Pennsylvania Keystone Exams

Chemistry: 11, 12

Properties and Classification of Matter CHEM.A.1

1 **Identify and describe how observable and measurable properties can be used to classify and describe matter and energy.** CHEM.A.1.1

1 Classify physical or chemical changes within a system in terms of matter and/or energy. CHEM.A.1.1.1

2 Classify observations as qualitative and/or quantitative. CHEM.A.1.1.2

3 Utilize significant figures to communicate the uncertainty in a quantitative observation. CHEM.A.1.1.3

4 Relate the physical properties of matter to its atomic or molecular structure CHEM.A.1.1.4

5 Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, ionic compounds containing polyatomic ions). CHEM.A.1.1.5

2 **Compare the properties of mixtures.** CHEM.A.1.2

1 Compare properties of solutions containing ionic or molecular solutes (e.g., dissolving, dissociating). CHEM.A.1.2.1

2 Differentiate between homogeneous and heterogeneous mixtures (e.g., how such mixtures can be separated). CHEM.A.1.2.2

3 Describe how factors (e.g., temperature, concentration, surface area) can affect solubility. CHEM.A.1.2.3

4 Describe various ways that concentration can be expressed and calculated (e.g., molarity, percent by mass, percent by volume). CHEM.A.1.2.4

5 Describe how chemical bonding can affect whether a substance dissolves in a given liquid. CHEM.A.1.2.5

Atomic Structure and the Periodic Table CHEM.A.2

1 **Explain how atomic theory serves as the basis for the study of matter.** CHEM.A.2.1

1 Describe the evolution of atomic theory leading to the current model of the atom based on the works of Dalton, Thomson, Rutherford, and Bohr. CHEM.A.2.1.1

2 Differentiate between the mass number of an isotope and the average atomic mass of an element CHEM.A.2.1.2

2 **Describe the behavior of electrons in atoms.** CHEM.A.2.2

1 Predict the ground state electronic configuration and/or orbital diagram for a given atom or ion. CHEM.A.2.2.1

2 Predict characteristics of an atom or an ion based on its location on the periodic table (e.g., number of valence electrons, potential types of bonds, reactivity). CHEM.A.2.2.2

3 Explain the relationship between the electron configuration and the atomic structure of a given atom or ion (e.g., energy levels and/or orbitals with electrons, distribution of electrons in orbitals, shapes of orbitals). CHEM.A.2.2.3

4 Relate the existence of quantized energy levels to atomic emission spectra. CHEM.A.2.2.4

3 **Explain how periodic trends in the properties of atoms allow for the prediction of physical and chemical properties.** CHEM.A.2.3

1 Explain how the periodicity of chemical properties led to the arrangement of elements on the periodic table.

2 Compare and/or predict the properties (e.g., electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations on the periodic table and known trends.

The Mole and Chemical Bonding CHEM.B.1

1 **Explain how the mole is a fundamental unit of chemistry.** CHEM.B.1.1

1 Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).

2 **Apply the mole concept to the composition of matter.** CHEM.B.1.2

1 Determine the empirical and molecular formulas of compounds CHEM.B.1.2.1

2 Apply the law of definite proportions to the classification of elements and compounds as pure substances. CHEM.B.1.2.2

3 Relate the percent composition and mass of each element present in a compound. CHEM.B.1.2.3

3 **Explain how atoms form chemical bonds.** CHEM.B.1.3

1 Explain how atoms combine to form compounds through ionic and covalent bonding CHEM.B.1.3.1

2 Classify a bond as being polar covalent, non-polar covalent, or ionic CHEM.B.1.3.2

3 Use illustrations to predict the polarity of a molecule. CHEM.B.1.3.3

4 **Explain how models can be used to represent bonding.** CHEM.B.1.4

1. Recognize and describe different types of models that can be used to illustrate the bonds that hold atoms together in a compound (e.g., computer models, ball-and-stick models, graphical models, solid-sphere models, structural formulas, skeletal formulas, Lewis dot structures). CHEM.B.1.4.1
2. Utilize Lewis dot structures to predict the structure and bonding in simple compounds. CHEM.B.1.4.2

Chemical Relationships and Reactions CHEM.B.2

1 **Predict what happens during a chemical reaction.** CHEM.B.2.1

1. Describe the roles of limiting and excess reactants in chemical reactions. CHEM.B.2.1.1
2. Use stoichiometric relationships to calculate the amounts of reactants and products involved in a chemical reaction. CHEM.B.2.1.2
3. 3 Classify reactions as synthesis, decomposition, single replacement, double replacement, or combustion. CHEM.B.2.1.3
4. Predict products of simple chemical reactions (e.g., synthesis, decomposition, single replacement, double replacement, combustion). CHEM.B.2.1.4
5. Balance chemical equations by applying the Law of Conservation of Matter. CHEM.B.2.1.5

2 **Explain how the kinetic molecular theory relates to the behavior of gases.** CHEM.B.2.2

1. Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e., Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law). CHEM.B.2.2.1
2. Predict the amounts of reactants and products involved in a chemical reaction using molar volume of a gas at STP. CHEM.B.2.2.2