Marietta City Schools

District Unit Planner

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

Honors Science 8

Unit title	*States of Matter, Phase Changes, and Thermal Energy*	**MYP year**	*4*	**Unit duration (hrs)**	*17.5 Hours*

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

GaDoE Standards

Standards

S8P1. Obtain, evaluate, and communicate information about the structure and properties of matter.
b. Develop and use models to describe the movement of particles in solids, liquids, gases, and plasma states when thermal energy is added or removed.
c. Plan and carry out investigations to compare and contrast chemical (i.e., reactivity, combustibility) and physical (i.e., density, melting point, boiling point) properties of matter.
d. Construct an argument based on observational evidence to support the claim that when a change in a substance occurs, it can be classified as either chemical or physical. (Clarification statement: Evidence could include ability to separate mixtures, development of a gas, formation of a precipitate, change in energy, color, and/or form.)

S8P2. Obtain, evaluate, and communicate information about the law of conservation of energy to develop arguments that energy can transform from one form to another within a system.
d. Plan and carry out investigations of the effects of heat transfer on molecular motion as it relates to the collision of atoms (conduction), through space (radiation), or in currents in a liquid or gas (convection).

Gifted Standards

- **MCS.Gifted.S1A.** Formulate thought-provoking questions to guide in depth research.
- **MCS.Gifted.S1B.** Devise and manage a research plan.
- **MCS.Gifted.S4A**. Develop skills and techniques associated with effective verbal and non-verbal communication, adjusting for a given audience or task.

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)
In fifth grade, students should have mastered the following:
S5P1. Obtain, evaluate, and communicate information to explain the differences between a physical change and a chemical change.
b. Construct an argument based on observations to support a claim that the physical changes in the state of water are due to temperature changes, which cause small particles that cannot be seen to move differently.

Concepts/Skills to be Mastered by Students

- Matter (structure, composition, properties)
- Thermal Energy
- States of Matter
- Chemical and Physical Properties and Changes

Key Vocabulary: (KNOWLEDGE & SKILLS)
molecule, atom, particle, state, solid, liquid, gas, plasma, physical property, melting point, boiling point, freezing point, physical change, thermal energy, metal, non-metal, conduction, convection, radiation, heat, macro scale, molecular scale, temperature, kinetic energy, speed/velocity

Year-Long Anchoring Phenomena: (LEARNING PROCESS)
Human Need for Energy

Unit Phenomena (LEARNING PROCESS)
How are planes designed and manufactured to withstand extreme temperature changes?

CER: Students answer the phenomenon in a Claim-Evidence-Reasoning constructed response as a formative and summative assessment. Allow students to make edits to their constructed response throughout the unit for a final submission.

Capstone Connective Theme:
Effects of Temperature on Aircraft Performance

UN Sustainable Development Goals: Responsible Consumption and Production

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

- Students have familiarity with the concept of solids, liquids, and gasses. Even though students have studied the sun in 6th Grade Earth Science, the concept of plasma being the 4th state of matter may be new.
- Students often mistake phase changes for a chemical, rather than physical change.
- Students often confuse melting point and boiling point as chemical properties, rather than physical properties.

Key concept	Related concept(s)	Global context
Change Change is a conversion, transformation, or movement from one form, state, or value to another. Inquiry into the concept of change involves understanding and evaluating causes, processes, and consequences.	Energy (MYP/CCC)	**Scientific and technical innovation** How the world works: an inquiry into the natural world and its laws; the interaction between the natural world (physical and biological) and human societies; how humans use their understanding of scientific principles; the impact of scientific and technological advances on society and on the environment.

Statement of inquiry
Scientific and technical innovations enable us to use thermal energy changes for practical applications.

Inquiry questions
Factual What are the similarities/differences between solids, liquids, gasses, and plasma? What happens to the molecules of a substance when it changes phase? What causes changes in molecular motion? What are the methods of thermal energy transfer? **Conceptual** Why can transferring energy into or out of a substance change molecular motion? How does the appearance of a substance change when it changes phase? How does the addition or removal of thermal energy impact the movement of particles in solids, liquids, and gasses? How can I use what I know about thermal energy to design an insulating device? **Debatable** What device design will be best for insulating a substance from temperature changes? How are planes designed and manufactured to withstand extreme temperature changes?

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* *ii. apply scientific knowledge and understanding to solve*	SOI: Scientific and technical innovations enable us to use thermal energy changes for practical applications. Throughout the unit, students are challenged to demonstrate their knowledge and conceptual understanding of how changes in matter occur at the atomic level when thermal energy is added or removed. The MYP Unit assessments require students to examine models of matter in different states and determine not only the state, but whether thermal energy was added or removed in order for the change to occur. Students are also required to predict and model how molecules will behave with the addition or removal of thermal energy. Ultimately, students are challenged with designing	**Formative Assessment(s):** CFA#1 (States of Matter) CFA#2 (Forms of Heat Transfer) States of Matter Choice Board Lab/SIM: Exploring Thermal Energy Transfer Between Various Materials (A-D)

problems set in familiar and unfamiliar situations *iii. analyze information to make scientifically supported judgments.* Criterion B: Inquiring and Designing *i. describe a problem or question to be tested by a scientific investigation* Criterion C: Processing and Evaluating *i. present collected and transformed data* *ii. interpret data and describe results using scientific reasoning* 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*	their own insulating system using the principles of thermal energy they have learned. In alignment with the Honors Science 8 Capstone theme of aviation, students will extend their learning to apply their understanding of thermal energy changes to the effects of temperature on aircraft materials and performance.	**<u>Summative Assessment(s):</u>** States of Matter, Phase Changes, and Thermal Energy Unit Assessment Paper I
Approaches to learning (ATL)		
Category: Communication **Cluster:** Communication Skills		

Skill Indicator: Read critically and for comprehension.

Learning Experiences Add additional rows below as needed.		
Objective or Content		**Personalized Learning and Differentiation**
S8P1. Obtain, evaluate, and communicate information about the structure and properties of matter. b. Develop and use models to describe the movement of particles in solids, liquids, gasses, and plasma states when thermal energy is added or removed.	• PhET SIM: States of Matter • States of Matter Choice Board	• Capstone Connections • Discovery Education High School Science Techbook • NGSS Case Studies for Differentiated Learners • Next Generation Science Standards: "All Standards, All Students" • Extensions – Enrichment Tasks/Projects Task-Specific Differentiation • Scaffolding • Extended Learning • Sentence Starters • Leveled Tasks • Mode/Method of Presentation • Type of Product
S8P1. Obtain, evaluate, and communicate information about the structure and properties of matter. c. Plan and carry out investigations to compare and contrast chemical (i.e., reactivity, combustibility) and physical (i.e., density, melting point, boiling point) properties of matter.	• PhET SIM: States of Matter • States of Matter Choice Board • Lab: Exploring Thermal Energy Transfer Between Various Materials (Science A-D)	
S8P1. Obtain, evaluate, and communicate information about the structure and properties of matter. d. Construct an argument based on observational evidence to support the claim that when a change in a substance occurs, it can be classified as either chemical or physical. (Clarification statement: Evidence could include ability to separate mixtures, development of a gas, formation of a precipitate, change in energy, color, and/or form.)	• PhET SIM: States of Matter • States of Matter Choice Board • Lab: Exploring Thermal Energy Transfer Between Various Materials (Science A-D)	

S8P2. Obtain, evaluate, and communicate information about the law of conservation of energy to develop arguments that energy can transform from one form to another within a system. d. Plan and carry out investigations of the effects of heat transfer on molecular motion as it relates to the collision of atoms (conduction), through space (radiation), or in currents in a liquid or gas (convection).	● Heat Transfer Demos (Convection in fish tank, Heat Lamp and Radiometer, Conduction through spoon, wax, and items) ● Lab: Exploring Thermal Energy Transfer Between Various Materials (Science A-D) ● CER: Forms of Heat Transfer in Flight	

Content Resources

Georgia Grade 8 Science GaDOE Instructional Segment

Discovery Education Grade 8 Science Techbook

Discovery Education Chemistry Science Techbook

Discovery Education: Boeing Partnership

PhET: States of Matter

Capstone Connections

- Capstone Brainstorming & Idea Selection
- Capstone Experience: Marietta Aviation History & Technology Center
- Lab/SIM: Exploring Thermal Energy Transfer Between Various Materials (Science A-D)
- CER: Forms of Heat Transfer in Flight