Storyline Unit Design

Understanding by Design (UbD) Template*

Unit	**Engines of the Past to Engines of the Future**	Course(s)	**Regents Chemistry**
Designed by	**Valley Central Chemistry**	Time Frame	**6 Weeks**

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

HS-PS1-2: Simple Chemical Reactions
Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

HS-PS1-4: Total Bond Energy Change in Chemical Reactions
Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. (Energy and Matter)

HS-PS1-5: Collision Theory and Rates of Reaction
Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. (Patterns)

HS-PS3-1: Energy Change in Components of a System
Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. (Systems and System Models)

Anchoring Phenomenon

Anchoring Phenomenon Worksheet

Enduring Understandings	Essential Questions
Type Here	*Type Here*

Stage 2: Assessments

HS-PS1-2	Predicting Products	Assessment	Key	Evidence Statement
HS-PS1-4	Chemical Reaction Energy Transfer	Assessment	Key	Evidence Statement
HS-PS1-5	Alka Seltzer Rockets	Assessment	Key	Evidence Statement
HS-PS3-1	Algodoo Ball Bounce	Assessment	Key	Evidence Statement

Assessment Screening Tools

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?
1-3 *Analyzing graphs and data* *Model energy changes into and out of a system* *Interpreting a data table* *Calculate Thermal Energy of a system* *1-2, 1-3 & 1-5* *Construct and revise an explanations based on reliable evidence* *Assume theories and laws are the same today as in the past and continue in the future* *1-4* *Labeling bonds bonds on a diagram* *1-5* *Model Particle Diagrams* *1-5* *Provide an explanation of phenomena using evidence and solve design problems, taking into account possible unanticipated effects.*	*1-3* *Systems/System Models: Stability & Change* *1-2 & 1-5* *Observe different patterns in different scales to provide evidence of phenomena* *1-4* *Energy & Matter (Energy)*	*1-4* *Energy absorbed as bonds broken Energy released as bonds formed* *1-4* *Electrons can be transferred or shared to form a chemical bond* *1-4* *Rearranging atoms to form new molecules results in a change in total bond energy in the system that will affect the kinetic energy of the surroundings* *1-2 Periodic table shows repeating patterns according to the outer level electrons* *1-2 Atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.* *1-5* *Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules,*

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.
Type Here	*Type Here*	*Type Here*	*Type Here*
Formative Assessment - What information are you collecting to know that they met the target?		Assess students	
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<u>Summative Assessment</u> 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

HS-PS1-2
Chemical reaction (e.g. sodium and chloride, carbon and oxygen, carbon and hydrogen)
Reactants and products
Bonds (i.e. ionic, covalent)
Reaction type (e.g. formation of ionic compound, combustion of hydrocarbons)
Electronegativity
Main group elements
Valence electrons
Periodic table
Chemical properties
Patterns

HS-PS1-4
Chemical reaction system
- Chemicals
- Surroundings

Total bond energy
Bonds
Potential energy
- Bond energy of reactants
- Bond energy of products

Kinetic energy
- Surroundings by molecular collisions

HS-PS1-5
Temperature
Concentration
Chemical reaction
Reactants and products
Chemical bonds
Molecules
Rate of reaction
Collision theory
Kinetic energy
Patterns

HS-PS3-1
System and boundaries
Components
Energy (thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields)
Energy flow

Mini Lessons

System Level 5 - Simulating Systems Mini-Lesson
System Level 5 - Simulating Systems Thinking Slides
Patterns Level 7 - Causal Patterns at Varying Scale
Patterns Level 7 - Causal Patterns at Varying Scale
Matter and Energy Level 5 - Cycles and Flows
Matter and Energy Level 5 - Cycles and Flows 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

◁ **HS-PS1-2 - Simple Chemical Reactions**
◁ **HS-PS1-4 - Total Bond Energy Change in Chemical Reactions**
◁ **HS-PS1-5 - Collision Theory and Rates of Reaction**
◁ **HS-PS3-1 - Energy Change in Components of a System**
◁ **Local and Relevant**
◁ **Favorite**

- **Combustion engine in a vehicle and development of the battery** ◁
    - **Gasoline/Fuel**
- **Baking soda and vinegar volcano** ◁◁
- **Hot/Cold Pack??? ◁f**
- **Road salt/Brines**
- **Electrolysis of water**
- **Digestions & Body Systems?**
- **Photosynthesis and plant growth**
- **Cooking an egg**
- **Baking cookies with varying amounts of ingredients**
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Screening Tools

Back to Stage 2

HS-PS1-2: Simple Chemical Reactions

Predicting Products Assessment Key Evidence Statement

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**

HS-PS1-4: Total Bond Energy Change in Chemical Reactions

Chemical Reaction Energy Transfer Assessment Key Evidence Statement

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)			
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Screening Tools

Back to **Stage 2**

HS-PS1-5: Collision Theory and Rates of Reaction

Alka Seltzer Rockets | Assessment | Key | Evidence Statement

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)			
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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**

HS-PS3-1: Energy Change in Components of a System

Algodoo Ball Bounce [Assessment] [Key] [Evidence Statement]

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.			
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