International Baccalaureate
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3D Science Unit Planner

Marietta City Schools

MARIETTA CITY SCHOOLS

Grade & Course: Physical Science	**Topic:** Atomic and Molecular Motion	**Duration:** S1 5 weeks
Teachers: Physical Science PLC		

Georgia Standards and Content:

SPS5. Obtain, evaluate, and communicate information to compare and contrast the phases of matter as they relate to atomic and molecular motion.

a. Ask questions to compare and contrast models depicting the particle arrangement and motion in solids, liquids, gases, and plasmas.

b. Plan and carry out investigations to identify the relationships among temperature, pressure, volume, and density of gases in closed systems. (*Clarification statement:* Using specific Gas laws to perform calculations is beyond the scope of this standard; emphasis should focus on the conceptual understanding of the behavior of gases rather than calculations.)

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. (*Clarification statement:* Limited to only the structure of simple acids and bases (e.g., HCl and NaOH) that demonstrates the presence of an H+ or OH-.)

e. Plan and carry out investigations to detect patterns in order to classify common household substances as acidic, basic, or neutral.

Topics to Cover: Phases of Matter, Behavior of Gases, Properties of Solutions and Acids/Bases

Unit 3 Study Guide

Lesson Content:

1. Phases of matter: Solid, Liquids, Gases, & Plasmas - Melting, Boiling, Evaporation, Sublimation, Condensation
2. Behaviors of Gases (density/compressible/pressure/volume/temperature/atmospheres)
3. Properties of Solutions (solute/solvent, concentration/unsaturated/saturated/conductivity/solubility curves/dissolving rate-temperature/surface area/agitation)
4. Acids and Bases - pH Scale, simple structure

Narrative / Background Information

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

Units 1 & 2 Atomic Structure and Nuclear Reactions and Periodic Table, Chemical Bonding and Chemical Reactions provided the foundation for completion of this unit. The pandemic impacted the exposure of rising 9th graders to the science classroom. Many rising 9th graders have not been exposed to the 8th Science GSE that provides the foundation for the high school Physical Science standards. Link to GSE 8th Grade Science

Unit Phenomena (LEARNING PROCESS): How can you explain the implosion of the tanker using gas laws?

Inquiry Statement: Scientific and technological modeling allow for identification of patterns which impact relationships.

Global Context/Exploration: Scientific and Technical Innovation/Systems & Models

Science & Engineering Practices:	**Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)**	**Crosscutting Concepts: (KNOWLEDGE & SKILLS)**
Asking Questions **Modeling**	**PS1: Matter and Its Interactions** **PS1.A: Structure and Properties of Matter** Matter of any type can be subdivided into	Change & Systems Interactions & Energy

Planning & Carrying out Investigations, Analyzing & Interpreting Data **Obtaining & Communicating Information**	particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1) The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2) Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3) **PS1.B: Chemical Reactions** When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4) No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)	**Key and Related Concepts:** Key: Relationships Related: Patterns & Models **Approaches to Learning (ATLs):** **Communication** I. Communication skills: Exchanging thoughts, messages and information effectively through interaction ● Organize and depict information logically ● Make inferences and draw conclusions **Research** VI. Information literacy skills: Finding, interpreting, judging and creating information ● Collect, record, and verify data ● Practice analyzing and attributing causes for failure ATL's need to be taught explicitly using a noncontent example then move into using them directly with content. ● Use thinking maps to show students how to organize information thinking-maps-overview-71525044.jpeg ● Provide students with an example of how to make inferences and draw conclusions Making Inferences & Drawing Conclusions ● Demonstrate how to collect, record and verify data from a very practical easy investigation ● Give students a data set to analyze and then take the steps to determine strengths and weaknesses of the investigation used to collect the data

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

- If a solid or liquid is heated, the particles get bigger. This is not the case. At higher temperatures, they move about more and take up more space, but they do not get bigger.
- Students tend to overestimate the space between the particles in liquids. They regard a liquid as half-way between a solid and a gas. This is not the case. The particles in a liquid are close together, although they are free to move and change place.
- Students often confuse 'melting' and 'dissolving'. Some children think that when a solid melts, the particles 'pop' or simply disappear.
- Students find it difficult to understand that most gas is empty space.
- Many of these students have not been exposed to the 8th Science GSE that provides the foundation for the high school

Physical Science standards.

The most common misconceptions that students have with acids and bases are:

- *Acids can burn and eat material away.* Students think of acids as active agents that damage skin and other materials. The idea develops in young children, who learn to think of acids as "dangerous". Acids are not perceived as being particulate, but rather continuous matter with special properties.
- *Neutralization means an acid breaking down.* Rather than considering neutralization as a reaction between an acid and an base, students perceive this as removing acid properties. The base may stop the action of an acid, or alternatively the acid may break down.
- *A base/alkali inhibits the burning properties of an acid.* Students tend to be exposed to acids in formal education well before bases, so ideas about these chemicals are relatively under-developed. Although dilute bases are in fact more corrosive than dilute acids, students' perceptions are that they have no corrosive properties, instead acting to or inhibit acids "eating away" other material.
- *Hydrogen ions are present in acids, but acids remain molecular in solution.* That hydrogen ions are responsible for acidic behavior is relatively well-known amongst students. However, a common model for acid behavior seems to be that hydrogen ions remain in a molecule and "swap partners" or are "displaced" from this molecule by reaction with a base or metal.

Content/Key Vocabulary: (KNOWLEDGE & SKILLS)
Split the unit into Part 1: Lessons 1 & 2 and Part 2: Lessons 3 & 4
Vocabulary Unit 3

Lesson 1: Phases of Matter	**Lesson 2: Behaviors of Gases**	**Lesson 3: Properties of Solutions**	**Lesson 4: Acids and Bases**
intensive property extensive property phase state of matter solid liquid gas attractive force intermolecular force constant motion random motion definite volume indefinite volume melting freezing condensation sublimation evaporation (vaporization) kinetic energy temperature Kelvin absolute zero	pressure atmosphere (atm) compressible temperature endothermic exothermic relationship between pressure and volume of gases (graphing) relationship between volume and temperature of gases (graphing relationship between pressure and temperature (graphing) hypothesis variable independent variable dependent variable controlled variable	solution solute (electrolyte) solvent dissolving concentration saturated solution unsaturated solution electrical conductivity solubility solubility curve (graphing)	acid base indicator pH scale neutralization reaction strong and weak acids and bases properties of acids and bases (identify household acids and bases based on properties)

These questions are related directly to the key concepts, related concepts, and global context and statement of inquiry. These are taking a step further from the content questions.
Inquiry Questions:

Factual -
How do solids, liquids, gases, and plasmas differ in their particle arrangement and motion?
What is the relationship between temperature, surface area, and agitation and the rate solutes dissolve in a specific solvent?

Identify patterns in order to classify common household substances as acidic, basic, or neutral.

Conceptual –
Compare and contrast models depicting the particle arrangement and motion in solids, liquids, gases, and plasmas.
Develop a model to explain the properties of solutions.

Debatable -
Although the three most common states of matter are solid, liquid, and gas, not all substances seem to fit perfectly into one of these groups. Can you decide whether shaving cream should be called a solid, liquid, gas, or something in between? Use CER (Claim Evidence Reasoning) to support your argument.

MYP A (Part 1) state-debate shaving cream.pdf **and MYP A (Part 2)** MYP A Acids and Bases Short Answer **MYP B and C (TBD)** **More explicit summary of assessments and how they are used**	**Formative Assessments:** **CFA 1 SPS5a Lesson 1 States of Matter**	**Summative assessment** **CSA Lessons 1-4** **Relationship between summative assessment task(s) and statement of inquiry:** **CFA1 - Use of models to identify states of matter based on patterns in particle arrangement and motion**

Unit Objectives: SPS5 States of Matter and Behavior of Gases and SPS6 Solutions and Acids/Bases

Learning Activities and Experiences	Inquiry & Obtain: (LEARNING PROCESS)	Evaluate: (LEARNING PROCESS)	Communicate: (LEARNING PROCESS)

Lesson 1: States/Phases of Matter	Introductory Guided Reading States of Matter Textbook Resource States of Matter Video - Liquid Sand States of Matter and Thermal Energy Text Investigation Matter and Thermal Energy Investigation **PhET Simulation** Copy of Intro to states of matter **Google Slides/Guided Notes** Intro to States of Matter States of Matter Guided Notes States of Matter Venn Diagram	State Debate: Shaving Cream https://drive.google.com/file/d/1rMrPTUBSZpaJHrGbN8Di0fQ3bFrn3uoh/view?usp=sharing CER Evaluation -Summative Phases of Matter Project - Summative Phase-Changes-Project-Choice-Board CFA 1 Unit 3 Lesson 1 States of Matter (Schoology AMP assessment) Gas Laws Practice	States of Matter Concept Map Activities (Engage, Explore, Explain) Concept Map Activities Oobleck Lab Students will maintain notebooks with all classwork, homework, and activities
CFA1 States of Matter	Schoology AMP Assessment on States of matter and changes of state		
Lesson 2: Behaviors of Gases	Gas Laws Notes gas_laws_google slides Gas Laws Guided Notes gas_laws_guided_notes Crash Course Video: Crash Course Video Ideal Gas Law Simulation: Gas Properties PhET Simulation Student Handout: Gas Laws student sheet		Behaviors of Gases Cut and Paste Notes Gases Laws - Concepts only Trends Pressure/Volume/Temperature GasLawsCutandPasteNotes.pdf Vapor+Pressure+Curve+Lab

Lesson 3: Solutions	Solutions Google Slides Guided Notes Solutions_guided_notes Textbook Resource Solutions (1).pdf		
Lesson 4: Acids & Bases	The-pH-Scale (1).pdf Acids_and_Bases acid_base_guided_notes	Acids and Bases pH/CER Lab Household chemicals - knowns and unknowns	Acids and Bases Cut and Paste Activity acids-and-bases-cut-amp-paste-activity.jpg
CSA Unit 3	Unit 3 overall Summative assessment over lessons 1-4		

Differentiation Strategies:

- Student Choice
- Shared interest centers
- Immediate Feedback with opportunities to re-submit without penalty
- 3D Assessments / Tiered Assessments
- Go Further Activities

Resources (hyperlink to model lessons and/or resources):
Resources are created and shared within the professional learning community (PLC) of all Physical Science Teachers. We collaborate on creating quality learning experiences for all students within the classroom environment.

Unit 3 Google Drive Resources:

Discovery Education: Chemistry Science Techbook

Holt Science Spectrum Physical Science Textbook

General DE Chapter Resources:
Interactive Periodic Table
Interactive Glossary
Engage & Explore Activities
Explorations
Virtual Labs
Skill Builders
Video Segments
CK12 High School Chemistry Flexbook/Adaptive Practice
Shared Physical Science Resources
https://marietta.schoology.com/group/4621413779/materials?f=231800526#/group/4621413779/materials

Reflection: Considering the planning, process and impact of the inquiry

Prior to teaching the unit	During teaching	After teaching the unit
Determine pacing at the PLC level - discuss where CFA/CSA assessments will be given Determine vocabulary and topics to teach and focus on for each lesson	Gas Law simulations were beneficial (phets) for understanding and the demonstrations were useful for engagement. Used physics classroom for gas laws with data - students were able to see the relationships between P, T, V and could earn achievement badges to stay engaged.	Turn demonstrations into stations to allow students to explore. Chemicals need to be restocked for labs ● pH Lab (hydrion pH strips) ● Gas Law demos ● reaction rate lab Use distilled water for pH lab