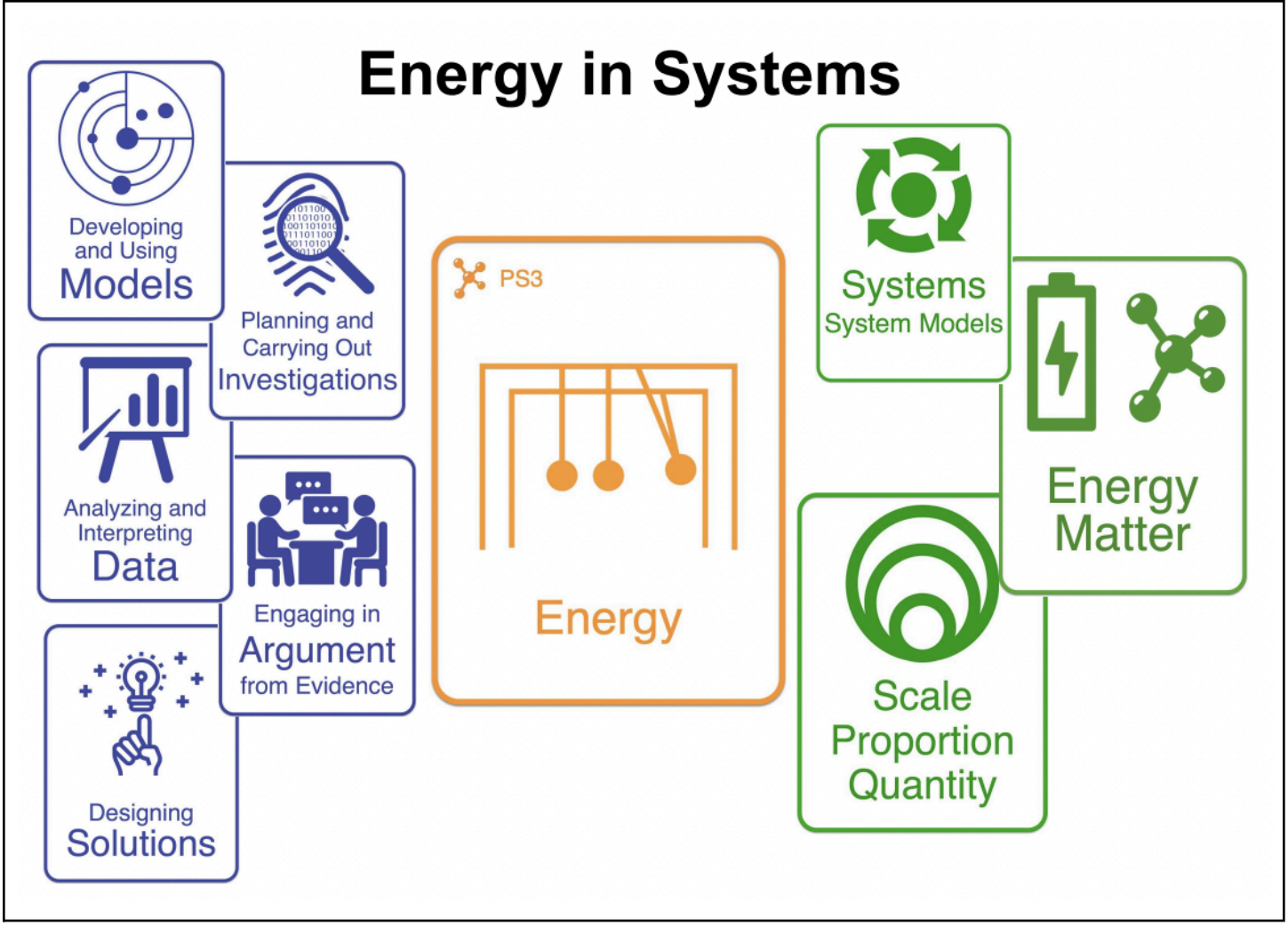
Storyline Unit Design

Understanding by Design (UbD) Template*

Unit	**Energy**	Course(s)	**Science7**
Designed by	**Berger, Cummings, Lopez & Robinson**	Time Frame	

Anchor Model



*UbD Unit Planner is from Wiggins, Grant and McTighe, Jay. Understanding by Design Guide to Creating High-Quality Units. Alexandria, VA: Association for Supervision and Curriculum Development. 2011.

Stage 1: Desired Results

Performance Expectations

MS-PS3-1: Kinetic Energy of an Object
Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. (Scale, Proportion, and Quantity)

MS-PS3-2: Potential Energy of the System
Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (Systems and System Models)

MS-PS3-3: Thermal Energy Transfer Solution
Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (Energy and Matter)

MS-PS3-4: Thermal Energy Transfer
Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. (Scale, Proportion, and Quantity)

MS-PS3-5: Energy Transfer to or from an Object
Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. (Energy and Matter)

MS-PS3-6: Electric Circuits (NY Standard)
Make observations to provide evidence that energy can be transferred by electric currents.

Anchoring Phenomenon

Anchoring Phenomenon Worksheet

Enduring Understandings	Essential Questions
Type Here	*Type Here*

Stage 2: Assessments

MS-PS3-1	Lego Cart Collision	Assessment	Key	Evidence Statement
MS-PS3-2	Gravity Light	Assessment	Key	Evidence Statement
MS-PS3-3	A Thermal Energy Design Fair	Assessment	Key	Evidence Statement
MS-PS3-4	Investigating Mass & Material	Assessment	Key	Evidence Statement
MS-PS3-5	Where Did the Energy Go?	Assessment	Key	Evidence Statement
MS-PS3-6	NY Standard - No TWoS Assessment			

Assessment Screening Tool Slides

Backward Design Elements

What new skills (practices) will students need to learn?	What thinking concepts will students need to learn?	What science concepts will students need to learn?
Construct and interpret energy graphs *Predict proportional relationships between variables* *Construct graphical displays of the data* *identify the relationships identified in two experiments.* *Design, construct, and test the design that minimizes or maximizes thermal energy transfer* *Develop a model to describe unobservable mechanisms* *Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.* *Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change*	*Energy and Matter* *Proportional relationships among different types of quantities provide information about the magnitude of properties and processes.* *Energy and matter flows within systems.* *Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.*	*Linear vs. nonlinear relationships* *KE in relation to mass and velocity* *Kinetic energy - is proportional to the mass of the moving object and grows with the square of its speed.* *Potential Energy (relative positions)* *Definition of Energy-Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.* ***Conservation of Energy**- Energy is spontaneously transferred out of hotter regions or objects and into colder ones.* *• When the motion energy of an object changes, there is inevitably some other change in energy at the*

in the average kinetic energy of the particles as measured by the temperature of the sample.		*same time.* *Temp is a measure of the average KE of particles of matter. The relationship between the temp & the total energy of a system depends on the types, states, and amounts of matter present.*

Stage 3: Learning Plan

 Phenomenon or Problem	 Learning Performance - What will they do? The three dimensions woven together into a single learning performance.	 Why is this important? How does this activity help build understanding of the anchoring phenomenon.	 Learning Experience - How will they do it? Graphic organizers, protocols, scaffolds, labs, mini-lesson, student discourse, etc.
Rollercoasters and energy changes			
Formative Assessment - What information are you collecting to know that they met the target?			
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Summative Assessment What information are you collecting to know that they met the target?			

Materials / Resources

Vocabulary

MS-PS3-1
Kinetic energy
Mass of the object (KE ∝ m)
Speed of the object (KE ∝ v^2)
Proportional

MS-PS3-2
Potential energy
Interacting stationary objects (e.g. Earth and roller coaster cart, magnets, charged objects)
Forces (electric, magnetic, or gravitational)
Distance between object
System

MS-PS3-3
Thermal energy transfer (hotter object to colder object)
Thermal energy transfer processes (conduction, convection, and radiation)
Temperature
Device
- Thermal conductor
- Thermal insulator

Energy

MS-PS3-4
Thermal energy transfer
Type of matter
Mass
Temperature (average kinetic energy of particles)
Environment
Proportional

MS-PS3-5
Energy transfer
Kinetic energy
Potential energy
Thermal energy
Object
Temperature
Motion
Environment
System

Mini Lessons

System Level 3 - Inputs, Processes and Outputs
System Level 3 - Inputs, Processes and Outputs Thinking Slides
Proportion Level 5 - Proportional Relationships
Proportion Level 5 - Proportional Relationships Thinking Slides
Energy Level 3 - Energy and Energy Transport
Energy Level 3 - Energy and Energy Transport Thinking Slides

Graphic Organizers

Phenomena Observation Graphic Organizer
Questioning Graphic Organizer
Modeling Graphic Organizer
Planning an Investigation Organizer - Experimental
Planning an Investigation Organizer - Observational
Investigation Evidence Organizer
Engaging in Argumentation Organizer

Differentiation / Modifications

Phenomenon Worksheet

Back to Stage 1

◁ **MS-PS3-1 - Kinetic Energy of an Object**
◁ **MS-PS3-2 - Potential Energy of the System**
◁ **MS-PS3-3 - Thermal Energy Transfer Solution**
◁ **MS-PS3-4 - Thermal Energy Transfer**
◁ **MS-PS3-5 - Energy Transfer to or from an Object**
◁ **Local**
◁ **Favorite**

- Rollercoasters◁ ◁
- penny falling from building◁◁I
- Collisions◁
- Sports (olympics)◁
- Dam ◁
- Water wheel◁
- Windmills◁
- Nuclear plant◁
- Thermoses
- Car racing◁
- Diving board◁◁
- Mohawk cliff diving◁◁I
- Van de graff generator
- Magnetic levitation
- Skateboarding◁ ◁
- diving◁ ◁I
- Archery◁
- Car accidents◁
- egg drop◁◁

Screening Tools

Back to Stage 2

MS-PS3-1: Kinetic Energy of an Object

Evidence Statement

Assessment: Lego Cart Collision (Google Template) (Key Template)

Reflections: *Type Here*

	No	Partial	Yes
1. The assessment contains a **phenomenon** (science) or a **problem** (engineering)			
2. The **prompts** match the Science and Engineering Practice (SEP) and engage students in sense making.			
3. The **stimuli** have multiple and sufficient information needed to utilize the SEP. (e.g. multiple data sets to analyze)			
4. The **prompts** elicit observable understanding of the Disciplinary Core Idea (DCI).			
5. The **prompts** explicitly mention the Crosscutting Concept (CCC).			
6. The **prompts** include language (i.e. bullets) from grade appropriate progressions. (SEP)(DCI)(CCC)			
7. The **graphic organizers** provide space for the observable features (e.g. 1, 2, 3...) in the evidence statement. (e.g. claim, evidence and reasoning)			
8. The **entire assessment** contains information that is scientifically accurate and properly attributed. (e.g. don't make up data and include the source)			
9. The **prompts** point in the direction of explaining a phenomenon (science) or designing a solution (engineering).			
10. The **phenomenon** or **problem** is authentic, interesting, and requires students to figure something out.			
11. The **phenomenon** or **problem** is novel to show the transfer of knowledge. (i.e. not in the unit)			

Screening Tools

Back to Stage 2

MS-PS3-2: Potential of an Energy

Evidence Statement

Assessment: Gravity Light (Google Template) (Key Template)

Reflections:

	No	Partial	Yes
1. The assessment contains a **phenomenon** (science) or a **problem** (engineering)			
2. The **prompts** match the Science and Engineering Practice (SEP) and engage students in sense making.			
3. The **stimuli** have multiple and sufficient information needed to utilize the SEP. (e.g. multiple data sets to analyze)			
4. The **prompts** elicit observable understanding of the Disciplinary Core Idea (DCI).			
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11. The **phenomenon** or **problem** is novel to show the transfer of knowledge. (i.e. not in the unit)			

Screening Tools

Back to Stage 2

MS-PS3-3: Thermal Energy Transfer Solution

Evidence Statement

Assessment: A Thermal Energy Design Fair (Google Template) (Key Template)

Reflections:			
	No	**Partial**	**Yes**
1. The assessment contains a **phenomenon** (science) or a **problem** (engineering)			
2. The **prompts** match the Science and Engineering Practice (SEP) and engage students in sense making.			
3. The **stimuli** have multiple and sufficient information needed to utilize the SEP. (e.g. multiple data sets to analyze)			
4. The **prompts** elicit observable understanding of the Disciplinary Core Idea (DCI).			
5. The **prompts** explicitly mention the Crosscutting Concept (CCC).			
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11. The **phenomenon** or **problem** is novel to show the transfer of knowledge. (i.e. not in the unit)			

Screening Tools

Back to Stage 2

MS-PS3-4: Thermal Energy Transfer

Evidence Statement

Assessment: Investigating Mass and Materials (Google Template) (Key Template)

Reflections:			
	No	**Partial**	**Yes**
1. The assessment contains a **phenomenon** (science) or a **problem** (engineering)			
2. The **prompts** match the Science and Engineering Practice (SEP) and engage students in sense making.			
3. The **stimuli** have multiple and sufficient information needed to utilize the SEP. (e.g. multiple data sets to analyze)			
4. The **prompts** elicit observable understanding of the Disciplinary Core Idea (DCI).			
5. The **prompts** explicitly mention the Crosscutting Concept (CCC).			
6. The **prompts** include language (i.e. bullets) from grade appropriate progressions. (SEP)(DCI)(CCC)			
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11. The **phenomenon** or **problem** is novel to show the transfer of knowledge. (i.e. not in the unit)			

Screening Tools

Back to Stage 2

MS-PS3-5: Energy Transfer to and from an Object

Evidence Statement

Assessment: Where Did the Energy Go? (Google Template (Key Template)

Reflections:			
	No	**Partial**	**Yes**
1. The assessment contains a **phenomenon** (science) or a **problem** (engineering)			
2. The **prompts** match the Science and Engineering Practice (SEP) and engage students in sense making.			
3. The **stimuli** have multiple and sufficient information needed to utilize the SEP. (e.g. multiple data sets to analyze)			
4. The **prompts** elicit observable understanding of the Disciplinary Core Idea (DCI).			
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