Dimensions illustrated in Fifth Grade Classes Regarding the Water Cycle

Drawn from the Framework for K-12 Science Education and the Next Generation Science Standards

Disciplinary Core Idea

**PS1.A: Structure and Properties of Matter, by the end of grade 5.** 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 (e.g., by weighing or by its effects on other objects). For example, a model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon; the effects of air on larger particles or objects (e.g., leaves in wind, dust suspended in air); and the appearance of visible scale water droplets in condensation, fog, and, by extension, also in clouds or the contrails of a jet. r.

[Not addressed: Measurements of a variety of properties (e.g., hardness, reflectivity) can be used to identify particular materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)]

Crosscutting Practices

*Cause and effect: Mechanism and explanation.* Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts. **By the upper elementary grades,** students should have developed the habit of routinely asking about cause-and-effect relationships in the systems they are studying, particularly when something occurs that is, for them, unexpected. The questions “How did that happen?” or “Why did that happen?” should move toward “What mechanisms caused that to happen?” and “What conditions were critical for that to happen?”

*Energy and Matter.* Matter is made of particles. Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. [Not addressed: The total weight of the substances does not change.] **Elementary grades** focus on recognition of conservation of matter and of the flow of matter into, out of, and within systems under study.

Practices

*Developing and Using Models.* Use simple models to describe phenomena concerning the functioning of a natural or designed system.

*Constructing explanations.* Offer causal explanations appropriate to their level of scientific knowledge (science).

*Engaging in argument from evidence.* Critique scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world.

*Obtaining, evaluating, and communicating information.* Use words and diagrams to communicate understanding or to ask questions about a system under study.