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	*Energy*	**MYP year**	*3*	**Unit duration (hrs)**	*12.5 Hours*

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

GSE Standards

Standards

SPS7. Obtain, evaluate, and communicate information to explain transformations and flow of energy within a system.

a. Construct explanations for energy transformations within a system. (*Clarification statement:* Types of energy to be addressed include chemical, mechanical, electromagnetic, light, sound, thermal, electrical, and nuclear.)
b. Plan and carry out investigations to describe how molecular motion relates to thermal energy changes in terms of conduction, convection, and radiation.
c. Analyze and interpret specific heat data to justify the selection of a material for a practical application (e.g., insulators and cooking vessels).

MCS Gifted Standards:

- **MCS.Gifted.S3A.** Develop and apply core critical thinking skills of metacognition, observation, questioning, prediction, analysis, interpretation, inference, summarization, evaluation, synthesis, explanation, and transference.
- **MCS.Gifted.S3C.** Use a variety of strategies for solving authentic, complex, real-world problems through evaluative thinking and the engineering design processes.
- **MCS.Gifted.S5A**. Explore personal beliefs, feelings, and understanding of self, regarding one's own unique giftedness.
- **MCS.Gifted.S6A.** Set appropriately high standards for work and behavior.

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

S6E4. Obtain, evaluate, and communicate information about how the sun, land, and water affect climate and weather.

b. Plan and carry out investigations to demonstrate how energy from the sun transfers heat to land, air, and water at different rates. (*Clarification statement:* Heat transfer should include the processes of conduction, convection, and radiation.)

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

Concepts/Skills to be Mastered by Students

- Energy
- Energy Transformations

- Thermal energy
- Heat
- Conduction, Convection, Radiation
- Specific Heat

Key Vocabulary: (KNOWLEDGE & SKILLS)
Conduction, convection, radiation, electrical energy, sound energy, thermal energy, chemical energy, light energy, electromagnetic, kinetic energy, potential energy, gravitational potential energy, elastic potential energy, mechanical energy, transformation, heat transfer, conductor, insulator, convection current, heat energy (joules), specific heat (J/kg * K or J/kg * C), temperature

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

Unit Phenomena (LEARNING PROCESS)
How can our understanding of energy transformations and specific heat data impact the design and selection of products for everyday use?

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)
- The majority of the students are familiar with most forms of energy, and can identify examples, but may not be able to articulate what the source of that energy form is.
- Students may have difficulty calculating specific heat.
- Students may have difficulty rearranging the specific heat equation to solve for a particular variable.

Key concept	Related concept(s)	Global context
Systems and System Models Systems are sets of interacting or interdependent components. Systems provide structure and order in human, natural and built environments. Systems can be static or dynamic, simple or complex.	Energy (MYP/CCC) Transformation (MYP/CCC)	**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 allow us to visualize, model, and explain changes and transformations in systems of energy.
Scientific and technical innovations allow us to observe and measure thermal energy and the transfer of heat between systems in order to design products with desired features.

Inquiry questions

Factual

What are the various forms energy can take?
What are the ways that thermal energy can be transferred?
What is specific heat?
How do I determine a material's specific heat?
How do I determine heat energy lost or gained, the change in temperature of a system, or an object's mass using the specific heat formula?

Conceptual

How is energy transferred and transformed?
How is thermal energy transferred at the molecular level?
Why do objects store and transfer energy differently?
How do I use specific heat data to select materials for particular applications?

Debatable

Which material is best for a particular application, based on its thermal conductivity?

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 A: Knowing and Understanding I. describe scientific knowledge Iii. analyze information to make scientifically supported judgments Science B: Inquiring and Designing Iv. design scientific investigations	SOI: Scientific and technical innovations allow us to visualize, model, and explain changes and transformations in systems of energy. SOI: Scientific and technical innovations allow us to observe and measure thermal energy and the transfer of heat between systems in order to design products with desired features. In the Energy Unit Assessment, students will demonstrate their ability to identify and model changes and transformations in energy systems for multiple forms of energy. Students will also demonstrate their understanding of thermal conductivity by using specific heat data to select appropriate materials in given scenarios. Throughout the unit, students will visualize, model, and explain energy transformations through the use of simulations and when designing their own system of energy transformations using a series of	**Formative Assessment(s):** Energy Forms & Transformations CFA **Summative Assessment(s):** Energy Unit Assessment Paper I and Paper II

Science C: Processing and Evaluating I. present collected and transformed data Ii. interpret data and results using scientific reasoning Science D: Reflecting on the Impacts of Science Ii. discuss and analyze the various implications of using science and its application in solving a particular problem or issue Iii. apply scientific language effectively Design B: Developing Ideas Iii. present the chosen design and outline the reason for its selection Iv. develop accurate planning drawings/diagrams and outline requirements for the creation of the chosen solution Design C: Creating the Solution Iii. follow the plan to create the solution, which functions as intended	objects. They will also develop and label diagrams to explain energy transfer and transformations as they occur. Students will utilize SIMS and design their own investigations to observe and measure thermal energy transfer and heat flow through conduction, convection, and radiation. Students will use thermal energy data to determine which skillet handle is best for a new cookware design.	
Approaches to learning (ATL)		
Category: Thinking **Cluster:** Critical Thinking Skills **Skill Indicator:** Consider consequences to events.		

Learning Experiences Add additional rows below as needed.		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
SPS7. Obtain, evaluate, and communicate information to explain transformations and flow of energy within a system. a. Construct explanations for energy transformations within a system.	PhET: Energy Skate Park Intro PhET: Energy Forms and Changes (Systems) Designing a System of Energy Transformations (Design B-D)	• Discovery Education High School Physics 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, DE Techbook) • Multiple Means of Action and Expression
SPS7. Obtain, evaluate, and communicate information to explain transformations and flow of energy within a system. b. Plan and carry out investigations to describe how molecular motion relates to thermal energy changes in terms of conduction, convection, and radiation.	Designing a Heat Transfer Lab (Science: B-D)	
SPS7. Obtain, evaluate, and communicate information to explain transformations and flow of energy within a system. c. Analyze and interpret specific heat data to justify the selection of a material for a practical application	DE Virtual Lab: Too Hot to Handle Specific Heat Practice Problems	

Content Resources
Physical Science Instructional Segment - Energy Part II: Transformers
Discovery Education Physics Techbook Unit 3: Concept 3.1: Types of Energy
Discovery Education Physics Techbook Unit 6: Concept 6.1 Heat
DE Interactives: Explorations:
-Changing the Form of Energy

-Heat Transfer

-Heat on the Move