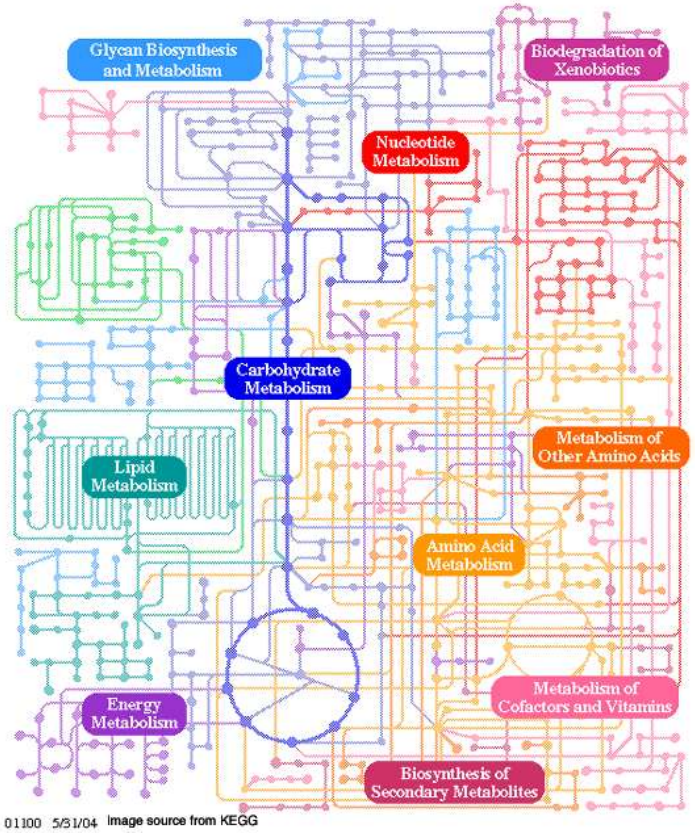


- Chapter 6~ A*n Introduction to Metabolism*

Metabolism/Bioenergetics

- *Metabolism*: The totality of an organism's chemical processes; managing the material and energy resources of the cell
- *Catabolic pathways*: degradative process such as cellular respiration; releases energy
- *Anabolic pathways*: building process such as protein synthesis; photosynthesis; consumes energy

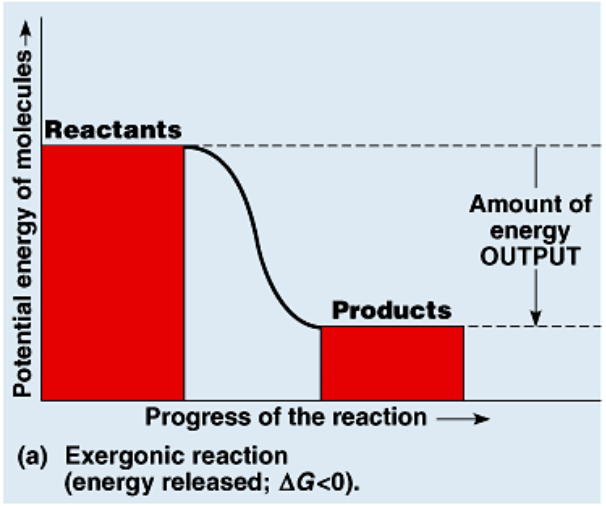
Thermodynamics

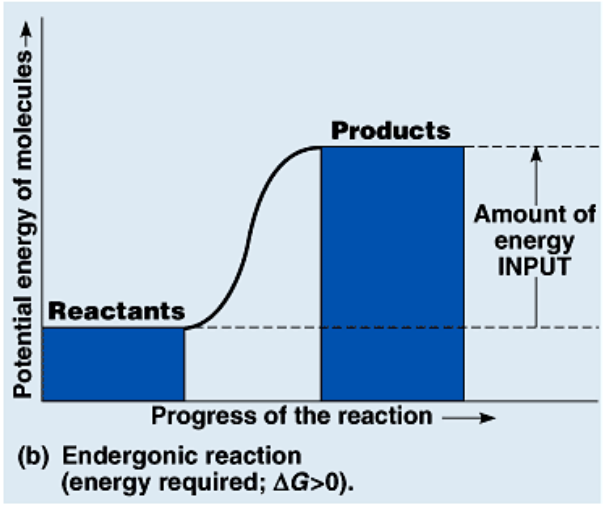
- Energy (E)~ capacity to do work; Kinetic energy~ energy of motion; Potential energy~ stored energy
- Thermodynamics~ study of E transformations
- 1st Law: conservation of energy; E transferred/transformed, not created/destroyed
- 2nd Law: transformations increase entropy (disorder, randomness)
- Combo: *q*

ot

Free energy

- *Free energy*: portion of system's E that can perform work (at a constant T)
- Exergonic reaction: net release of free E to surroundings
- Endergonic reaction: absorbs free E from surroundings





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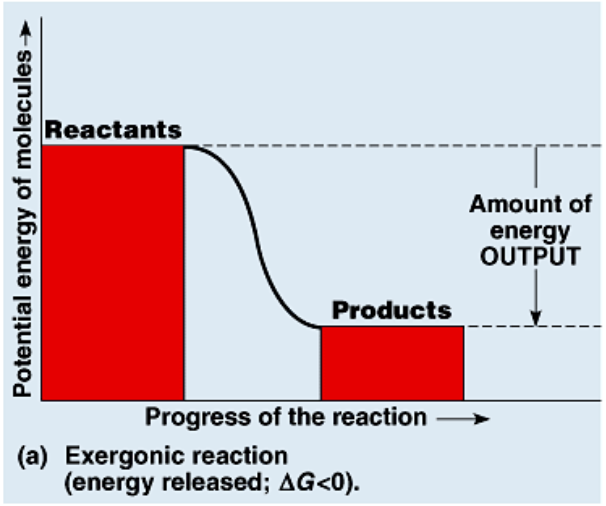
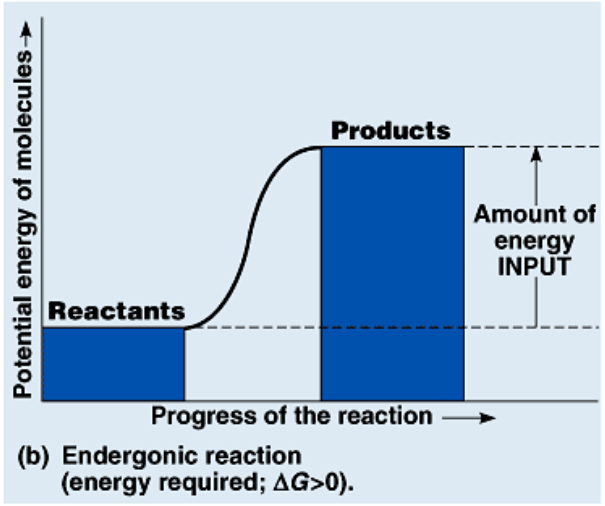
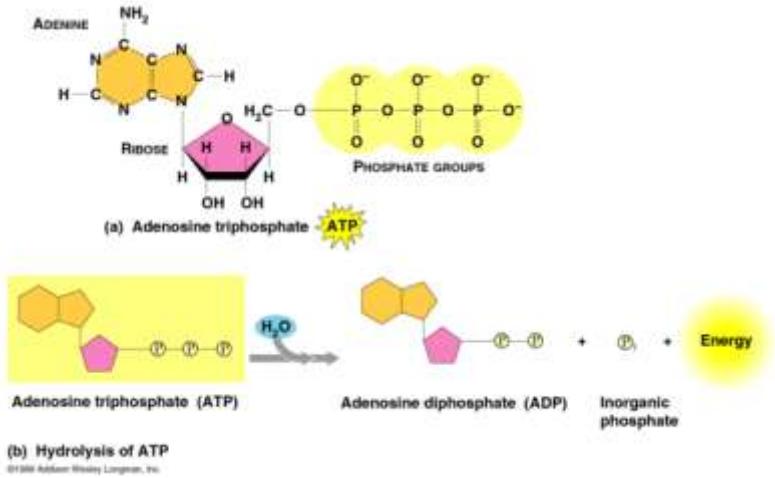




Energy Coupling & ATP

- E coupling: use of exergonic process to drive an endergonic one (ATP)
- *Adenosine triphosphate*
- ATP tail: high negative charge
- ATP hydrolysis: release of free E
- Phosphorylation (phosphorylated intermediate)~ enzymes



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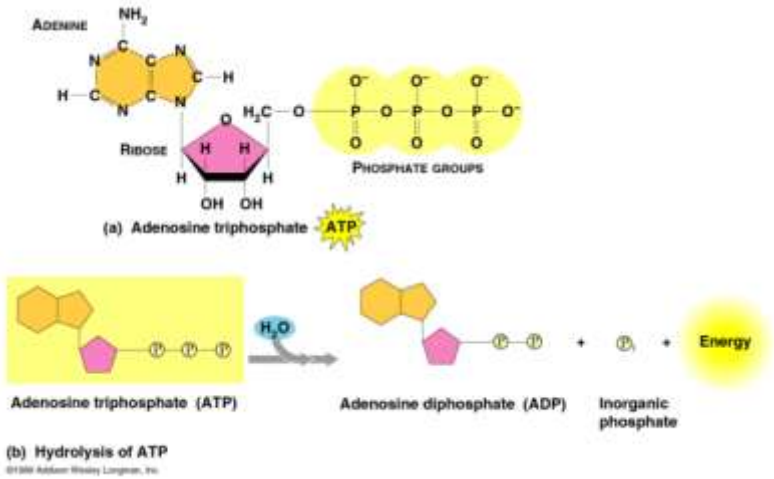
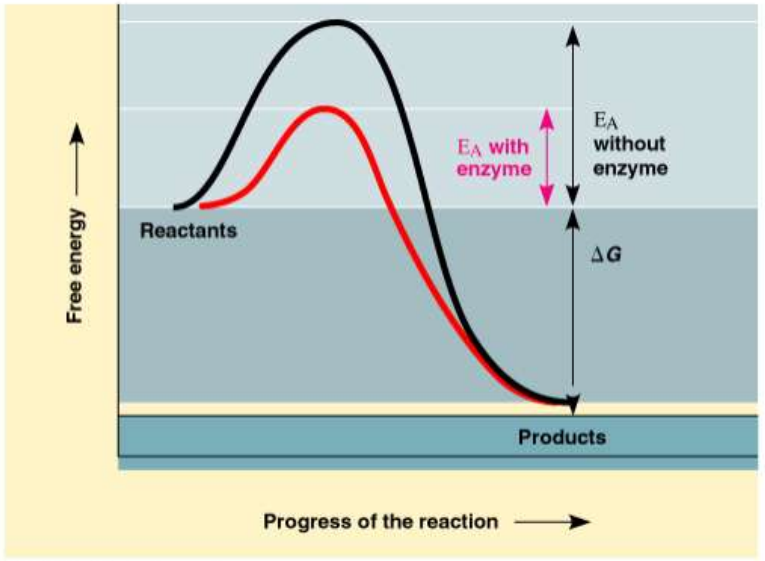


Enzymes

- *Catalytic proteins*: change the rate of reactions w/o being consumed
- *Free Energy of activation* : the Energy required to break bonds
- *Substrate*: enzyme reactant
- *Active site*: pocket or groove on enzyme that binds to substrate
- Induced fit model



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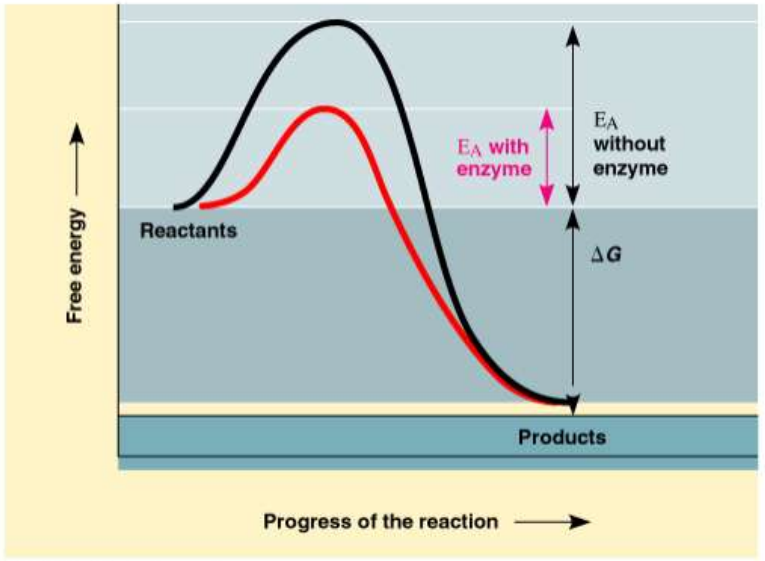

Effects on Enzyme Activity

- Temperature
- pH
- Cofactors:

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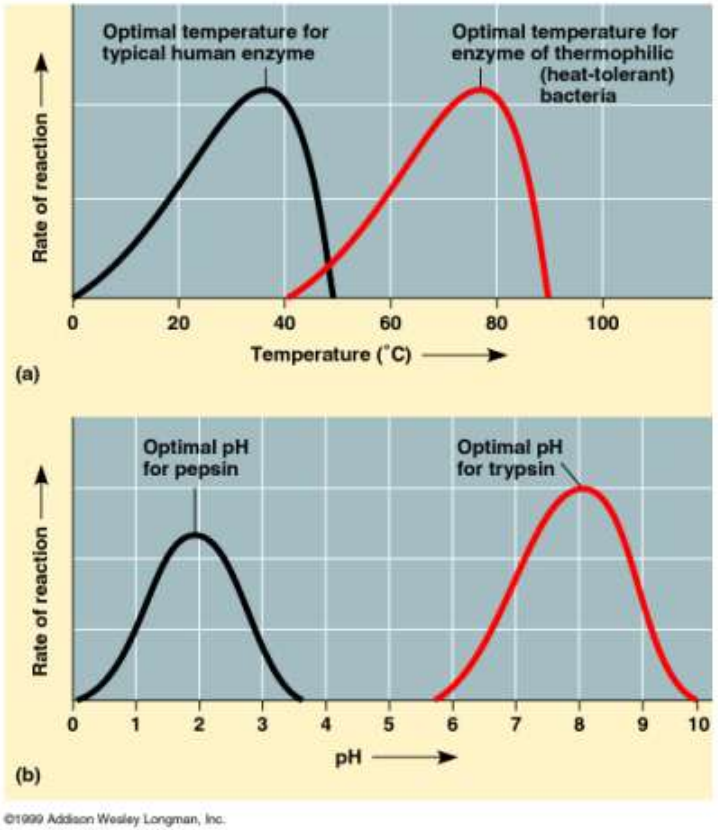
- Coenzymes: organic helpers; ex.: vitamins



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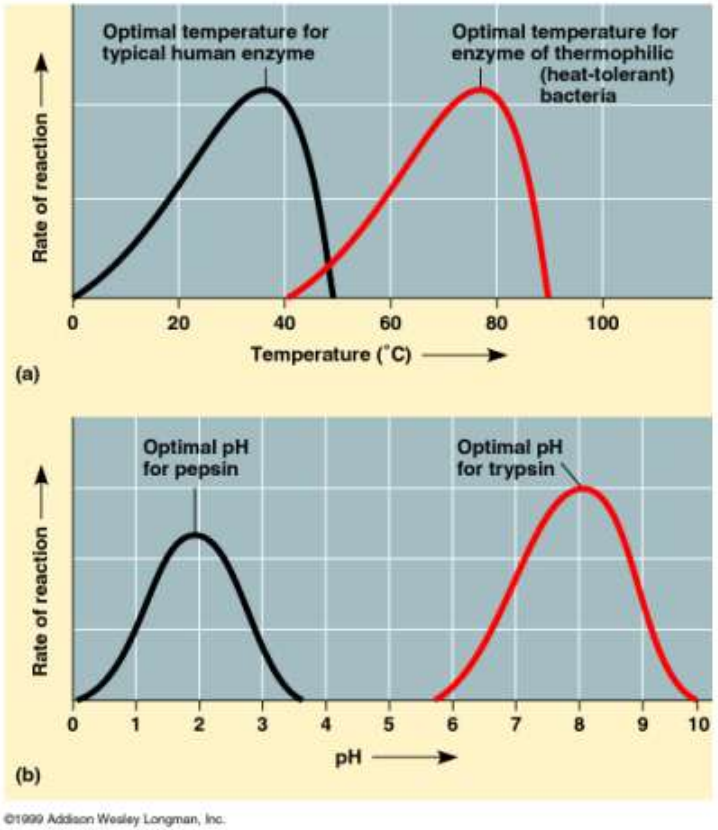
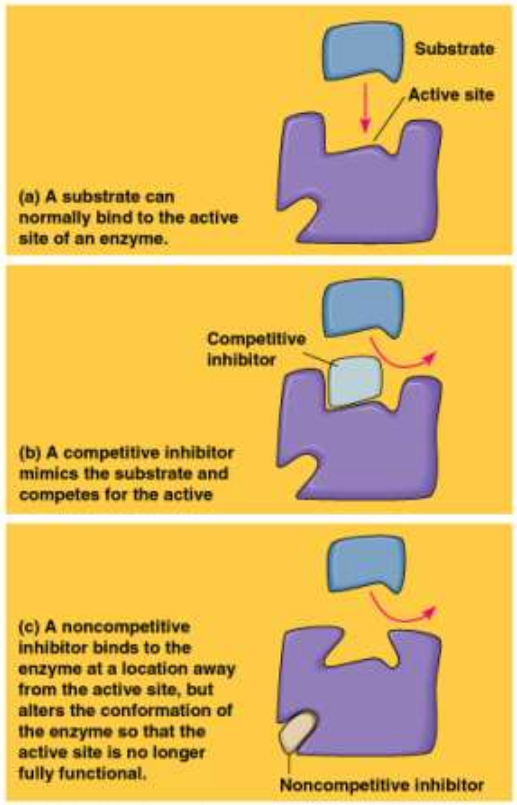


Enzyme Inhibitors

- Irreversible (covalent); reversible (weak bonds)
- *Competitive*: competes for active site (reversible); mimics the substrate
- *Noncompetitive*: bind to another part of enzyme (*allosteric site*) altering its conformation (shape); poisons, antibiotics



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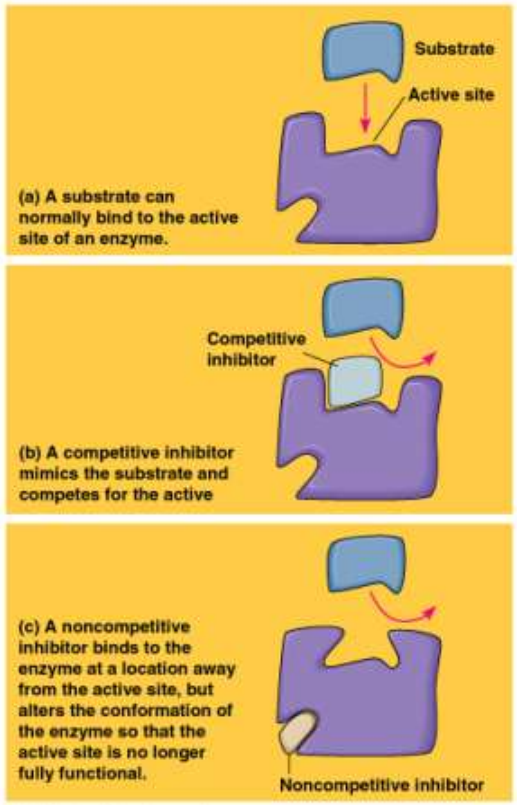


How Enzymes Work

http://highered.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::640::480::/sites/dl/free/0003292010/819778/How_Enzymes_Work.swf::How%20Enzymes%20Work

Enzyme Modelling Lab

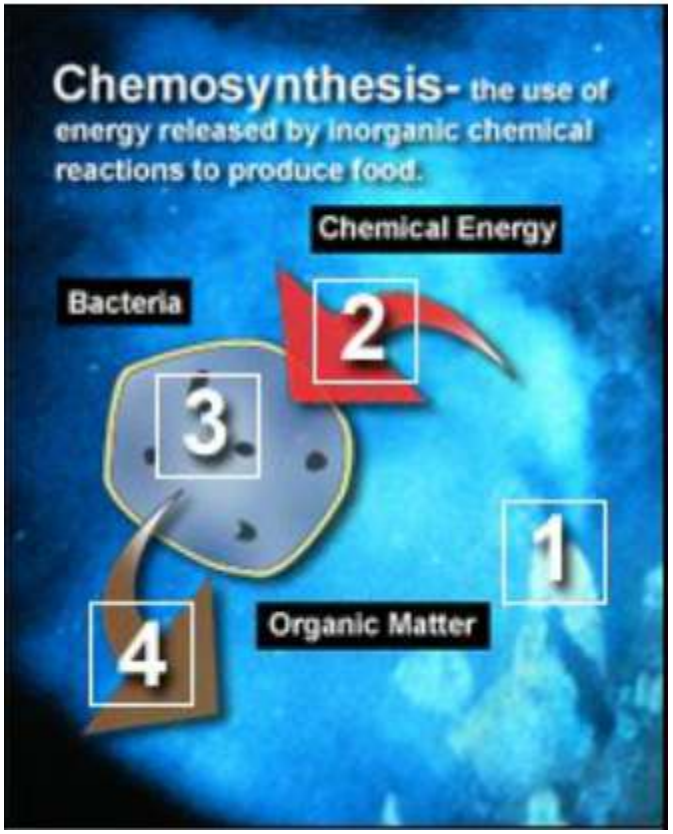
- **Pre-Lab:**
- **Vocabulary**
  - Enzyme
  - Active site
  - Substrate
  - Anabolism
  - Catabolism
  - Competitive inhibitor
  - Allosteric inhibitor

- **Procedure:**
- Use the enzyme models to demonstrate anabolism and catabolism
- Use the enzyme models with extra foam to illustrate competitive and allosteric inhibition

- **Data:** Draw and Describe each model in 3-5 bullets, label each model
- **Analysis:** 1. Discuss the benefits and limitations of enzymes 2. Explain the role of inhibitors in controlling enzymatic reactions
- Conclusion: Sum it up

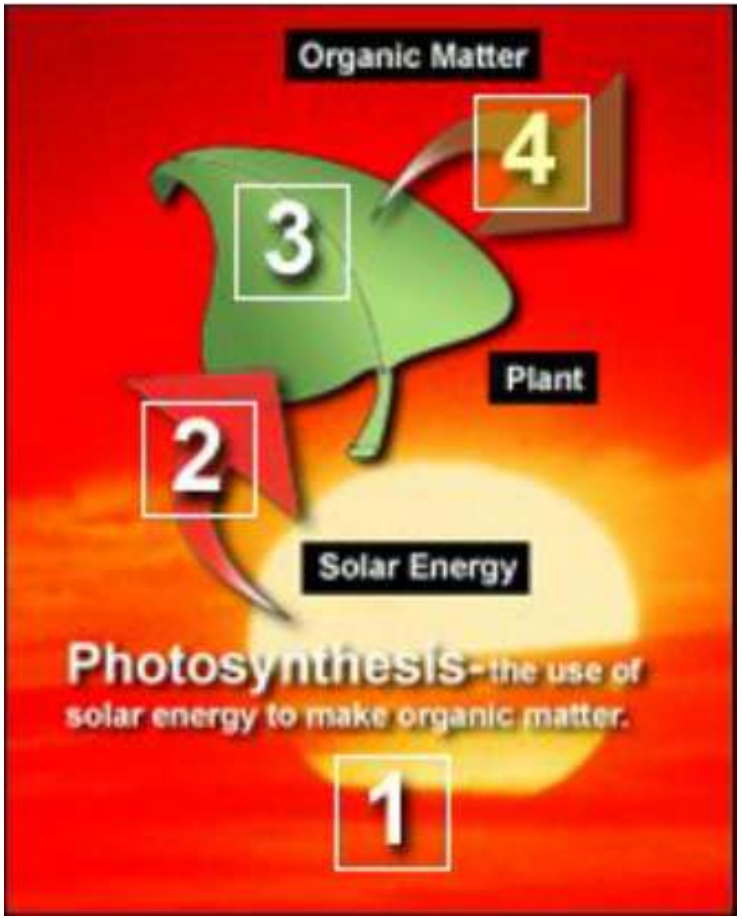
Chemosynthesis

- organisms use the energy released by chemical reactions to make a sugar, but different species use different pathways.
- $CO_2 + 4H_2S + O_2 \rightarrow CH_20 + 4S + 3H_2O$
- bacterial communities have been found in hot springs on land, and on the sea floor around hydrothermal vents, cold seeps, whale carcasses, and sunken ships



Photosynthesis

- organisms use solar energy to turn carbon dioxide and water into sugar and oxygen.
- $CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
- occurs in plants and some bacteria, wherever there is sunlight - on land, in shallow water, even inside and below clear ice.



Venn Diagram

- Please make a Venn Diagram for Photosynthesis and Chemosynthesis
- Include at least 5 bullets in each section, these may be equations, pictures examples and locations