9th Grade Physical Science Essential Standards

The Physical Science PLC Team identified the following Idaho State Standards as Essential–Semester 1 Chemistry

1

- **PSC1-HS-1**. Develop models to describe the atomic composition of simple molecules and extended structures.
  - Clarification Statement: Emphasis is on reviewing how to develop models of molecules that vary in complexity. This should build on the similar middle school standard (PS1-MS-1). Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamond. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.
  - Assessment Limit: Students will be provided with the names of the elements, a list of common ions, a list of numerical prefixes and their meanings, and the charges of all cations and anions within the item as necessary. Confine element symbols to the representative and familiar transition metal elements.

2

- **PSC1-HS-2**. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level.
  - Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.
  - Assessment Limit: Elements will be limited to main group elements. Properties assessed will be limited to reactivity, valence electrons, atomic radius, electronegativity, ionization energy (first), shielding effect, and the most common oxidation number.

3

- **PSC2-HS-1**. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states (configurations) of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
  - Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.
  - Assessment Limit: Identify types of chemical reactions including: synthesis/formation/combination reactions, decomposition reactions, single replacement/displacement reactions, double replacement/displacement reactions, oxidation-redox reactions, acid-base reactions, and combustion reactions. Predict the products of double replacement, single replacement, and combustion reactions only. For the second skill statement, do not use acid names or hydrocarbons when translating between words and formulas. Items will include a list of common ions as needed.

4

- **PSC2-HS-2**. Develop a model to illustrate the release or absorption of energy from a chemical reaction depends upon the changes in total bond energy.
  - Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.
  - Assessment Limit: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of the reactants and products.

5

- **PSC2-HS-4**. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
  - Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques. Should also include calculations related to determining the concentration and/or pH of a solution.
  - Assessment Limit: Conversion problems will be one to two steps (e.eg, grams to moles to atoms/molecules). Compounds and formulas should be provided in the stem of the equation. Students should be given molecular masses in problems involving gram to other unit conversions. Molar mass calculations should not be combined with conversion problems. All volumes must be at standard temperature and pressure (STP). A balanced equation

and molar masses should be included in the item. Calculations may include grams/moles/volume of reactant to grams/moles/volume of product.

6

- **PSC1-HS-4**. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the process of fission, fusion, and other types of radioactive decay.
    - Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.
    - Assessment Limit: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decay.

7

- **PSC3-HS-3**. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).
    - Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy. Examples of models could include diagrams, drawings, descriptions, and computer simulations.
    - Assessment Limit: Provide equations for the gas laws (i.e., ideal gas laws, Boyle's Law, Charles' Law, and the combined gas laws.)