<table>
<thead>
<tr>
<th>WEEK</th>
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| Week 1 | Introduction to AIS | Introduction to AIS  
|        | Part 1: Randomness | Entropy  
|        |                    | Temperature and the Laws of Thermodynamics  
|        |                    | Introduction to Maple  
| Week 2 |                        | Introduction to Statistics  
|        |                        | Genetics  
|        |                        | Introduction to Lab Practices  
| Week 3 |                        | Specific Heat Capacity  
|        |                        | The Boltzmann Distribution  
|        | Part 2: Structure & States - Atomic to Cellular | Diffusion  
|        |                        | Structure: Water  
|        |                        | Measuring properties of soil: H2O  
|        |                        | Atomic Structure  
|        |                        | Electromagnetic Radiation and Matter  
|        |                        | Structure of the Nucleus  
| Week 4 |                        | Behavior of a Gas (Boltzmann Distribution)  
|        |                        | Kinetic Molecular Theory  
|        |                        | Ideal Gas  
|        |                        | Dispersion Forces  
|        |                        | Diffusion and Diffusion of a Gas  
|        |                        | Introduction to Liquid and Solid phases  
|        |                        | Fundamental Particles  
|        |                        | Measuring Interactions: Forces and Energy  
|        |                        | Covalent and Ionic Bonding  
| Week 5 | Midterm #1 | Chemical Bonding (cont'd)  
|        |                        | Valence Shells, Octets, and Lewis Representations  
|        |                        | Extending the model: molecular geometries (going 3D)  
|        |                        | Extending the model: bond polarity, partial charge, formal charge & dipole moments  
|        |                        | Extending the model: resonance  
|        |                        | Molecular Model and Physical Bulk Properties  
|        |                        | Water Collection and Testing at Mount Baldy Stream  
| Week 6 |                        | Bulk Properties (cont'd)  
|        |                        | Intermolecular Interactions  
|        |                        | The Liquid Phase  
|        |                        | Melting Points and Boiling Points (Phase Transitions)  
|        |                        | Vectors: math to describe the 3D world  
|        |                        | Water quality pH II: bacterial assays  
| Week 7 | Statics | Newton's Laws  
|        |                        | Aqueous Environments  
|        |                        | Dissolution  
|        |                        | Properties of Solutions  
|        |                        | Dissolving Neutral Molecules  
|        |                        | Dissolving Gases  
|        |                        | Precipitation Reactions  
|        |                        | Solubility Rules  
| Week 8 |                        | Diffusion and Osmosis  
|        |                        | Microscopy  
|        |                        | Force fields  
|        |                        | Gravitational Forces  
| Week 9 | Midterm #2 | Electrical Forces  
|        |                        | Composite Forces  
|        |                        | Ions in Water  
|        |                        | Chemical Bonds  
|        |                        | Enthalpy of Chemical Systems  
| Week 10 | Equilibrium Reactions | Enthalpy of Chemical Systems (cont'd)  
|        |                        | Enthalpies of Formation  
|        |                        | Magnetic Fields and Forces  
|        |                        | Composite fields  
|        |                        | Chemical Equilibria  
|        |                        | Introduction to Reaction Rates  
| Week 11 |                        | Equilibrium Reactions  
|        |                        | Equilibrium Expressions and the Law of Mass Action  
|        |                        | Reaction Quotients  
|        |                        | LeChatler's principle  
|        |                        | Bronsted-Lowry Acids and Bases  
|        |                        | Re-visiting the Water Lab  
| Week 12 |                        | Acids and Bases  
|        |                        | Bronsted-Lowry Acid-Base Reactions  
|        |                        | Conjugate Pairs in Acid Base Chemistry  
|        |                        | Biological Acid-Base Phenomena  
|        |                        | Introduction to pH  
|        |                        | Relative strengths of Different Acids and Bases  
|        |                        | Biological Molecules: Lipids  
|        |                        | Lipid Structure/Function Dependence on pH  
|        |                        | Lipid Aggregation in Aqueous Environments  
|        |                        | Cellular Membranes  
|        |                        | Cellular Membrane Transport  
| Week 13 |                        | Continuous Distribution Field Examples  
|        |                        | Electric Fields  
|        |                        | Biological molecules: Carbohydrates  
|        |                        | The Structure and Properties of Alcohols  
|        |                        | Biological molecules: Amine Acids  
|        |                        | Chemistry of Amine Acid Functional Groups  
| Week 14 |                        | Genetic Mutations  
|        |                        | Macromolecular machines: DNA Replication  
|        |                        | Origin of Structure: Protein Synthesis  
|
Gene and Genome Structure: Pro- and Eukaryotes
Transcription and Translation
Gene Regulation

Semester Final Exam and Lab Practical
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Cellular Structure  
Cell Cycle and Mitosis  
Protein and Gene Families  
Sequence similarities  
Metagenome Analysis of Baby Stream Microbes  
Phylogeny and Diversity  
Speciation  
Acid-Base Equilibria  
Acid-Base Structure and Function  
Acid-Base Titrations and Calculations  
Buffers  
Buffers in Biological Systems  
Gene Regulation |
| Week 2 | Protein and Gene Families  
Metagenome Analysis of Baldy Stream Microbes  
Phylogeny and Diversity  
Speciation  
Acid-Base Equilibria  
Acid-Base Structure and Function  
Acid-Base Titrations and Calculations  
Buffers  
Buffers in Biological Systems  
Gene Regulation |
| Week 3 | Energy and Energy States  
Physical Waves  
Anatomy and Function of the Ear  
Electromagnetic Radiation  
Optical Radiation - Reflection and Refraction  
Particle and Wave Properties of Matter and Light  
Energy Quantization |
| Week 4 | Quantum Mechanics  
Quantum Approach to Atomic and Molecular Structure  
Wave/Particle Behavior of Electrons  
Orbitals- Electrons, Atoms, and Energy |
| Midterm #1 | Orbital Model of Covalent Bonds  
Pi Bond- Isomerization  
Absorption Spectroscopy  
Single Particle Systems  
Multi-Particle Systems |
| Week 5 | Non-Conservative Forces  
Energetics of Chemical Phenomena  
Entropy and Enthalpy  
Gibbs Free Energy of Formation  
Non-Standard Conditions |
| Week 6 | Biological Energy Transformation  
Biological Example: ATP  
Cellular respiration: Glycolysis and the Citric Acid Cycle  
Reaction Chemistry Review  
Precipitation Reactions  
Lewis Acid/Base Chemistry  
Oxidation/Reduction States and Reactions |
| Midterm #2 | Synthesis and Analysis of a Cobalt Complex  
Energy/Thermodynamics Principles Revised  
Biological Energy Transformation (Part II)  
Oxidative Phosphorylation and the Electron Transport Chain  
Photosynthesis |
| Week 7 | The Hill Reaction- Photosynthesis  
Flow of Energy in Biological Systems  
Field Potentials/Energy Gradients  
Cell Membranes and Nernst Equation  
Action Potential Experiments |
| System Evolution and Dynamics | Basics of Rate Equations  
Population Biology  
Modeling: Discrete Dynamics  
Population Biology- Predator and Prey Relationships |
| Midterm #3 | Momentum principle and Kinematics  
Chemical Kinetics: Rates of Reaction  
Reaction Reversibility  
Modeling Rate Laws with Maple  
Activation Energy and Catalytic Processes  
Chain Reactions |
| Week 12 | Dynamic Systems: Mechanics, Gravitational, Multiple Particle, Collisions  
Angular Momentum  
Physiological Adaptation  
Ecology  
Population Genetics: Hardy-Weinberg Principle  
Community Ecology |
| Week 13 | Dynamical Systems: Electric, Electro-chemistry and Circuits  
Microscopic View of Electric Currents  
Action Potential  
Population Biology: Self Regulating Systems  
Electrochemistry: Cells, Anodes, Cathodes, Batteries, Electrolysis  
Cell Potential  
Nernst Equation |
| Week 14 | Control of Cellular and Molecular Systems  
Development, Selection Theory, Variability  
Ecosystems and Boundaries to Regulation  
Negative Feedback Systems  
Patterns in Space  
Faraday's Law  
Energy Flow in Biosystems |
| Semester Final Exam and Lab Practical |