Astronomy 141 -- Winter 2012
Quiz 2 Study Guide

What is Life
- Biological definition of life
  - 6 basic characteristics for life
  - Order and Structure
  - Reproduction and growth/development
  - Energy utilization
  - Response to environment
  - Adaptation to environment by evolving
  - Natural Selection

Cells
- Cell membranes
  - Carbon Chemistry - what makes carbon special
  - Proteins and enzymes
  - Amino Acids - only 22 in Earth life, all left-handed
  - Chirality (handedness)
  - Nucleic acids - RNA and DNA
  - Prokaryotes
  - Eukaryotes
  - Phylogenetic Tree of Life
  - Three Groupings: Bacteria, Archaea, and Eukarya

Chemistry of Life
- Main elements: CHON plus sulfur (S) and phosphorus (P)
- Metabolism
  - ATP cycle
  - Sources of carbon: Autotrophs vs. Heterotrophs
  - Sources of energy: chemical and sunlight
- Photosynthesis
- Chemosynthesis
  - Crucial role of liquid water as the ideal solvent medium of biochemistry

DNA, RNA, and Heredity
- Use of DNA to store and transmit cellular operating instructions
  - DNA structure - sugar and phosphate backbone, 4 nucleotides base-pairs
  - AT and GC
  - Base pair sequences and how the code for amino acids for proteins
  - Double-helix structure and replication
  - RNA structure - sugar and phosphate backbone, AUGC pairs
  - Role of RNA (transcription, translation, catalyze protein synthesis)
  - Copying errors and mutations
  - Mutations are molecular basis of evolution by providing genetic variation

Life on the Edge: Extremophiles
- Main Types: thermophiles, psychrophiles, halophiles, acidophiles
  - Thermophiles - why is heat bad, how have thermophiles adapted
  - Environment of thermophiles, metabolism, first forms of life?
  - Psychrophiles - why is cold bad, how have psychrophiles adapted
  - Halophiles - why is salinity bad
  - Acidophiles - why is acidity bad
  - Radiation-resistant organisms
  - Endoliths
  - Life not possible without liquid water

Origin of Life on Earth
- What are the requirements for life?
  - What is Abiogenesis
  - Miller-Urey Experiment
  - Sources of Amino Acids
  - Role of Lipid vesicles as proto-cell membranes
  - RNA World model of life’s origin
  - Metabolism First model of life’s origin

Earliest forms of Life
- Challenges of finding the oldest fossils
  - Stromatolites - fossil and present-day, oldest form of life
  - Microfossils - fossil cells, challenges and oldest microfossils
  - Carbon Isotope ratios - why a marker for life, challenges

Which came first, photosynthesis or chemosynthesis?
Were extremophiles the first forms of life?

History of Life on Earth
- Proterozoic Eon - rise of oxygen, first eukaryotes
  - Phanerozoic Eon - first multicellular animals
  - Cambrian Explosion of animal diversity
  - Plants and fungi colonize land (why not earlier?)
  - Animals colonize land
  - Emergence of mammals and dinosaurs
  - K-T event and rise of mammals
  - Emergence of hominids and humans

Extinction and Impacts
- Role of mass extinctions in the history of life
  - The K-T (Cretaceous-Tertiary) event and death of dinosaurs
  - What is the evidence that the K-T event was an asteroid impact?
  - Other mass extinctions in geological history
  - Current-day hazards from asteroidal impacts
  - What was the Tunguska Event?