7.2

Enzymes

Biological molecules that act as catalysts for biochemical reactions are called **enzymes**, and almost all enzymes are proteins. Enzymes lower the activation energy by binding to the reactants in such a way that the shape of the molecules are changed enough to destabilize the bonds. A destabilized bond is easier to break or make, thus requiring less heat energy to get the process started. Enzymes don't actually change the ΔG, they simply reduce the activation energy needed to start the reaction process.

Reactants that bind to enzymes are called **substrates** and the location at which they bind is called the enzymes **active site**. In fact, enzymes are name after the substrate and designated with a suffix -**ase** (ATPase, Lactase, etc.) Active sites are created by unique combinations of amino acids and their side chains. Since side chains of amino acids can be acidic, basic, hydrophilic, hydrophobic, positively, or negatively charged, binding sites can be very specific to a particular substrate, in fact, enzymes are defined by their unique specificity towards substrates. However, this uniqueness also comes with very little wiggle room if environmental conditions change (i.e., temperature, pH), which can greatly alter enzyme effectiveness. Still, the enzyme-substrate complex is designed specifically to lower the activation energy which can involve: promoting reactions by bringing certain substrates closer together, creating proper environments like acidic, basic, polar, or non-polar, altering arrangements of bonds to facilitate bond breaking or bond forming, and even providing additional needed substrates like ions or certain chemical groups. After the enzyme helps to catalyze the chemical reaction, the products are released and the enzyme is ready for more substrate, with the enzyme essentially remaining unchanged by the reaction.