How the Inquiry Project Investigations Reflect the Science Framework Grade 5 – Investigating Water Transformations

	Water, a Liquid, Investigations 1-5	Water to Vapor, Investigations 6-9	Water to Ice, Investigations 10-12	Air, a Gas, Investigations 13-16	Two Scales, Investigations 17-18
Component Ideas about Matter and Its Interactions	*The focus*: Weight is an indicator of the *amount of matter in a system* and can be used to account for and explain transformations of matter. Even *small bits of matter* such as a drop of water or a grain of sand have *weight and volume*.	*The focus*: The process of *evaporation* involves a transformation: water particles that are too small to see break away from the surface of liquid water and spread out among other components of air, becoming a gas. The process of condensation also involves a transformation: water vapor particles lose enough energy to reconnect with other particles to form a liquid; this process depends on temperature differences between air and cooler surfaces of a 2-bottle system.	*The focus*: At the macroscopic scale, water and ice have different properties. At the microscopic scale, water and ice are made of identical particles that differ only in their motion and the spaces between them. Water particles have more space between them, on average, when they are fixed in position (ice) than when they can freely move about each other (water). The volume of a water sample increases when it freezes.	*The focus*: Air has weight, takes up space, and is composed of particles too small and too spread apart to see. Water vapor is a component of air, a gas. A particle model can explain macroscopic properties of air such as compressibility and thermal phenomena.	*The focus*: Students use a) observations from their investigations, b) their graph of weight measurements and c) a model of matter that is made of particles too small to be seen to explain matter transformations
Scientific Practices	*Planning and carrying out investigations** *Analyzing and interpreting data:* students use data to compare the weight: volume ratios of water and sand; they interpret data to find evidence of what happens to dissolved salt. *Engaging in argument from evidence:* students use weight data as evidence to explain what happens to the dissolved salt they can no longer see; weight data serves as evidence to explain what happens when the mini-lake is changed from a closed to an open system. *Developing and using models:* students create a change of weight over time graph to represent transformations in their mini-lakes.	*Planning and carrying out investigations** *Developing and using models:* students use the closed two-bottle systems to study the transformations of water and collect evidence to build the case that when it evaporates, water is transformed to vapor that is part of air in the system. *Analyzing and interpreting data:* students use observational data as they investigate the questions What happened to the water? Why do water drops form? *Constructing Explanations*: students explain changes in the two-bottle system, the disappearance of water in the lower bottle and appearance of water in the upper bottle.	*Planning and carrying out investigations** *Developing and using models*: students use a computer simulation, the Particle Magnifier, to explore the behavior of water particles at different temperatures. *Analyzing and interpreting data:* students use weight and volume data to investigate the transformations of water by freezing and melting. *Engaging in argument from evidence:* students take a position on whether ice and water are the same material.	*Planning and carrying out investigations** *Developing and using models:* students make annotated drawings and use the Particle Magnifier to test ideas about properties of gases. *Analyzing and interpreting data:* students use observational data as evidence to support claims about the properties of air. *Constructing explanations:* students use the Particle Magnifier to explain properties of air such as compressibility and thermal expansion.	*Analyzing and interpreting data:* students annotate their mini-lake graphs to tell the story of changes over time in their actual mini-lakes. *Constructing explanations:* students use their observations to explain how the shape of their mini-lake graphs changes over time. They use the particle model to explain what happened (e.g., dissolving salt, evaporation of water) at the particle level.
Crosscutting Concepts	*Systems and system models:* studying a mini-lake system helps students understand open and closed systems and transformations of matter in real lakes.	*Systems and system models:* changing the mini-lake to an open system allows evaporation to occur; a two-bottle system allows students to investigate evaporation and condensation in a closed system.	*Scale, proportion and quantity*: students look at freezing and melting of water at two scales, the macroscopic and microscopic.	*Scale, proportion, and quantity:* students use centimeter cubes to estimate the volume of a rock by building a "replica," and use displacement of water to check the accuracy of their estimate.	*Scale, proportion, and quantity:* Students tell the story of transformation of water in both the mini-lake system on a macroscopic (visible) scale and on a microscopic (particle) scale. *Systems and system models*: Investigations of the mini-lake system allows students to explain transformations of the Aral Sea.

* Planning and carrying out investigations. Each investigation in this curriculum is framed as an investigation. Guided by an investigation question, students explore phenomena and/or collect observational or measurement data. They use evidence from the data to support claim or response to the investigation question. In addition, they are expected to explain their reasoning. As they broaden their experience and build a body of evidence, students learn to construct explanations.