Phoenixville Area School District Understanding by Design (UbD) Science Template

Grade Level &/or HS Subject: 11/ Chemistry Unit Name: Chemical Reactions and Solutions

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="4">Overarching NGSS & PA Standards:

PA-CR5: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

PA-CR1: 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</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

Ask questions and/or define problems

Develop and/or use models

Plan and/or carry out investigations

Analyze and interpret data using computational thinking

Obtain, evaluate, and communicate information (supported by evidence)

Construct explanations and design solutions</td></tr>
<tr><td colspan="2">Meaning-Making</td></tr>
<tr><td>Students will understand that…
Interactions between chemical reactants and products can be written as chemical equations.
Chemical reactions must follow the law of conservation of mass.
The five basic reaction types can be used to predict products and reactants for reactions.
Reactions can absorb and/or release energy/heat based upon the bonds made/broken.
Mixtures can be classified based on appearance and method of separation.
Concentration of a solution can be expressed in terms of moles/liter of water.
Solute solvent interactions depend upon the forces between molecules.</td><td>ESSENTIAL QUESTIONS
Students will keep considering...
How do substances make new substances?
How do particles interact with one another?
What is conservation of matter/mass?
How are energy and particle interactions related?
How are mixtures different from pure substances?
What role does water play in solutions?</td></tr>
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<td rowspan="4">of chemical properties.

PA-SPM2:
Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

Which branch(es) of science apply:

LS PS E&SS</td>
<td></td>
<td>• How does temperature affect particle interactions?
• How can we measure the concentration of a solution?</td>
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<td colspan="2">Knowledge and Skills Acquisition</td>
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<td>UNDERSTANDINGS
Students will know…
• Equations must be balanced due to the law of conservation of mass.
• The basic forms of the five main reaction types.
• The difference between exothermic and endothermic reactions.
• The difference between heterogeneous and homogeneous mixtures.
• How to differentiate solute from solvent.
• Water is the solvent in aqueous solutions.
• Molarity is a measure of moles solute dissolved in a one liter of water.
• Solutions can be diluted using mathematical relationships between the molarities and volumes of the two solutions.
• Solubility curves can be used to predict solubility of certain masses at specific temperatures.
• Differences in electronegativity and bond geometry are major causes of polarity.
• Intermolecular forces help determine properties of substances.</td>
<td rowspan="2">Students will be skilled at…
• Use a model to predict the relationships between systems or between components of a system
• Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources.
• Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
• Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
• Reason abstractly and quantitatively.</td>
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<td>KEY VOCABULARY

• Reactant
• Product
• Synthesis
• Single replacement
• Double replacement
• Combustion
• Decomposition
• Exothermic
• Endothermic
• Heterogeneous
• Homogeneous
• Solution
• Solute</td>
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	• Solvent • Molarity • Molality • Concentration • Solubility • Polarity	• Use mathematical representations of phenomena to support claims.

Stage 2 – Evidence		
Evaluative Criteria	***Assessment Evidence***	
Lab Report Rubrics Student Model Rubrics Mathematical Solutions Discussion Rubrics Formative Checks for Understanding	PERFORMANCE TASK(S): • Students will predict the type of reaction that will take place for given substances. Students will make observations to support their predictions. • Students will use activity series to predict the products of single replacement reactions. They will gather observations to support their predictions. • Students will collaborate to devise a procedure for separating a heterogeneous mixture. Students will record data to determine the efficiency of their procedure. Students will discuss their results with the class before refining their procedure. • Students will use data collected and mathematical relationships to determine the concentration of an acid solution. • Students will design an experiment to investigate differences in properties of substances with differing intermolecular forces.	Differentiation Considerations: • Assignments can be scaffolded to a variety of difficulties. • Example models can be made for students who struggle to start. • Some data can be given at the start of activities. • Teacher prompts to get students talking.

Mathematical Solutions Test Keys / Rubrics Presentation Rubrics	OTHER EVIDENCE: • PHET simulations • Unit tests (multiple choice and written response) • Quizzes (multiple choice and written response) • Mathematical problems: molarity calculations, dilutions, solubility, balancing equations • Power point presentations	Differentiation Considerations: • Multiple-choice assessments can be shortened. • Assignments can be made vocabulary based for EL's • Larger assignments can be chunked with multiple student check ins.