The Next Generation Science Standards (NGSS)

CHAPTER 3, LESSON 3: DENSITY OF WATER

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

DISCIPLINARY CORE IDEAS

PS1.A: Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)
- Each pure substance has characteristic physical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3)

Students find the density of different amounts of water and see that the density is the same regardless of the size of the sample. Students use illustrations and animations of water molecules and see that they are in constant motion, packed close together, and spread evenly throughout a sample. Students further develop their understanding of how atoms and molecules determine a material's characteristic properties, including density, and can be used to identify it.

SCIENCE AND ENGINEERING PRACTICES

Developing and Using Models

- Develop a model to predict and/or describe phenomena. (MS-PS1-1), (MS-PS1-4)

Planning and carrying out investigations

Analyzing and interpreting data

Using mathematics and computational thinking

Engaging in Argument from Evidence

Students investigate the question: Do different volumes of water have the same density? Students discover a method for finding the mass of 100ml, 50ml, and 25ml of water. They then use the mass and volume to calculate the density of each sample. Students discover that each sample, regardless of the volume, has the same density. Students graph the volume vs. the mass and get a straight line and then use the graph to predict the mass of a given volume and calculate its density. Students realize that the density of water is 1gram/ cm3 for any volume chosen.

Students develop a molecular model of water to understand why any volume of water has the same density. Students use and further develop this molecular model and apply it to evidence they have observed to explain their observations on the molecular level and to answer the question to investigate.

CROSSCUTTING CONCEPTS

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)

  Students use molecular-level models of water to explain how these sub-microscopic characteristics affect the macroscopic observable characteristic of density.

