Marietta City Schools

District Unit Planner

Everything on the unit planner must be included on the unit curriculum approval statement.

Accelerated Physical Science

Unit title	*Solutions, Acids, and Bases*	**MYP year**	*3*	**Unit duration (hrs)**	*17.5 Hours*

Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): ***What will students learn?***

GSE Standards

Standards

SPS6. Obtain, evaluate, and communicate information to explain the properties of solutions.

a. Develop and use models to explain the properties (solute/solvent, conductivity, and concentration) of solutions.
b. Plan and carry out investigations to determine how temperature, surface area, and agitation affect the rate solutes dissolve in a specific solvent.
c. Analyze and interpret data from a solubility curve to determine the effect of temperature on solubility.
d. Obtain and communicate information to explain the relationship between the structure and properties (e.g., pH, and color change in the presence of an indicator) of acids and bases.
e. Plan and carry out investigations to detect patterns in order to classify common household substances as acidic, basic, or neutral.

Gifted Standards

- **MCS.Gifted.S1C.** Gather, organize, analyze, evaluate, and synthesize data from multiple sources for research applications.
- **MCS.Gifted.S2B.** Develop and apply the cognitive components of creative thinking: fluency, flexibility, originality, and elaboration.
- **MCS.Gifted.S2D.** Apply components of creative thinking in finding, solving, and evaluating solutions to authentic real-world problems and dilemmas.
- **MCS.Gifted.**S5E Advocate for self.

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)

Students typically come to AC Physical Science with a basic conceptual understanding of a solution as a mixture, and are familiar with examples of solutions. Students will have typically addressed the conductivity of a solution during Unit 3: Principles of Atomic Bonding, during which they are expected to investigate the properties of ionic vs. covalent compounds in terms of their conductivity. The construction and interpretation of solubility curves is a new concept for students in this unit.

Students typically have heard the terms “acid” and “base,” but do not have a scientific understanding of what these terms mean. Students typically have not had the opportunity to use various indicators to test the pH of substances.

In fifth grade, students investigate the following:

S5P1. Obtain, evaluate, and communicate information to explain the differences between a physical change and a chemical change.

a. Plan and carry out investigations of physical changes by manipulating, separating, and mixing dry and liquid materials.

These students have not been exposed to the 8th Science GSE that lay the foundation for the high school Physical Science standards.

Concepts/Skills to be Mastered by Students

- Solutions
- Acids & Bases

Key Vocabulary: (KNOWLEDGE & SKILLS)
Solution, properties, solute, solvent, conductivity, concentration, surface area, agitation, dissolve, solubility, solubility curve, unsaturated, saturated, super saturated, acid/acidic, base/basic, pH, pH scale, neutral, hydrogen ions (H+), hydronium ions (H_3O+), hydroxide ions (OH-), indicator

Year-Long Anchoring Phenomena: (LEARNING PROCESS)
How does matter and energy interact within the universe?

Unit Phenomena (LEARNING PROCESS)
How can we use our understanding of solutions, acids, bases, and pH level to help pH be used to determine whether a wound is healing properly?

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)

- Students may have difficulty distinguishing between and correctly applying the terms solute and solvent.
- Students may have difficulty articulating how surface area impacts the solubility of a solute.
- Students may have difficulty interpreting solubility curves, including pinpointing when solutions will be unsaturated, saturated, and supersaturated as a function of temperature.
- Students may confuse acids and bases with one another, as well as the ranges in which they fall on the pH scale.

Key concept	Related concept(s)	Global context
Relationships Relationships are the connections and associations between properties, objects, people and ideas— including the human community's connections with the world in which we live. Any change in relationship brings consequences—some of which may occur on a small scale, while others may be far-reaching, affecting large networks and systems such as human societies and the planetary ecosystem.	Interactions (MYP)	**Scientific and Technical Innovation** Students will explore the natural world and its laws; the interaction between people and the natural world; how humans use their understanding of scientific principles; the impact of scientific and technological advances on communities and environments; the impact of environments on human activity; how humans adapt environments to their needs.

Statement of inquiry

Scientific and technical innovations use the relationships and interactions between substances to create new solutions and products with specific properties.

Inquiry questions		
Factual What are the properties of solutions? How do I distinguish between a solute and a solvent? What information can I obtain from a solubility curve? What are the properties of acids and bases? **Conceptual** How can I model properties of solutions, such as conductivity and concentration? How do temperature, surface area, and agitation affect the rate solutes dissolve in a solvent? How can I use a solubility curve to determine the amount of solute that will dissolve in a given amount of solvent at a particular temperature? How can I determine whether a substance is an acid or a base? How do acids and bases interact with one another? **Debatable** What is the best method for determining the pH of a solution? Why?		
MYP Objectives	**Assessment Tasks**	
*What specific MYP **objectives** will be addressed during this unit?*	***Relationship** between summative assessment task(s) and statement of inquiry:*	*List of common formative and summative assessments.*
Science: Criterion A: Knowing and Understanding I. describe scientific knowledge Iii. analyze information to make scientifically supported judgments Science: Criterion B: Inquiring and Designing	SOI: Scientific and technical innovations use the relationships and interactions between substances to create new solutions and products with specific properties. The inquiry statement focuses on the ability to visualize, model, and explain interactions between various substances and how those interactions can result in new solutions with desired properties that are observable and testable. Students are required to demonstrate their understanding of SPS6, which includes the principles of solutions, acids, and bases, through the completion of a multiple-choice standards-aligned unit assessment that mimics the GA Milestones. Students will be required to analyze data in order to identify characteristics of solutions and classify substances as acidic, basic, or neutral.	**Formative Assessment(s):** Solutions CFA **Summative Assessment(s):** Solutions, Acids, and Base Unit Assessment Paper I and Paper II (Science A,D)

Iii. describe how to manipulate the variables, and describe how data will be collected Iv. design scientific investigations Science: Criterion C: Processing and Evaluating I. present collected and transformed data Ii. interpret data and describe results using scientific reasoning Science: Criterion D: Reflecting on the Impacts of Science I. describe the ways in which science is applied and used to address a specific problem or issue Iii. apply scientific language effectively	On Assessment Paper II, students will be tasked with using their knowledge of solutions, acids, and bases to make a claim that answers the question: Is an understanding of solutions and pH helpful to those in the fields of cosmetics and medicine? Students will use what they have learned through simulations and laboratory investigations to provide evidence to support their claim, and conclude with reasoning that ties real-world applications of the uses of solutions, acids, and bases to a disciplinary core idea they have learned. Students are tasked with planning and carrying out their own experiment to see how solubility rate can be impacted by factors such as surface area, temperature, and agitation rate. Students use their findings to determine the scenario under which dissolving is most likely to occur at the fastest rate for a particular solution. Students are also tasked with investigating the pH of multiple substances using various indicators to determine the pH and classify substances as acids or bases, based upon their data. They also look for patterns in how different indicator solutions respond when they are in the presence of an acid or a base. Students also investigate the importance of acid-base chemistry and how pH is essential to the production of various goods. During their investigation, students are tasked with using various indicators to test common household substances and determine patterns amongst how acids and bases are used in everyday life and where they might be located throughout a household.	
Approaches to learning (ATL)		
Category: Critical Thinking **Cluster:** Critical Thinking Skills **Skill Indicator:** Identify trends and forecast possibilities.		

Learning Experiences Add additional rows below as needed.		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
SPS6. Obtain, evaluate, and communicate information to explain the properties of solutions. a. Develop and use models to explain the properties (solute/solvent, conductivity, and concentration) of solutions.	PhET: Salt & Sugar Solutions	• Discovery Education High School Chemistry Science Techbook • NGSS Case Studies for Differentiated Learners • Next Generation Science Standards: "All Standards, All Students" • Extensions – Enrichment Tasks/Projects All information included by PLC in the differentiation box is the responsibility and ownership of the local school to review and approve per Board Policy IKB. Task-Specific Differentiation • Modeling • Small Group • Multiple Means of Engagement • Multiple Means of Content Representation (laboratories, SIM, NearPod, DE Techbook) • Multiple Means of Action and Expression
SPS6. Obtain, evaluate, and communicate information to explain the properties of solutions. b. Plan and carry out investigations to determine how temperature, surface area, and agitation affect the rate solutes dissolve in a specific solvent.	Factors that Affect Solubility Lab (Science: B, C)	
SPS6. Obtain, evaluate, and communicate information to explain the properties of solutions. c. Analyze and interpret data from a solubility curve to determine the effect of temperature on solubility.	Analyzing and Interpreting Solubility Curves Practice Problems	
SPS6. Obtain, evaluate, and communicate information to explain the properties of solutions. d. Obtain and communicate information to explain the relationship between the structure and properties (e.g., pH, and color change in the presence of an indicator) of acids and bases.	Identifying Acids & Bases Lab (Science: B,C) PhET: pH Scale Basics	

SPS6. Obtain, evaluate, and communicate information to explain the properties of solutions. e. Plan and carry out investigations to detect patterns in order to classify common household substances as acidic, basic, or neutral.	Exploring Acids & Bases at Home PhET: pH Scale Basics	

Content Resources

Discovery Education High School Chemistry Science Techbook

Unit 7: Solution Chemistry

- Concept 7.1: Acids, Bases, and Salts
- Concept 7.2: Solutions

PhET: Acid-Base Solutions

PhET: pH Scale Basics

PhET: Salt and Sugar Solutions

Holt Science Spectrum Textbook

GaDOE Instructional Segment: What's Inside Our Drinks

GaDOE Instructional Segment: Acids and Bases in Everyday Life