NAME THAT MOLECULE CHALLENGE

BRAINSTORM & DESIGN LESSON

MOLECULE BRAINSTORM

It's brainstorm time! Think about all the molecules that make up everything around you. Students will explore the different types of molecules in this world to hone in on one to build.

FOR THE CLASSROOM

POSSIBLE APPROACH FOR THE CLASSROOM

LESSON LENGTH

30-50 MINUTES

OBJECTIVE

LEARN THE DIFFERENT TYPES OF MOLECULES

MATERIALS

PEN, PAPER, COMPUTER, INTERNET

VOCABULARY:

- Molecule
- Diatom
- Heteronuclear
- Homonuclear
- Brainstorm
- Design
- Criteria
- Solid
- Liquid
- Gas
- Natural
- Synthetic

PROCEDURE

1) Download and teach the MOLECULE BRAINSTORM SLIDE DECK. Feel free to customize it to suit your teaching needs.

2) ACTVITY ONE: BRAINSTORM TYPES OF MOLECULES

Put your students in groups and have them research and brainstorm the following categories to guide them with their molecule selection.

a. Liquids: Water, juice, milk and shampoo are just some of the liquids we might come in contact with daily. What molecules are they made of?

b. Gases: Take a deep breath and think about what gas molecules we take in and exhale. What molecules make up air, steam, smoke and pollution? Can you think of any other gases you interact with?

c. Solids: What types of solids do you encounter on a daily basis? Are the molecules natural or synthetic? This one is a bit tricky because some metal solids aren't made of molecules. For example, a gold bar is only made of gold atoms!

d. Food: We need food to give us energy. But have you ever thought of what molecules make up food? What does sugar, chocolate or caffeine look like? What atoms make up the carbs in bread, protein in beans or fat in bacon?

e. Human Body: Our bodies contain seven octillion atoms. (That's 7,000,000,000,000,000,000,000,000,000, or 7 with 27 zeros!) These atoms make up thousands of different molecules. What are they, and how do they help us function? And beyond humans, what about your pets?

f. Health & Medicine: Scientists design synthetic molecules for advanced medicines, treatments and therapy, but what about the more common medicines that we use for colds and cuts? Or every day natural supplements - like vitamins. What might these molecules look like?

LESSON PLAN CONTINUED
MOLECULES

PROCEDURE

3) ACTVITY TWO: DESIGN & SKETCH

Use the information gathered to choose, design and sketch your molecule that you will make in 3D

BACKGROUND INFORMATION

Classification of Molecules

When two or more atoms combine you get a molecule. Molecules can be classified by the number of atoms and type of elements in them. When a molecule has two atoms, its called a diatom. "Di" means two, so this makes perfect sense. Triatomic, is a molecule with three atoms and Tetra-atomic has four. If an atom consists of one element, like O2 (oxygen), it is called homonuclear. If an atom consists of two or more different elements it is referred to as heteronuclear.

States of Matter and Molecules

Matter can exist in three main states: solid, liquid, and gas. For example: ice, liquid water, and water vapor are made of the same molecules (H2O), but their physical properties are different due to intermolecular forces (forces that attract molecules to each other) and kinetic energy (movement of the molecules). Most matter will move through different states depending on the temperature of the environment.

Solid

In a solid, molecules are tightly packed together in a regular pattern and hold a specific shape. Intermolecular forces hold the molecules together and generally speaking, the molecules don't move. They may jiggle, but stay tightly packed and hold their shape. For the H2O example - the solid state would be ice (solid water).

Liquid

As temperature rises, kinetic energy increases and the the molecules will start to move past each other. The molecules are still attracted to each other via intermolecular forces and stay close together, but they don't have a regular arrangement. Instead, liquids take the shape of the space or container they are in. For the H2O example - the liquid state could be water in a glass.

Gas

As temperature rises even more, the molecules have so much energy that they break apart from each other. In a gas, molecules have no regular arrangement and are spread apart. The molecules move freely at high speeds and gases take the shape and volume of the container they are in. For the H2O example - the gas state could be water vapor in a pot. Gases may even have so much energy that they pop off a lid!

LESSON PLAN CONTINUED

MOLECULES

BACKGROUND INFORMATION

Food

Proteins, carbohydrates, fats and sugars are just the tip of the iceberg of food molecules that exist. Student's can dive into what molecules make up their favorite foods. For example, ice cream is made up of a mixture of water, sugar and fat molecules. Depending on the flavor, their ice cream could also have vanilla or even chocolate molecules.

Human Body

The human body is water, protein, lipids (fats), carbohydrates, connective tissue, air, hormones, bodily fluids, nervous tissue, and DNA. 99% of our bodies are made carbon, oxygen, hydrogen, nitrogen, calcium and phosphorus. These elements, along with potassium, sulfur, sodium, chlorine and magnesium combine to make the molecules in our bodies.

Health and Medicine

Some molecules in medicine are top secret chemical formulas, but others are more common - like antibiotics or penicillin people may take when they are sick. Vitamins are also a great molecule to research! Their chemical formulas are easy to find and they each have a different benefit to our health. Vitamins could also be part of the food exploration.

NEXT GENERATION SCIENCE STANDARDS

MS-PS1-1 Matter and its Interactions

Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.

- 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. Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g. Crystals)
- Crosscutting Concepts: Scale, Proportion, and Quantity
  Time, space and energy phenomena can be observed at various scales using models to study systems that are too small.