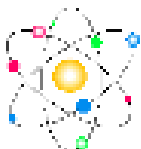


Principles of Alchemy (Chemistry)
by Dr Jamie Love from Merlin Science
www.synapses.co.uk/alchemy

Syllabus for *Principles of Alchemy (Chemistry)*

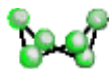
AIR (Atoms)

Atoms and atomic structure. Mass and Daltons. Isotopes, radioactivity and half-life. Nuclear chemistry and nuclear synthesis. Electron shells and orbitals (s and p orbitals; d and f orbitals are covered in EARTH). The Bohr atom. Quantum mechanics.



WATER (Molecules)

Molecular formulas and molecular mass. Lewis structures. Strong bonds - ionic, covalent and metal. Weak "bonds" - polar(ized), hydrogen and van Der Waals. Hydrophobic and hydrophilic forces. The states of matter. Solutions, condensation, evaporation and distillation. Molecular shapes - electrostatics, molecular orbitals, hybrid orbitals and VSEPR theory. Allotropes. Crystals. Amorphous and devitrified structures. Gels.



EARTH (Elements)

The Periodic Table - its trends, uses and concepts (including atomic size, ionization energies, electron affinity and electronegativity). A "tour" highlights the traits, similarities and differences among the common elements. More shells and orbitals.



FIRE (Chemical Reactions)

Breaking and making bonds. Exothermic and endothermic. Combination, decomposition and replacement reactions. Standard conditions. Energy diagrams and reaction paths. Catalysts. Valency. Oxidation and reduction. Balancing equations. Rates and equilibria. Entropy and enthalpy. Thermodynamics, Hess's Law, Le Chatelier's principle and Gibbs energy. Dissociation and ionization in water. Enthalpy of formation. "Special reactions" like combustion, electrolysis, photosynthesis, and respiration.



Many other topics are covered in less detail. For example, the graduate will gain an understanding of the fundamentals of pH but not to the depths required for calculating it (because that requires logarithms). Another example is Gibbs energy - the student will learn how changes in Gibbs energy determine the direction of a reaction but s/he will not see the (complete) Gibbs energy equation. As needed and where relevant, the student will learn a wee bit of Biology, Physics and Geology too!