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

Grade Level 5 **Unit Name: Mixtures & Solutions (Matter)** **Authors: B. Douglas & K. Parsons**

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

3.2.5.A
Develop a model to describe that matter is made of particles too small to be seen.

3.2.5.B
Make and communicate observations and measurements to identify materials based on their properties.

3.2.5.C
Interpret and analyze data to make decisions about how to utilize materials based</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

1. Ask questions and/or define problems
2. Develop and/or use models
3. Plan and/or carry out investigations
4. Analyze and interpret data using computational thinking</td></tr>
<tr><td colspan="2">Meaning-Making</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand…
• Matter of any type can be subdivided into particles that are too small to see, but even then, the matter still exists and can be detected by other means.
• The amount (weight) of matter is conserved when it changes form, even in transitions. Measurements of a variety of properties can be used to identify materials.
• When two or more different substances are mixed, a new substance with different properties may be formed.
• No matter what reaction or change in properties occurs, the total weight of the substances does not change.</td><td>ESSENTIAL QUESTIONS
Students will keep considering...

• What happens when two or more samples of materials are combined?
• What is the best way to explain a phenomenon for which you have incomplete information?
• How can we use models to explain the difference between the phenomena of melting and dissolving?
• How can solutions made with the same substances be distinguished one from another?
• How can the property of solubility be used to identify a substance?</td></tr>
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on their properties. **3.2.5.D**		• What observations serve as evidence that a chemical reaction has occurred?
	Knowledge and Skills Acquisition	

Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. **3.2.5.E** Conduct an investigation to determine whether the mixing of two or more substances results in new substances. **What branches of science apply:** PS	*Students will know…* • A mixture is two or more materials intermingled. • An aqueous solution is a mixture in which a substance dissolves in water to make a clear liquid. • Mixtures can be separated into their constituents by using screens, filters, and evaporation. • The mass of a mixture is equal to the mass of its constituents. • Dissolving is an interaction between two (or more) substances: a solute which dissolves, and a solvent, which does the dissolving and into which the solute disappears. • Melting is a change in a single substance from solid to liquid caused by heat (energy transfer). • The amount of matter is conserved when it changes form. • Concentration is the amount of dissolved solid material per unit volume of water. • Solutions with a lot of solid dissolved in a volume of water are concentrated; solutions with little solid dissolved in a volume of water are dilute. • When equal volumes of two salt solutions are weighed, the heavier one is more concentrated. • Density is mass per unit volume; More concentrated salt solutions are denser. • Solutions form layers based on density. • A substance is a single, pure material. • Solutions are composed of a solvent (liquid) and a solute (solid), which is dissolved in the solvent. • Solubility is the property that indicates how readily a solute dissolve in a solvent. • A solution is saturated when as much solid material as possible has dissolved in the liquid. • Solubility varies from substance to substance. • Substances form predictable, identifiable crystals. • Engineers plan designs, select materials, construct products, evaluate results, and improve ideas. • A substance is a single, pure material.	*Students will be skilled at… (SEPS)* • Use models to describe phenomena. • Measure and graph quantities such as weight to address scientific and engineering questions and problems. • Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. • Investigate collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

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VOCABULARY:

• Chemical Reaction • Concentration • Crystals • Density • Dissolve • Dilute • Evaporation • Gas • Liquid • Mass • Matter • Melting	• Mixtures • Model • Particles • Saturation • Solid • Solubility • Solute • Solution • Solvent • Substance • System • Volume

Stage 2 – Evidence		
Evaluative Criteria	**Assessment Evidence**	
What criteria will be used in each assessment to evaluate attainment of the desired results? Rubrics related to each will be developed.	PERFORMANCE TASK(S): Investigations: I. **Task(s):** Students engage with three distinct phenomena: simple mixtures, suspensions, and solutions. Students make mixtures of water and solid materials and separate the mixtures with screens and filters. They find that water and salt make a particular kind of mixture, a solution, which cannot be separated with a filter but only through evaporation. They begin to develop a model of dissolving. Students are challenged with a problem: how to separate a mixture of three dry solid materials. The investigation concludes with students going outdoors to see what natural materials make solutions with water. **Assessment**: Investigation 1 I-Check II. **Task(s):** Science requires the development of scientific models for coherent, conventional explanations of important phenomena. Students experience a variety of ways to represent models that have explanatory power for different phenomena, including the phenomena of dissolving and melting. Students make multisensory observations of sealed black boxes in an effort to determine what is inside. They develop models and try to reach consensus with other students who investigated the same boxes. Students construct physical models of black boxes in an effort to explain the behaviors of the original black boxes. Students observe a "droughtstopper" device and develop conceptual modules for how they think it works. Students investigate melting and freezing in terms of models and conservation of mass and explain the difference between the processes of melting and dissolving. **Assessment**: Investigation 2 I-Check	Differentiation Considerations: For labs, some students may wish to: • Explain verbally instead of in a written format • Draw their responses • Write in their first language If challenges arise with the complexity of the task(s), some students may need: • Additional incremental steps • An alternative activity Other considerations: • When grouping students' various skills sets and strengths will be considered • When asking students to describe a model, opportunities to draw or write it, as well. • Teacher can scribe written responses for students

	III. **Task(s):** Concentration is an important phenomenon impacting many of the natural and designed systems in students' lives from chemicals in water to carbon dioxide or other gases in the air. Students investigate the ratio of solute to solvent (concentration) in solutions. They observe and compare soft-drink solutions that differ in the amount of powder (water held constant) and in the amount of water (powder held constant) in order to develop the concept of concentration. They make salt solutions of different concentrations and compare them, using a balance. Students determine the relative concentrations of three mystery solutions made from the same solid material by comparing the mass of equal volumes of the solutions. Finally, students layer salt solutions to determine their relative concentrations, based on density. **Assessment**: Investigation 3 I-Check IV. **Task(s):** Students investigate the solubility of solutes in water to discover that there is a different maximum amount of every solute that will dissolve in a measure of water—the phenomenon of saturation. Students make a saturated solution by adding salt to water until no more salt will dissolve. They also make a saturated Epsom salts solution. Using a balance, they compare the solubility of the two solid materials by comparing the mass of the salt and Epsom salts dissolved in the saturated solutions. Students use the property of solubility to identify an unknown material. They analyze local water samples, using separation techniques and design a way to remove salt from ocean water. **Assessment**: Investigation 4 I-Check V. **Task(s):** Students make more complex mixtures of water with multiple solutes and observe transformations of reactants to new products—the phenomenon of chemical reaction. Students make three solutions with water, calcium chloride, baking soda, and citric acid. They systematically mix pairs of those solutions and observe changes that occur. The changes (formation of a gas and a white precipitate) are identified as evidence of a chemical reaction. Students repeat the reactions in sealed zip bags to observe the volume of gas produced. **Assessment**: Investigation 5 I-Check	

	Unit Projects/Activities 1. Task to determine if a substance be a liquid and a solid: a. Rachel Ray, a Food Network Chef, created a new substance by accident. b. Written Response 2. Task to design, build and test a water filtration system. c. Written Reflection OR 3. Task- to create a Tap Water Research Project d. How safe is our tap water? How can we provide clean drinking water? e. Research Presentation Rubric	For the Project 1, consider that some students may wish to: • explain this verbally or use gestures or other objects to depict this For Project 2 – water filtration system, consider that some students may wish to: • explain this verbally or use gestures or other objects to depict this • draw their reflection For Project 3 – Tap Water Research Project, consider that some students may wish to: • have annotated slides/notes • explain this verbally or use gestures or other objects to depict this
What criteria will be used in each assessment to evaluate attainment of the desired results? Rubrics related to each will be developed.	OTHER EVIDENCE: • Checklists of collaborative behaviors in labs and activities • Checklists of collaborative behaviors in class discussions • Daily journal entries • Self-Assessment Rubrics for all performance tasks • Science Notebook • TO CONSIDER FOR LATER: UNIT TEST(S)	Differentiation Considerations: For journal entries, consider that some students may wish to: • draw instead of write entries • write in their first language • record verbally instead of in a written format annotated notes/slides