Grades and Standards	Example Lesson	Depth of Knowledge Questioning
<u>Grades K-2</u> **Arizona Science Standard:** Grade 2 – 2.P1U1.1 Plan and carry out an investigation to determine that matter has mass, takes up space, and is recognized by its observable properties; use the collected evidence to develop and support an explanation. **Arizona English Language Proficiency Standard:** 2.SL.6 Produce complete sentences when appropriate to task and situation to provide requested detail or clarification. **NAGC Gifted Standard:** 3.4.3. Educators use models of inquiry to engage students in critical thinking, creative thinking, and problem-solving strategies	**Objectives**: Students will (a) use complete sentences to determine and explain what qualifies an item as a solid, liquid, or gas; and (b) use problem-solving strategies to conduct a matter experiment. **Discussion**: After an introduction to states of matter, have students describe, discuss, and determine the states of matter of various objects. Provide them with items that fit one or more states of matter (e.g., a can of soda could qualify as a solid (metal), liquid (soda), or gas (bubbles). Have them categorize these items and require them to defend their choices with complete sentences **Experiment**: *Materials* – One plastic water bottle per group; Multiple water balloons per group; and multiple calcium carbonate tablets (to be provided as needed). *Procedure* – Have small groups of students fill the water bottle half-way with water and put in half a tablet of calcium carbonate. Ask students to observe and describe what happens in full sentences (e.g., It is making bubbles.) Next, have students carefully attach a balloon to the bottle opening. (They may need help). Ask	Level 2. Can you explain how a solid can be affected by a liquid? Level 3. How is gas related to liquid? Level 3. Can you elaborate on the reason this item qualifies as a solid, liquid, or gas? Level 4. Create steps for testing if an item is a solid, liquid or gas. How would you explain this to someone? What makes it qualify for one category more than another?

	students to again observe and describe (e.g., The balloon is not filling.). Ask students to brainstorm ways to make the balloon inflate (e.g., slowly add more tablets to make more gas). Discuss. (Adapted from O'Brien, 2019)	
<u>Grades 3-6</u> **Arizona Science Standard:** Grade 5 – 5.P1U1.2 Plan and carry out investigations to demonstrate that some substances combine to form new substances with different properties and others can be mixed without taking on new properties. **Arizona English Language Proficiency Standard:** 5.SL.3 Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence. **NAGC Gifted Standard:** 3.4.3. Educators use models of inquiry to engage students in critical thinking, creative thinking, and problem-solving strategies	**Objectives**: Students will (a) summarize points a speaker makes and explain how each claim is supported by reasons and evidence regarding how some substances combine to form new substances with different properties while others can be mixed without taking on new properties; and (b) engage in problem-solving to design and execute an experiment to demonstrate the differences between baking soda and baking powder. **Discussion**: Lead students in a discussion about different substances that can be mixed and what happens to their properties (e.g., salt and sugar mixed together each still have the same properties, but mixing salt and sugar with butter, eggs, and flour forms a cookie and changes their properties). **Experiment:** *Materials* – Baking powder, baking soda, vinegar, juice, ketchup, water, cream of tartar, brown sugar, a kettle, clear cups, and forks. *Procedure* -	Level 2. Explain how (the chosen substances) affect baking soda? How did they affect baking powder? Level 3. How would you adapt your experiment if you could do it over? Would you replace the ingredients you selected with something else? Why? Level 3. Can you predict the outcome if (any ingredient no one used) was swapped for the ingredients your team selected? Level 4. If there is time, design and conduct the experiment with a different ingredient. Determine which had the better outcome. Explain which is more reactionary. Why is this useful to consider in baking? Which would be better for cleaning according to your results? Use the internet for more information.

	Place students into teams and provide baking soda and baking powder. Ask teams to conduct an experiment to see what is different about the two ingredients. Have them note the difference can't be seen. Ask students for other ways determine difference. Direct students to design an experiment using baking soda, baking powder, and two of the materials listed above using the scientific method. They must present their plan to the teacher. Once the teacher clears it, they can conduct their experiment, record their results, and write a discussion summarizing the points learned using evidence from the experiment. (Adapted from American Chemical Society, n. d.)	
<u>Grades 7-12</u> **Arizona Science Standard: High School:** Essential HS+C.P1U1.5 Plan and carry out investigations to test predictions of the outcomes of various reactions, based on patterns of physical and chemical properties. **Arizona English Language Proficiency Standard:** 9-10.L.6 Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking,	**Objectives:** Students will use academic and domain specific language to plan and carry out investigations of various reactions based on patterns of physical and chemical properties. **Discussion:** Ask students to use rich academic and domain specific language to describe bouncy balls (e.g., rubbery, malleable). **Experiment:** *Materials* – borax, cornstarch, glue, warm water, cups, something to mix with, and resealable bags.	Level 2. Can you explain how (ingredient) affected (ingredient)? Level 3. How would you change the (ingredient) to make the substance have more bounce? Can you elaborate on the reason? Level 4. What other information could you gather to support your idea that (choice ingredient) was the correct ratio to increase in order to produce more of a bounce with the created bouncy ball?

and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. **NAGC Gifted Standard:** 3.4.3. Educators use models of inquiry to engage students in critical thinking, creative thinking, and problem-solving strategies, particularly in their domain(s) of talent, both to reveal and address the needs of students with gifts and talents.	*Procedure* – Pair students to create a bouncy ball using the materials listed above. Give students a recipe to begin and have them produce a bouncy ball and test the bounce.* Allow students to experiment with different ratios to see if they can produce more bounce. Students must record the exact adjustments they made and describe their results with academic and domain specific language. (Eash, n. d.) *An alternative for gifted learners would be to allow them to experiment from the beginning rather than providing an initial recipe.	