Unit 05: Solutions and Reactions in Aqueous Solutions

Content Area: **Science**
Course(s):
Time Period: **Marking Period 4**
Length: **5-6 Weeks**
Status: **Published**

Brief Summary of Unit

In this unit, several physical aspects of solutions including types of solutions and methods of expressing solution concentrations as well as reactions that occur in aqueous solutions will be examined. Measuring the amount of carbon dioxide and other greenhouse gases in units of ppm will be calculated and its negative effect on the climate will be discussed. Factors affecting solubility as well as the effect of solutes on such solvent properties as vapor pressure, freezing point, and boiling point will also be considered. The students will learn how to write balanced precipitation reactions, acid-base reactions, and redox reactions. The concept of molarity will be presented and solution stoichiometry problems will be solved.

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Standards

SCI.HS-PS1-1	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 of atoms.
LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
SCI.HS.PS2.B	Types of Interactions
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
LA.K-12.NJSLSA.R8	Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
SCI.HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
LA.K-12.NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
SCI.HS.PS1.A	Structure and Properties of Matter
LA.K-12.NJSLSA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.K-12.NJSLSA.W6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

Essential Questions/Enduring Understandings

Essential Questions

What are the various types and characteristics of different chemical solutions and reactions?

Enduring Understandings

Solutions can be analyzed qualitatively and quantitively due to their unique characteristics.

Aqueous reactions can be categorized as precipitation, reduction-oxidation, or acid-base reaction.

Students Will Know/Students Will be Skilled At

Students will be skilled at preparing solutions.

Students will know how a solution is formed on a molecular level.

Students will know the difference between unsaturated, saturated, and supersaturated solutions.

Students will be skilled at analyzing the quantitative aspects of a solubility curve.

Students will know how to determine whether 2 substances are miscible.

Students will know which factors affect the solubility of a solid in a liquid vs a gas in a liquid.

Students will be skilled at calculating and converting between the different concentration units.

Students will be skilled at solving solution stoichiometry problems using molarity.

Students will know how electrolytes vs nonelectrolytes affect a colligative property.

Students will be skilled at calculating the freezing point and boiling point of a solution.

Students will know the difference between an electrolyte and a nonelectrolyte in terms of percent ionization and conductivity.

Students will know how aqueous reactions are determined.

Students will know how to apply the solubility rules.

Students will be skilled at writing net ionic equations for aqueous reactions.

Students will be skilled at assigning oxidation numbers to determine which species is reduced and which species is oxidized.

Students will be skilled at balancing a redox reaction.

Students will know the properties of acids and bases.

Students will be skilled at identifying conjugate acid-base pairs.

Students will know water ionizes itself and how to use this relationship to determine the concentration of the hydronium and hydroxide ions.

Students will be skilled at calculating the pH and pOH of a strong acid and strong base.

Students will know how to properly perform a titration to determine the concentration of an unknown solution.

Learning Plan

Preview the essential questions and connect to learning throughout the unit.

Discuss the components of a solution and give a visual representation of a solution formation on a molecular level.

Model how to properly make a solution.

Units of concentration will be modeled. Parts per million and parts per billion (ppm, ppb) will be utilized to address the quantitative impacts of carbon dioxide and other greenhouse gases in the atmosphere on climate change.

Discuss how to determine whether 2 substances will be miscible.

Differentiate between electrolytes and nonelectrolytes and their qualitative affect on colligative properties.

Model how to calculated the freezing point and boiling point of a solutions.

Differentiate between a strong, weak, and nonelectrolyte.

Introduce the solubility rules and utilize them in determine whether a precipitate will form.

Model how to write a net ionic equation.

Model how to assign oxidation number to determine which species is being oxidized/reduced.

Model how to solve stoichiometry problems using molarity.

Introduce properties of acids and bases.

Discuss the different definitions of acids and bases as well as how to identify conjugate acid/base pairs.

Introduce the pH scale and how to use the quantitative relationships between pH, pOH, and the autoionization of water.

Labs/Activities:

The following PhET simulations can be utilized: solutions, concentration, pH scale, acids and bases

Preparing solutions

Chromatography Lab

Solubility Curves Lab

Colligative Properties Lab

Precipitation Reactions Lab

Acid-Base Titration Lab

Redox Titration Lab

Evidence/Performance Tasks

Formative

Applying proper lab techniques for making solutions

Identification of unknown from its solubility curve.

Identifying which solute is best to melt ice on roads.

Self Assessment problems during class.

Completed problems in CHEMFILE: MINI GUIDE TO PROBLEM-SOLVING HOLT 1999

Assigned homework problems in CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013

Summative

Unit Quizzes and Tests

Benchmark

Final Exam

Alternative

Lab Report for Solubility Curves, Precipitations Reactions Lab, or Titration Labs

Business proposal on which de-icing chemical is best (Colligative properties lab)

Materials

CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013

CHEMFILE: MINI GUIDE TO PROBLEM SOLVING HOLT 1999

Approved Textbook Link

In addition to general lab and safety equipment as noted in lab handouts:

potassium nitrate

potassium chloride

sodium chloride

sodium carbonate

sodium sulfate

copper(II) sulfate

Zn metal

copper (II) nitrate

calcium chloride

potassium hydroxide

silver nitrate

cobalt (II) chloride

hydrochloric acid

sodium hydroxide

Suggestions Strategies for Modifications

FOR SPECIAL EDUCATION STUDENTS , ELL, AT RISK AND STUDENTS GIFTED STUDENTS

https://docs.google.com/spreadsheets/d/1pQwsQoD_QLot65BTdHFEHN5dXIiqS54iQ5iDL8C4q6o/edit?usp=sharing