**Study Guide for Exam I**

Please be reminded that this guide is not intended to be comprehensive, and you should still review the textbook and lecture materials.

## Evolution, the Themes of Biology and Scientific Inquiry

What are levels of Biological Organization: from molecules to biosphere?
What is Charles Darwin's Theory of Evolution by Natural Selection?
What is Scientific Process: hypothesis, controlled experiments & variables, scientific theory?

## Chemical Context of Life

What are atomic number, mass, protons, neutrons, and electrons, and their relationships?
What are isotopes? what are the differences between two isotopes?
What is energy levels of an atom's electrons (first shell, second shell, third shell)?
What are differences among covalent bonds (polar and non-polar), ionic bonds, hydrogen bonds?
What are valence shell, valence electrons, and valence? how to calculate valence?

## Water & Life

What are four important water properties? How do they support life on Earth?
What are Acids and Bases? What does PH mean? How to calculate the PH of a solution?
Solute concentration: definition of molecular mass, mole (mol), and Molarity (M). How to calculate molarity of a solution?
Acidification of seawater by increased $CO_2$ in the air and what is its effect on marine organisms?

## Carbon and Molecular Diversity of Life

What are unique features of carbon and their contribution to molecular diversity?
What are isomers (structural and cis-trans isomers)?
What do enantiomers mean?

## Large Biological Molecules

The synthesis (dehydration) and breakdown (hydrolysis) of polymers
Diversity of polymers:

- Carbohydrates: What are monosaccharides, disaccharides, polysaccharides (glycogen, starch, and cellulose), their structures and functions?
- Lipids: What are fat (triacylglycerol) and phospholipids, and their features and functions?
- Proteins: What are amino acids, polypeptides (amino acid polymers), and four levels of protein structure, and their relationships?
- Nucleic acids: what are DNA, RNA, and their important features, structures and functions?

## Cells

Prokaryotic and eukaryotic cells, what is the main difference?
What is ratio of surface area to volume? Why is high ration of surface area to volume is so important for cellular functions?