**CLUE BIG IDEAS**

**Chapter 1 Big Ideas**

* Matter is made of atoms, that are the smallest distinguishable part of an element.
* We use models (mental and physical) to represent many chemical entities. We use different models for different purposes.
* Theories (such as atomic theory) change over time according to the evidence available
* All atoms/molecules attract each other because of the attractive electrical forces between them
* Attractions lower the potential energy of a system and repulsions tend to raise the potential energy
* Stable systems form where the attractive forces and the repulsive forces are equal
* The temperature of a phase change depends on the strength of the intermolecular forces.

**Chapter 2 Big Ideas**

* Electromagnetic radiation has both wave and particle properties
* Electrons in atoms have quantized energy levels
* Electrons have both wave and particle properties
* Periodic trends result from the quantized arrangement of electrons in atoms.
* Most periodic trends can be explained using the idea of effective nuclear charge.

**Chapter 3 Big Ideas**

* Atoms are formed in stars.
* The macroscopic properties of a substance can be explained by the interactions at the molecular level
* We can explain bonding using a number of different models (e.g. valence bond, molecular orbital, metallic)
* Chemical bonds determine the identity of the substance.
* To explain bonding we need to include both electrostatic ideas and quantum mechanical ideas.

**Chapter 4 Big Ideas**

* We can use the same models of bonding to explain how heterogeneous (ie between different atoms) bonds are formed.
* We often represent 3D structures with 2D “cartoons”
* Understanding the 3D molecular structures, combined with atoms electronegativities can help us infer the type and strength of intermolecular forces present between molecules.

**Chapter 5 Big Ideas**

* The temperature at which a phase change occurs depends upon the molecular structure of the compound.
* For molecular substances, as a substance changes phase intermolecular forces are overcome (not chemical bonds)
* The direction of change is determined by an increase in the total entropy change, ΔStotal or the Gibbs energy change ΔG
* Measuring temperature changes can be related to molecular level changes in interaction strength by the thermodynamic function ΔH, and bond energies

**Chapter 6 Big Ideas**

* A solution is a stable heterogeneous molecular mixture; it will not become “unmixed” over time.
* The factors that affect solubility are the enthalpy change (ΔH), and the entropy change (ΔS)
* A rule of thumb for predicting solubility is “like dissolves like” but does not tell us why.
* Molecules that have both polar and non-polar parts will often assemble to form larger structures, through a process driven by a decrease in entropy (involving the water molecules, primarily.)

**Chapter 7 Big Ideas**

* Chemical Reactions involve rearrangements of atoms to produce new chemical species with new bonds.
* Chemical Reactions produce new species with properties than cannot be predicted.
* Chemical Reactions involve only changes in arrangements of atomic cores and valence electrons.
* Chemical Reactions can be classified by how the valence electrons behave during the course of the reaction. For example: acid base reactions, or redox reactions
* Energy changes in reactions arise from the changes in bond energies as bonds in reactants are broken (which requires an energy input) and new bonds are formed (which releases energy to the surroundings)

**Chapter 8 Big Ideas**

* Rates of reactions depend on the probability that molecules will collide with enough energy to surmount the activation energy barrier.
* The extent of a reaction (position of equilibrium) is related to the free energy change from reactants to products and the temperature
* The position of equilibrium (but not the equilibrium constant) can be changed by changing concentrations of reactants or products.

**Chapter 9 Big Ideas**

* Buffers can resist changes in pH
* Acidic and Basic groups will protonate and deprotonate depending on the pH
* Reactions can be coupled by common intermediates, so that unfavorable reactions can be driven by coupling to a favorable reaction.