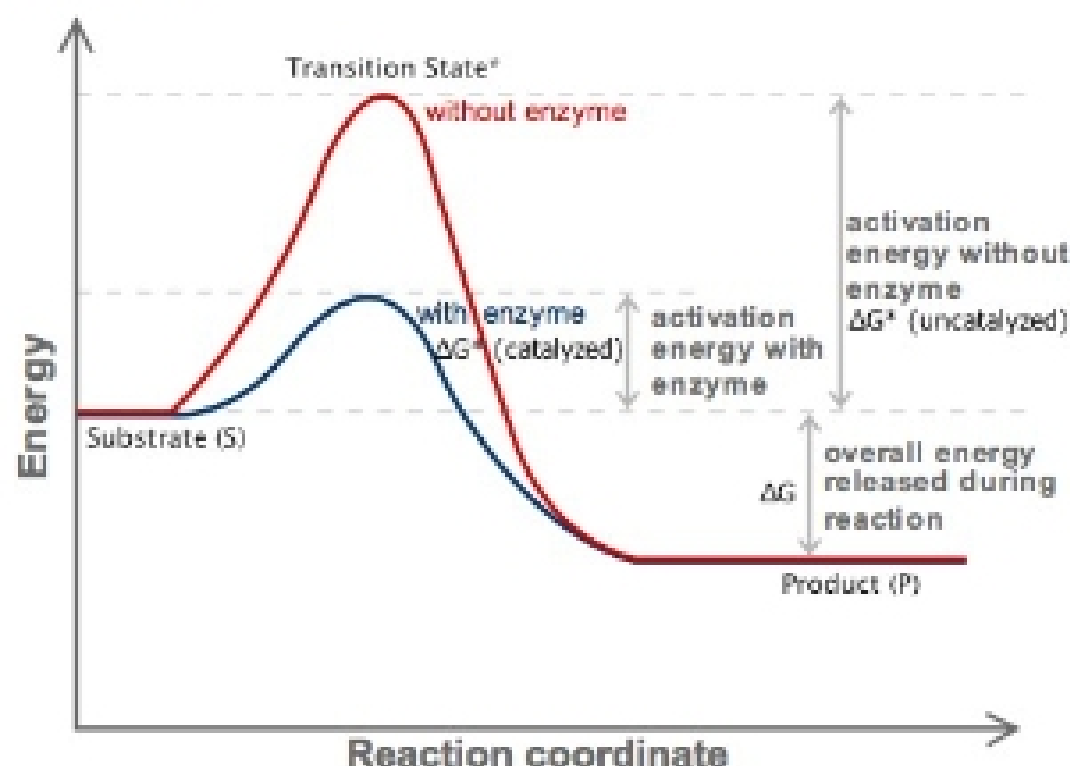


Exam #2 Study Guide

Lecture 10:

Enzymes: Proteins with a very specific structure and job.

- The site on an enzyme is for a specific substrate
- **The Active Site:** Small part of the enzyme that binds to the substrate
 - It breaks a bond (of the substrate) by stretching/putting in additional energy in the bond and will use H₂O in hydrolysis as well.
- The products formed may or may not bind to the active site for the reverse reaction.
 - Ex: Sucrase breaks down sucrose into glucose and fructose but the enzyme cannot form sucrose from glucose and fructose.
- If the enzyme can't go backwards it will release the product and leave.
- The enzyme is a catalyst for the breaking down or formation of a substrate creating the activation energy of the reaction to be lower and more easily reactable.



Reactions are either **Exergonic** or **Endergonic**

Endergonic: Energy is required to react

Exergonic: Energy is released from the reaction

Most reactions involve breaking or forming bonds

- Forming bonds releases energy
- Breaking bonds requires energy
 - A reaction will occur if the total energy needed to break the bond is less than the energy released by forming the bonds (if its energetically favorable)

Entropy: Measure of disorder in a system (to increase order in a system requires energy)

Ex: Making a polymer decreases disorder (entropy) also concentrating cells to a certain area of a cell increases order (requires energy- decreases entropy)

Anabolic Reaction: Decreases disorder/decreases entropy

- Links simple molecules forming complex molecules

Catabolic Reaction: Breaking down complex molecules into simple molecules

- Increases disorder/increases entropy
 - o Although energy is needed to break the bonds between the simple molecules there is energy in the form of entropy involved

In a cell: Catabolic reaction are linked to (drive) anabolic reactions

- Ex: $\text{ATP} + \text{Creatine} \rightarrow \text{ADP} + \text{Phosphocreatine}$

Exergonic Reactions: Cell Respiration and Catabolism

Endergonic Reaction: Active transport and cell movements

Creatine Kinase- Adding ATP to creatine to make phosphocreatine (left with ADP) and the reaction also moves backwards.

For enzymes to be "happy" the environment need to be controlled (pH 7.4, temperature of 37 degrees Celsius, and enough cations and salts). These are the conditions within the human body.

Lecture 11:

When an enzyme is reacting it is ideal to have an excess of reactants.

Error decreases by the more points you have- error is much higher at the point 0.5 compared to a point at 30.

- Error is associated with the first measure is always higher since it is a small amount and the higher the amount of product the easier it is to determine and be closer to the actual amount of product produced.

ATP has a critical role in cellular metabolism:

- Energy is released from exergonic reactions and the energy lost is captured by another molecule and used for endergonic reactions.
 - o Energy released from the formation of ADP from ATP can be used to form ATP from ADP.

Some enzymes are always present and their activity is only controlled by the level of substrate present.

- Many enzymes are not active all the time (their activity is regulated)
- If an enzyme cant catalyze a reaction the reaction will not occur.

If one reactant has a lot and the other reaction has a small amount the reaction will be slow and can only produce the amount of product allowed from the limiting reactant.

Controlling Enzymes:

- 1) **Some enzymes are only made when they are needed**
 - i. This approach is very slow and is usually only used in long term cell response.
 - ii. The process includes the formation of DNA that encodes the genetic information for that specific protein that then is transcribed and translated.
- 2) **The activity of some enzymes are regulated by the binding of another molecule or protein.**
 - i. This approach is very fast and can occur min/min or sec/sec.
 - ii. In both images below there is allosteric regulation, which is binding of an activator or inhibitor that changes the shape of the protein that the active site can or cannot bind the substrate.

