Unit 8 AP test Prep Practice - Simulation Training

Content Area: **Science**
Course(s): **AP Chemistry**
Time Period: **April**
Length: **6 weeks**
Status: **Published**

Transfer Skills

Simulation Training: AP test Prep Practice

During this time, students will be given three full practice AP exams in testing like conditions and scored similar to the AP Exam. Students will also be provided a test prep manual with the previous 10 years of exams broken up by topic. Students will have vast exposure to the types of problems presented on the AP Chemistry Exam.

Enduring Understandings

How you prepare for a test is an important as the test itself.

Calculators are not necessary to complete all math based problems.

Essential Questions

Is guessing valid in testing situations?

How are mathematical functions performed without a calculator?

Content

Vocabulary Review:

Thermodynamics:

State function, disorder, entropy, enthalpy, Gibbs free energy

Equilibrium:

Dynamic equilibrium, ion product, reaction quotient, titration, equivalence point, indicators.

Skills

Solve mathematical problems without a calculator.

Determine and implement appropriate test taking strategies.

Resources

Standards

Big Idea 1: The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.
1.A.1 Learning Objective:
LO 1.1 The student can justify the observation that the ratio of the masses of the constituent elements in any pure sample of that compound is always identical on the basis of the atomic molecular theory. [See SP 6.1]

1.A.2 Learning Objectives:
LO 1.3 The student is able to select and apply mathematical relationships to mass data in order to justify a claim regarding the identity and/or estimated purity of a substance. [See SP 2.2, 6.1]

1.A.3 Learning Objective:
LO 1.4 The student is able to connect the number of particles, moles, mass, and volume of substances to one another, both qualitatively and quantitatively. [See SP 7.1]

1.B.1 Learning Objectives:
LO 1.5 The student is able to explain the distribution of electrons in an atom or ion based upon data. [See SP 1.5, 6.2]

1.B.2 Learning Objectives:
LO 1.8 The student is able to explain the distribution of electrons using Coulomb's Law to analyze measured energies. [See SP 6.2]

1.C.1 Learning Objectives:
LO 1.9 The student is able to predict and/or justify trends in atomic properties based on location on the periodic table and/or the shell model. [See SP 6.4]

LO 1.10 Students can justify with evidence the arrangement of the periodic table and can apply periodic properties to chemical reactivity. [See SP 6.1]

1.D.1 Learning Objective:
LO 1.13 Given information about a particular model of the atom, the student is able to determine if the model

is consistent with specified evidence. [See SP 5.3]

1.D.2 Learning Objective:
LO 1.14 The student is able to use data from mass spectrometry to identify the elements and the masses of individual atoms of a specific element. [See SP 1.4, 1.5]

1.D.3 Learning Objectives:
LO 1.15 The student can justify the selection of a particular type of spectroscopy to measure properties associated with vibrational or electronic motions of molecules. [See SP 4.1]

1.E.1 Learning Objective:
LO 1.17 The student is able to express the law of conservation of mass quantitatively and qualitatively using symbolic representations and particulate drawings. [See SP 1.5]

Big Idea 2: Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.
2.A Learning Objectives:
LO 2.2 The student is able to explain the relative strengths of acids and bases based on molecular structure, interparticle forces, and solution equilibrium. [See SP 7.2, connects to Big Idea 5, Big Idea 6] Note: These learning objectives apply to essential knowledge components of 2A–2D.

2.A.2 Learning Objectives:
LO 2.4 The student is able to use KMT and concepts of intermolecular forces to make predictions about the macroscopic properties of gases, including both ideal and nonideal behaviors. [See SP 1.4, 6.4]

LO 2.5 The student is able to refine multiple representations of a sample of matter in the gas phase to accurately represent the effect of changes in macroscopic properties on the sample. [See SP 1.3, 6.4, 7.2]

LO 2.6 The student can apply mathematical relationships or estimation to determine macroscopic variables for ideal gases. [See SP 2.2, 2.3]

2.A.3 Learning Objectives:
LO 2.8 The student can draw and/or interpret representations of solutions that show the interactions between the solute and solvent. [See SP 1.1, 1.2, 6.4]

LO 2.9 The student is able to create or interpret representations that link the concept of molarity with particle views of solutions. [See SP 1.1, 1.4]

2.B.1 Learning Objective:
LO 2.11 The student is able to explain the trends in properties and/or predict properties of samples consisting of particles with no permanent dipole on the basis of London dispersion forces. [See SP 6.2, 6.4]

2.B.2 Learning Objectives:
LO 2.12 The student can qualitatively analyze data regarding real gases to identify deviations from ideal behavior and relate these to molecular interactions. [See SP 5.1, 6.5, connects to 2.A.2]

LO 2.13 The student is able to describe the relationships between the structural features of polar molecules and the forces of attraction between the particles. [See SP 1.4]

LO 2.14 The student is able to apply Coulomb’s Law qualitatively (including using representations) to describe the interactions of ions, and the attractions between ions and solvents to explain the factors that contribute to the solubility of ionic compounds. [See SP 1.4, 6.4]

2.B.3 Learning Objectives:

LO 2.15 The student is able to explain observations regarding the solubility of ionic solids and molecules in water and other solvents on the basis of particle views that include intermolecular interactions and entropic effects. [See SP 1.4, 6.2, connects to 5.E.1]

LO 2.16 The student is able to explain the properties (phase, vapor pressure, viscosity, etc.) of small and large molecular compounds in terms of the strengths and types of intermolecular forces. [See SP 6.2]

2.C Learning Objective:
LO 2.17 The student can predict the type of bonding present between two atoms in a binary compound based on position in the periodic table and the electronegativity of the elements. [See SP 6.4]

2.C.1 Learning Objective:
LO 2.18 The student is able to rank and justify the ranking of bond polarity on the basis of the locations of the bonded atoms in the periodic table. [See SP 6.1]

2.C.3 Learning Objective:
LO 2.20 The student is able to explain how a bonding model involving delocalized electrons is consistent with macroscopic properties of metals (e.g., conductivity, malleability, ductility, and low volatility) and the shell model of the atom. [See SP 6.2, 7.1, connects to 2.D.2]

2.C.4 Learning Objective:
LO 2.21 The student is able to use Lewis diagrams and VSEPR to predict the geometry of molecules, identify hybridization, and make predictions about polarity. [See SP 1.4]

2.D.1 Learning Objectives:
LO 2.24 The student is able to explain a representation that connects properties of an ionic solid to its structural attributes and to the interactions present at the atomic level. [See SP 1.1, 6.2, 7.1]

2.D.2 Learning Objectives:
LO 2.25 The student is able to compare the properties of metal alloys with their constituent elements to determine if an alloy has formed, identify the type of alloy formed, and explain the differences in properties using particulate level reasoning. [See SP 1.4, 7.2]

LO 2.26 Students can use the electron sea model of metallic bonding to predict or make claims about the macroscopic properties of metals or alloys. [See SP 6.4, 7.1]

LO 2.28 The student is able to explain a representation that connects properties of a metallic solid to its structural attributes and to the interactions present at the atomic level. [See SP 1.1, 6.2, 7.1]

2.D.3 Learning Objectives:
LO 2.30 The student is able to explain a representation that connects properties of a covalent solid to its structural attributes and to the interactions present at the atomic level. [See SP 1.1, 6.2, 7.1]

2.D.4 Learning Objectives:
LO 2.31 The student can create a representation of a molecular solid that shows essential characteristics of the structure and interactions present in the substance. [See SP 1.1]

LO 2.32 The student is able to explain a representation that connects properties of a molecular solid to its structural attributes and to the interactions present at the atomic level. [See SP 1.1, 6.2, 7.1]

Big Idea 3: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.
3.A Learning Objective:

LO 3.1 Students can translate among macroscopic observations of change, chemical equations, and particle views. [See SP 1.5, 7.1]

3.A.1 Learning Objective:
LO 3.2 The student can translate an observed chemical change into a balanced chemical equation and justify the choice of equation type (molecular, ionic, or net ionic) in terms of utility for the given circumstances. [See SP 1.5, 7.1]

3.A.2 Learning Objectives:
LO 3.3 The student is able to use stoichiometric calculations to predict the results of performing a reaction in the laboratory and/or to analyze deviations from the expected results. [See SP 2.2, 5.1]

3.B.2 Learning Objective:
LO 3.7 The student is able to identify compounds as Brønsted-Lowry acids, bases, and/or conjugate acid-base pairs, using proton-transfer reactions to justify the identification. [See SP 6.1]

3.B.3 Learning Objectives:
LO 3.8 The student is able to identify redox reactions and justify the identification in terms of electron transfer. [See SP 6.1]

3.C.3 Learning Objectives:
LO 3.12 The student can make qualitative or quantitative predictions about galvanic or electrolytic reactions based on half-cell reactions and potentials and/ or Faraday's laws. [See SP 2.2, 2.3, 6.4]

LO 3.13 The student can analyze data regarding galvanic or electrolytic cells to identify properties of the underlying redox reactions. [See SP 5.1]

Big Idea 4: Rates of chemical reactions are determined by details of the molecular collisions.
4.A.1 Learning Objective:
LO 4.1 The student is able to design and/or interpret the results of an experiment regarding the factors (i.e., temperature, concentration, surface area) that may influence the rate of a reaction. [See SP 4.2, 5.1]

4.A.2 Learning Objective:
LO 4.2 The student is able to analyze concentration vs. time data to determine the rate law for a zeroth-, first-, or second-order reaction. [See SP 5.1, connects to 4.A.3]

4.A.3 Learning Objective:
LO 4.3 The student is able to connect the half-life of a reaction to the rate constant of a first-order reaction and justify the use of this relation in terms of the reaction being a first-order reaction. [See SP 2.1, 2.2]

4.B.1 Learning Objective:
LO 4.4 The student is able to connect the rate law for an elementary reaction to the frequency and success of molecular collisions, including connecting the frequency and success to the order and rate constant, respectively. [See SP 7.1, connects to 4.A.3, 4.B.2]

4.B.2 Learning Objective:
LO 4.5 The student is able to explain the difference between collisions that convert reactants to products and those that do not in terms of energy distributions and molecular orientation. [See SP 6.2]

4.B.3 Learning Objective:
LO 4.6 The student is able to use representations of the energy profile for an elementary reaction (from the reactants, through the transition state, to the products) to make qualitative predictions regarding the relative

temperature dependence of the reaction rate. [See SP 1.4, 6.4]

4.C Learning Objective:
LO 4.7 The student is able to evaluate alternative explanations, as expressed by reaction mechanisms, to determine which are consistent with data regarding the overall rate of a reaction, and data that can be used to infer the presence of a reaction intermediate. [See SP 6.5, connects to 4.C.1, 4.C.2, 4.C.3]

4.D.1 Learning Objective:
LO 4.8 The student can translate among reaction energy profile representations, particulate representations, and symbolic representations (chemical equations) of a chemical reaction occurring in the presence and absence of a catalyst. [See SP 1.5]

4.D.2 Learning Objective:
LO 4.9 The student is able to explain changes in reaction rates arising from the use of acid-base catalysts, surface catalysts, or enzyme catalysts, including selecting appropriate mechanisms with or without the catalyst present. [See SP 6.2, 7.2]

Big Idea 5: The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in matter.
5.A Learning Objective:
LO 5.1 The student is able to create or use graphical representations in order to connect the dependence of potential energy to the distance between atoms and factors, such as bond order (for covalent interactions) and polarity (for intermolecular interactions), which influence the interaction strength. [See SP 1.1, 1.4, 7.2, connects to Big Idea 2] Note: This learning objective applies to essential knowledge components of 5A–5E.

5.A.2 Learning Objective:
LO 5.3 The student can generate explanations or make predictions about the transfer of thermal energy between systems based on this transfer being due to a kinetic energy transfer between systems arising from molecular collisions. [See SP 7.1]

5.D.2 Learning Objective:
LO 5.10 The student can support the claim about whether a process is a chemical or physical change (or may be classified as both) based on whether the process involves changes in intramolecular versus intermolecular interactions. [See SP 5.1]

5.E.1 Learning Objective:
LO 5.12 The student is able to use representations and models to predict the sign and relative magnitude of the entropy change associated with chemical or physical processes. [See SP 1.4]

5.E.2 Learning Objective:
LO 5.13 The student is able to predict whether or not a physical or chemical process is thermodynamically favored by determination of (either quantitatively or qualitatively) the signs of both ΔH° and ΔS°, and calculation or estimation of ΔG° when needed. [See SP 2.2, 2.3, 6.4, connects to 5.E.3]

5.E.3 Learning Objective:
LO 5.14 The student is able to determine whether a chemical or physical process is thermodynamically favorable by calculating the change in standard Gibbs free energy. [See SP 2.2, connects to 5.E.2]

5.E.4 Learning Objectives:
LO 5.16 The student can use LeChatelier's principle to make qualitative predictions for systems in which coupled reactions that share a common intermediate drive formation of a product. [See SP 6.4, connects to 6.B.1]

5.E.5 Learning Objective:
LO 5.18 The student can explain why a thermodynamically favored chemical reaction may not produce large amounts of product (based on consideration of both initial conditions and kinetic effects), or why a thermodynamically unfavored chemical reaction can produce large amounts of product for certain sets of initial conditions. [See SP 1.3, 7.2, connects to 6.D.1]

Big Idea 6: Any bond or intermolecular attraction that can be formed can be broken. These two processes are in a dynamic competition, sensitive to initial conditions and external perturbations.
6.A.1 Learning Objective:
LO 6.1 The student is able to, given a set of experimental observations regarding physical, chemical, biological, or environmental processes that are reversible, construct an explanation that connects the observations to the reversibility of the underlying chemical reactions or processes. [See SP 6.2]

6.A.2 Learning Objective:
LO 6.2 The student can, given a manipulation of a chemical reaction or set of reactions (e.g., reversal of reaction or addition of two reactions), determine the effects of that manipulation on Q or K. [See SP 2.2]

6.A.3 Learning Objectives:
LO 6.6 The student can, given a set of initial conditions (concentrations or partial pressures) and the equilibrium constant, K, use stoichiometric relationships and the law of mass action (Q equals K at equilibrium) to determine qualitatively and/or quantitatively the conditions at equilibrium for a system involving a single reversible reaction. [See SP 2.2, 6.4]

6.A.4 Learning Objective:
LO 6.7 The student is able, for a reversible reaction that has a large or small K, to determine which chemical species will have very large versus very small concentrations at equilibrium. [See SP 2.2, 2.3]

6.B.1 Learning Objectives:
LO 6.8 The student is able to use LeChatelier's principle to predict the direction of the shift resulting from various possible stresses on a system at chemical equilibrium. [See SP 1.4, 6.4]

6.B.2 Learning Objective:
LO 6.10 The student is able to connect LeChatelier's principle to the comparison of Q to K by explaining the effects of the stress on Q and K. [See SP 1.4, 7.2]

6.C.1 Learning Objectives:
LO 6.14 The student can, based on the dependence of Kw on temperature, reason that neutrality requires [H+] = [OH–] as opposed to requiring pH = 7, including especially the applications to biological systems. [See SP 2.2, 6.2]

LO 6.15 The student can identify a given solution as containing a mixture of strong acids and/or bases and calculate or estimate the pH (and concentrations of all chemical species) in the resulting solution. [See SP 2.2, 2.3, 6.4]

LO 6.16 The student can identify a given solution as being the solution of a monoprotic weak acid or base (including salts in which one ion is a weak acid or base), calculate the pH and concentration of all species in the solution, and/ or infer the relative strengths of the weak acids or bases from given equilibrium concentrations. [See SP 2.2, 6.4]

6.C.2 Learning Objectives:
LO 6.19 The student can relate the predominant form of a chemical species involving a labile proton (i.e., protonated/deprotonated form of a weak acid) to the pH of a solution and the pKa associated with the labile

proton. [See SP 2.3, 5.1, 6.4]

LO 6.20 The student can identify a solution as being a buffer solution and explain the buffer mechanism in terms of the reactions that would occur on addition of acid or base. [See SP 6.4]

6.C.3 Learning Objectives:
LO 6.21 The student can predict the solubility of a salt, or rank the solubility of salts, given the relevant Ksp values. [See SP 2.2, 2.3, 6.4]

LO 6.23 The student can interpret data regarding the relative solubility of salts in terms of factors (common ions, pH) that influence the solubility. [See SP 5.1]

6.D.1 Learning Objective:
LO 6.25 The student is able to express the equilibrium constant in terms of ΔG° and RT and use this relationship to estimate the magnitude of K and, consequently, the thermodynamic favorability of the process. [See SP 2.3]