CHEMISTRY I: COURSE OVERVIEW

The academic standards establish the practices and core content for all Chemistry I courses in Tennessee high schools. The core ideas within the framework and standards are not meant to represent an equal division of material and concepts.

The major disciplinary core ideas utilized for Chemistry I include:

Physical Science (PSCI)
Physical Sciences (PS)
Matter and Its Interactions ● Structure and properties of matter ● Chemical reactions ● Nuclear process
Motion and Stability: Forces and Interactions
Energy ● Definitions of energy ● Conservation of energy and energy transfer ● Relationship between energy and forces ● Energy in chemical processes and everyday life
Waves and Their Applications in Technologies for Information Transfer

Students should explore these chemistry concepts and the seven crosscutting concepts (patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter; structure and function; and, stability and change) through laboratory techniques, manipulation of chemical quantities, and problem-solving practices. Within the Chemistry I standards, scientific and engineering practices are embedded as a means to learn about specific topics identified for the course. Engaging in these practices with current applications will help students become scientifically literate and astute consumers of scientific information.

Teachers, schools, and districts should use these standards to make decisions concerning the structure and content for Chemistry I classes in Tennessee schools. All chemistry courses must allow students to engage in problem solving, decision making, critical thinking, and applied learning. Chemistry courses are also laboratory based and require a minimum of 30% hands-on investigation. Chemistry laboratories will need to be stocked with the materials and equipment necessary to complete scientific investigations.

Although science is a body of content knowledge consisting of theories that explain data, science is also a set of practices that use analysis and argumentation to establish, extend, and refine knowledge. The science and engineering practices are used as a means to learn science by doing science, thus combining content knowledge with skill. These practices are not intended to be a sequence of steps nor are they intended to be taught as a separate, introductory unit for the course. By combining content knowledge with skill, students discover how scientific knowledge is acquired and applied to solve problems or advance scientific knowledge further. In addition, there are seven crosscutting concepts that are fundamental to the nature of science and thus stretch across all science disciplines. The Chemistry I standards have been constructed by explicitly integrating practices and crosscutting concepts, iteratively and in combination, within each core idea to provide students with a well-rounded education in science.

The academic standards for Chemistry I should be the basis for the development of classroom and course-level assessments.

CHEMISTRY I: ACADEMIC STANDARDS

CHEM1.PS1: Matter and Its Interactions

1) Obtain, evaluate, and communicate information to compare historical models of the atom (from Democritus to quantum model) and construct explanations to show how scientific knowledge evolves over time based on scientific evidence.

2) Use the Periodic Table as a model to predict chemical and physical properties of main group elements (e.g. reactivity, number of subatomic particles, valence electrons, electronegativity, ion charge, ionization energy, and atomic radius) based on locations on the periodic table.

3) Model different representations of atoms (e.g. Lewis Dot Structures, Bohr Models, electron configurations).

4) Use the periodic table and properties of elements to develop an explanation to predict the types of bonds that are formed between atoms.

5) Evaluate the components of a substance to write the chemical name and formula using IUPAC criteria, including covalent compounds, ionic compounds, polyatomic ions, and common acids.

6) Construct and use a model to show that atoms, and therefore mass, are conserved during a chemical reaction. Symbolically represent this by balancing chemical equations.

7) Perform stoichiometric calculations involving the following relationships: mole-mole; mass-mass; mole-mass; mole-particle; and mass-particle.

8) Use models to show a qualitative understanding of the concept of percent yield, limiting reactants, and excess reactants in a chemical reaction.

9) Develop an explanation using the reactants in a chemical reaction to identify reaction type (i.e., synthesis, decomposition, combustion, single replacement, double replacement) and predict products.

10) Conduct investigations and develop models to characterize the behavior of gases (e.g., pressure, volume, temperature).

11) Develop an explanation for the behavior of gases using the Kinetic Molecular Theory and the Combined Gas Law.

12) Use the Ideal Gas Law (PV=nRT) to quantitatively evaluate the relationship among the number of moles, volume, pressure, and temperature for ideal gases.

13) Create models of solutions to describe solutes and solvents, concentration of solutions, and the process of solvation.

14) Quantitatively analyze solutions to describe concentration using molarity, percent composition, and ppm.

15) Demonstrate separation methods such as evaporation, distillation, electrophoresis, and/or chromatography. Construct an argument to justify the use of certain separation methods under different conditions.

16) Obtain, evaluate, and communicate information to identify acids and bases as a special class of compounds due to their unique properties.

17) Use models to describe radioactive stability, radioactive decay, fusion, and fission.

18) Develop and use models to compare alpha, beta, and gamma radiation in terms of mass, charge, and penetrating power. Identify examples of applications of different radiation types in everyday life.

CHEM1.PS3: Energy

1) Construct an explanation of thermal energy as a form of energy, and temperature as a measure of average kinetic energy of a group of particles.

2) Analyze and interpret data using heating/cooling curves and phase diagrams.

3) Analyze the energy changes involved in calorimetry by using the law of conservation of energy quantitatively (use of $q=mc\Delta T$) and qualitatively.

4) Distinguish between endothermic and exothermic reactions by constructing potential energy diagrams and explaining the differences between the two using chemical terms (e.g. activation energy).

5) Analyze data to explain how energy is absorbed or given off depending on the bonds formed and broken.