

Brainstorm & Design Your 3D Molecule

Middle School



Objectives

[MS-ETS1-1](#)

- Learn about the different types of molecules.
- Brainstorm what type of molecule to build.

Vocabulary

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

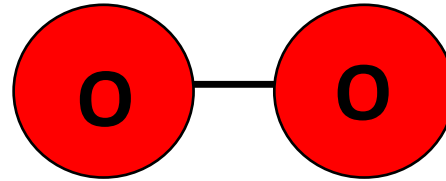


First, let's look a few ways to classify molecules.

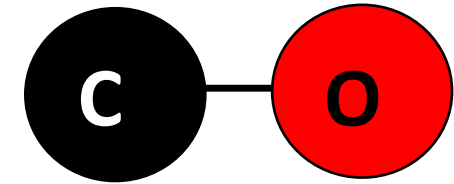
Molecules can be classified by the number of atoms in them. If a molecule has 2 atoms, it is called a diatom.

Take a look a few examples of diatoms.

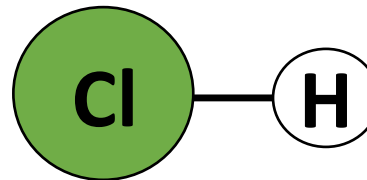
Oxygen (O_2)



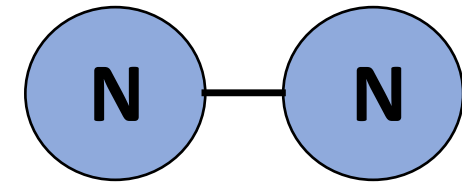
Carbon Monoxide (CO)



Hydrochloric Acid (HCl)



Nitrogen (N_2)



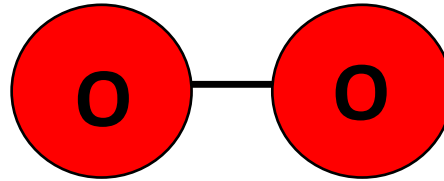
Homonuclear

When a molecule is made up of only one element, it is called a homonuclear molecule.

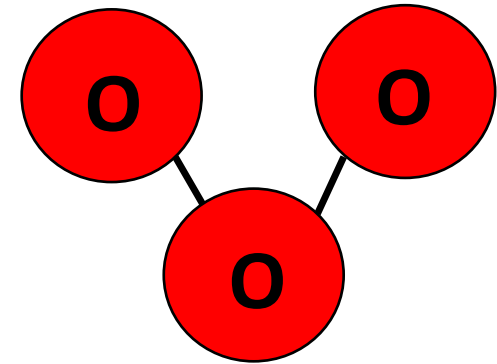
Hydrogen, Oxygen and Ozone are all homonuclear molecules.

Which one/s are homonuclear diatoms?

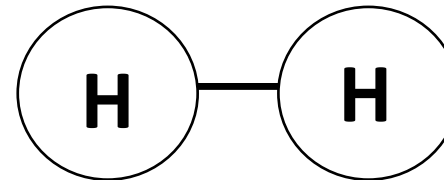
Oxygen (O_2)



Ozone (O_3)



Hydrogen (H_2)



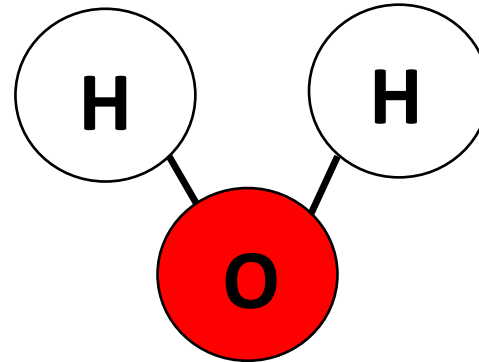
Heteronuclear

When a molecule is made up of only two or more elements, it is called a heteronuclear molecule, and more commonly is called a compound.

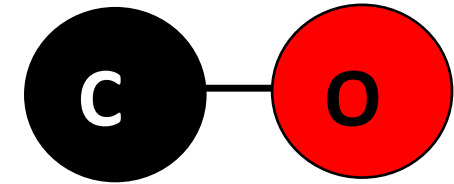
Water, Carbon Monoxide and Ammonia are all heteronuclear.

Which molecule/s are heteronuclear diatomic?

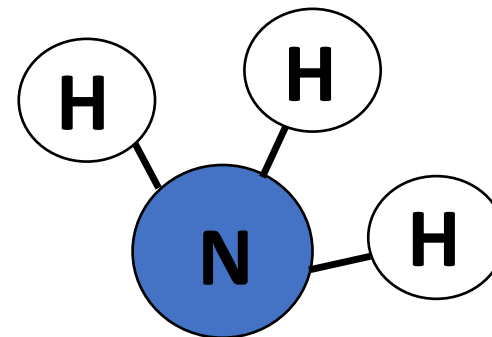
Water (H₂O)



Carbon Monoxide (CO)



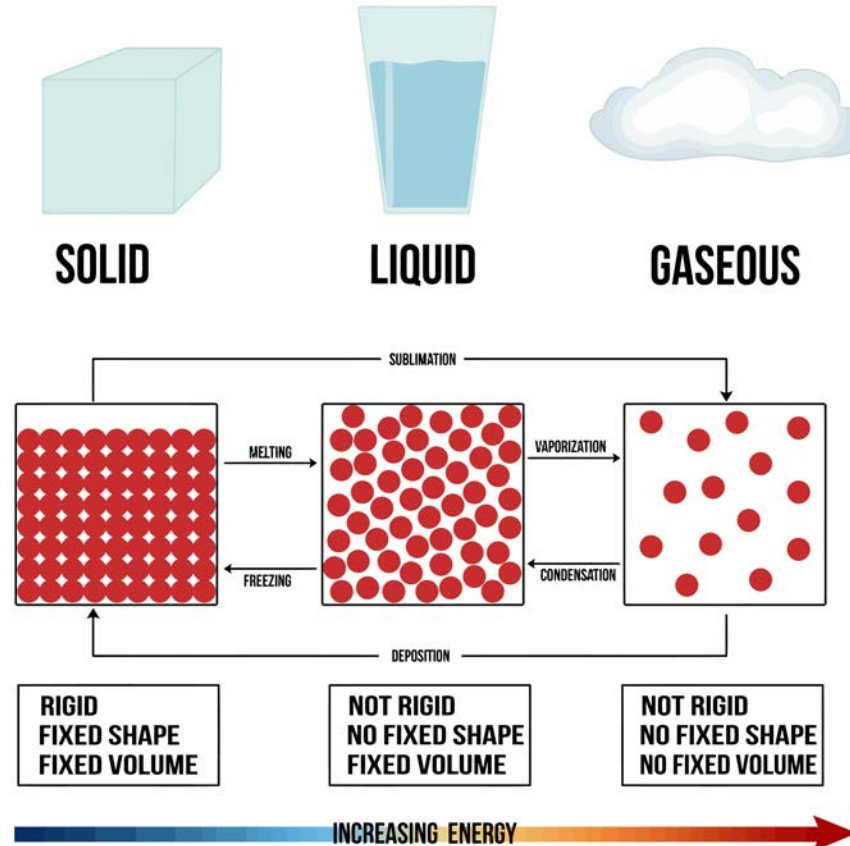
Ammonia (NH₃)



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 (H_2O), 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.

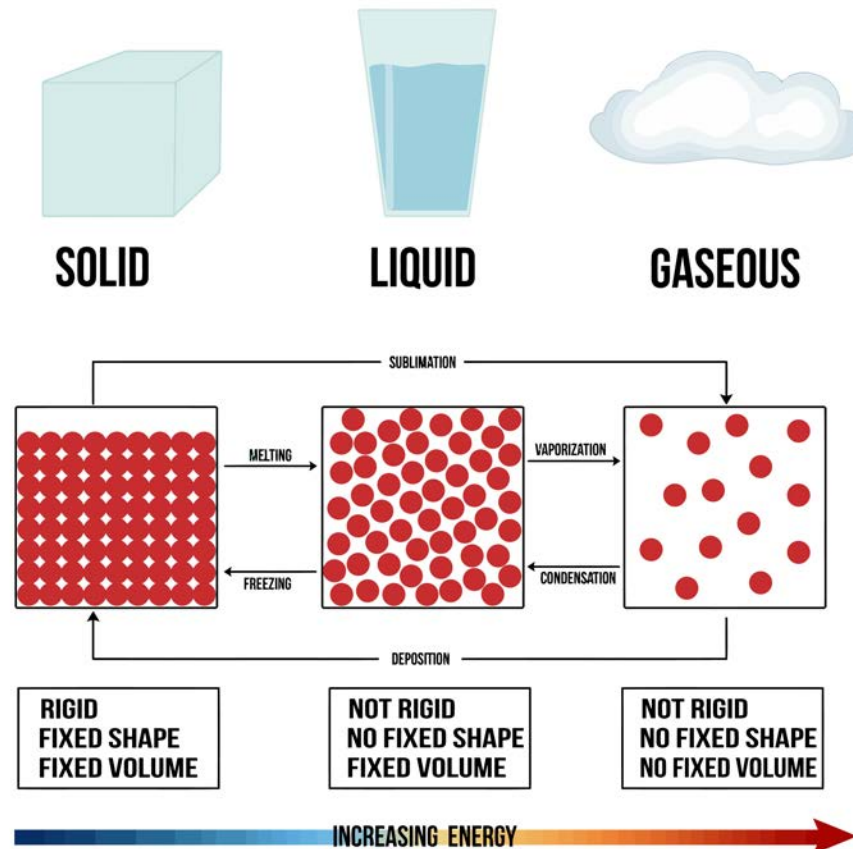
STATES OF MATTER



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.

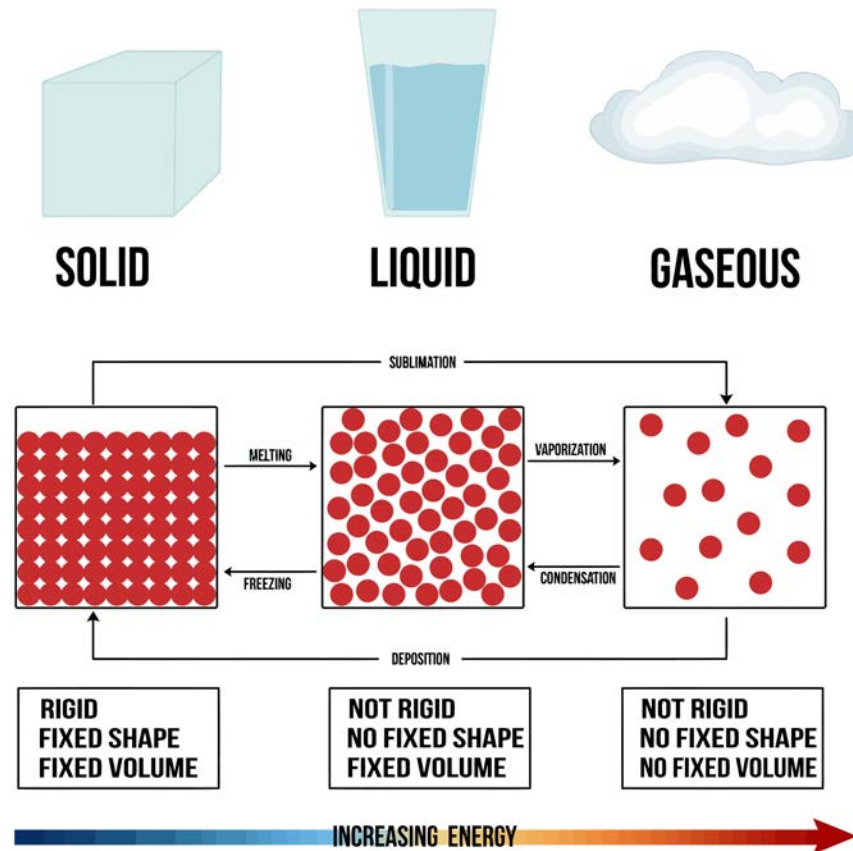
STATES OF MATTER



Liquid

At higher temperatures, kinetic energy increases and molecules will start to move past each other. The molecules are still attracted to each other via intermolecular forces and stay near each other, but they don't have a regular arrangement. Instead, liquids take the shape of the space or container they are in.

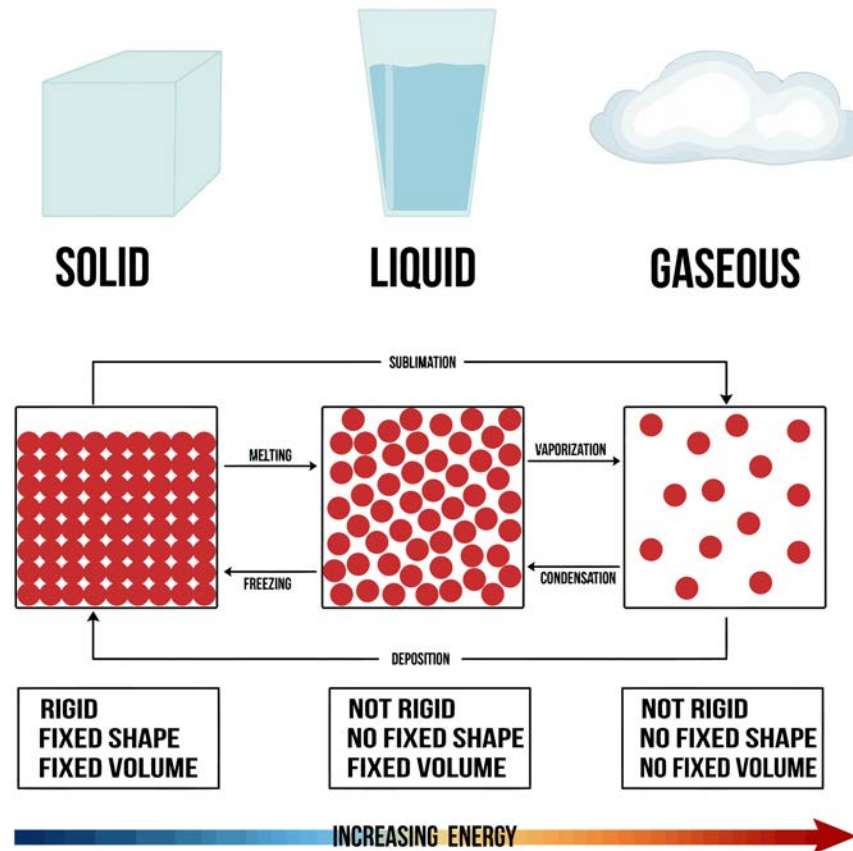
STATES OF MATTER



Gas

At even higher temperatures, 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. Gases may even have so much energy that they pop off a lid!

STATES OF MATTER



NOW IT'S TIME TO BRAINSTORM YOUR MOLECULE

For the “Name that Molecule” challenge, you need to create a digital 3D model of a molecule that you see or interact with everyday. You also need to write an explanation of your molecule including its composition, relevance in our world, and/or physical properties. So let’s start brainstorming molecules! Use the following categories as a guide.



Brainstorm Categories

Liquids

Gases

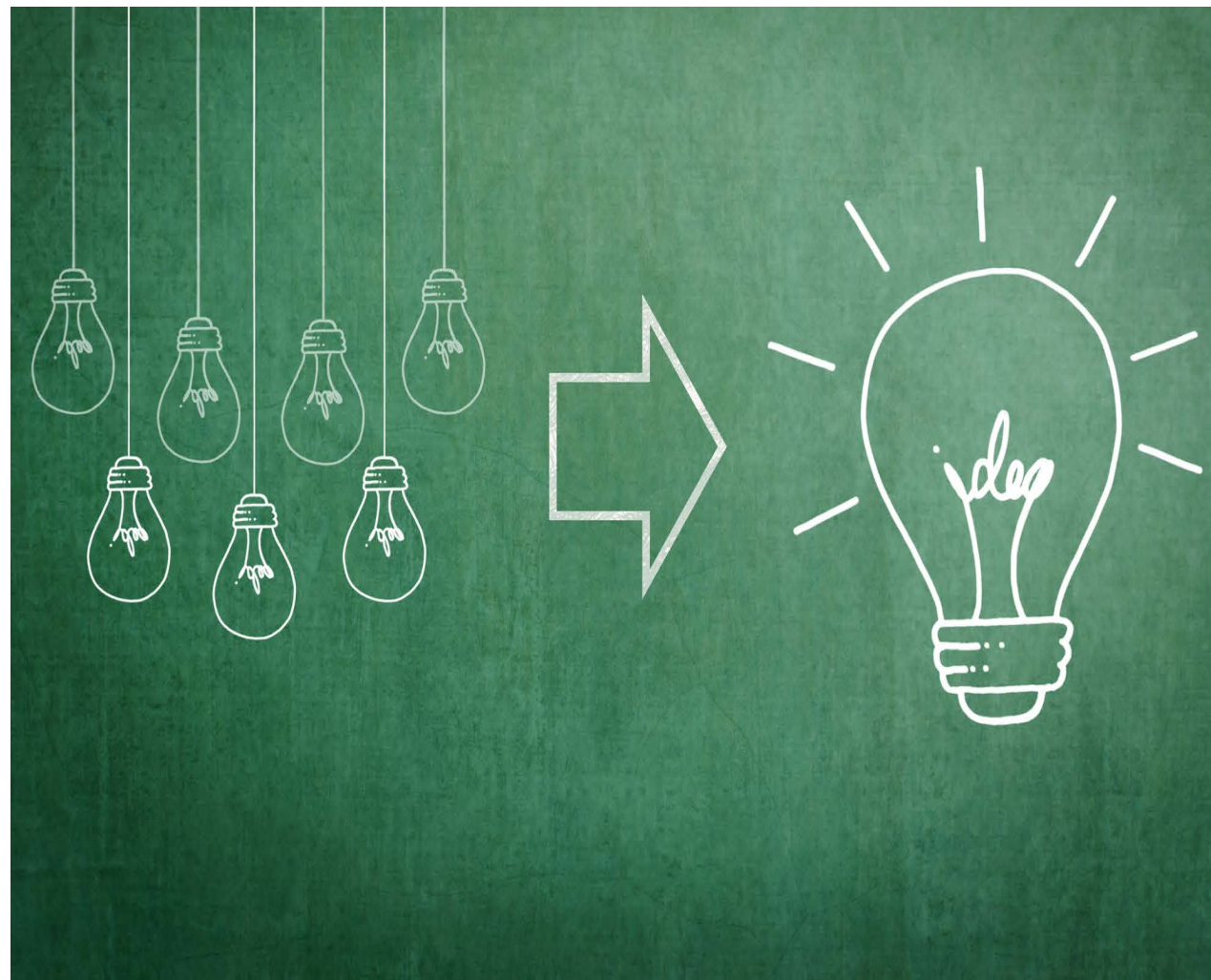
Solids

Food

Human Body

Health and Medicine

Something Else?



Liquids

Water, juice, milk and shampoo are just some of the liquids we might come in contact with daily. What liquids can you think of? What are the chemical formulas of the molecules they are made of?

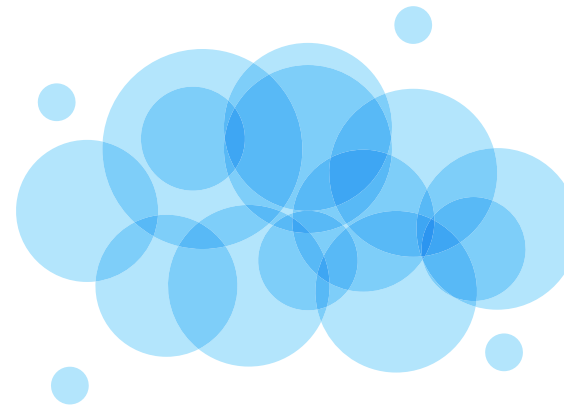
LIQUID



Gases

Take a deep breath and think about what gas molecules we inhale and exhale. What molecules make up air, steam, smoke and pollution?

GAS



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!

SOLID



Food

We need food to keep our bodies going, but what molecules make up food? What elements make up sugar, chocolate or caffeine? What do the carbs in bread, protein in beans or fat in bacon look like on a molecular level?



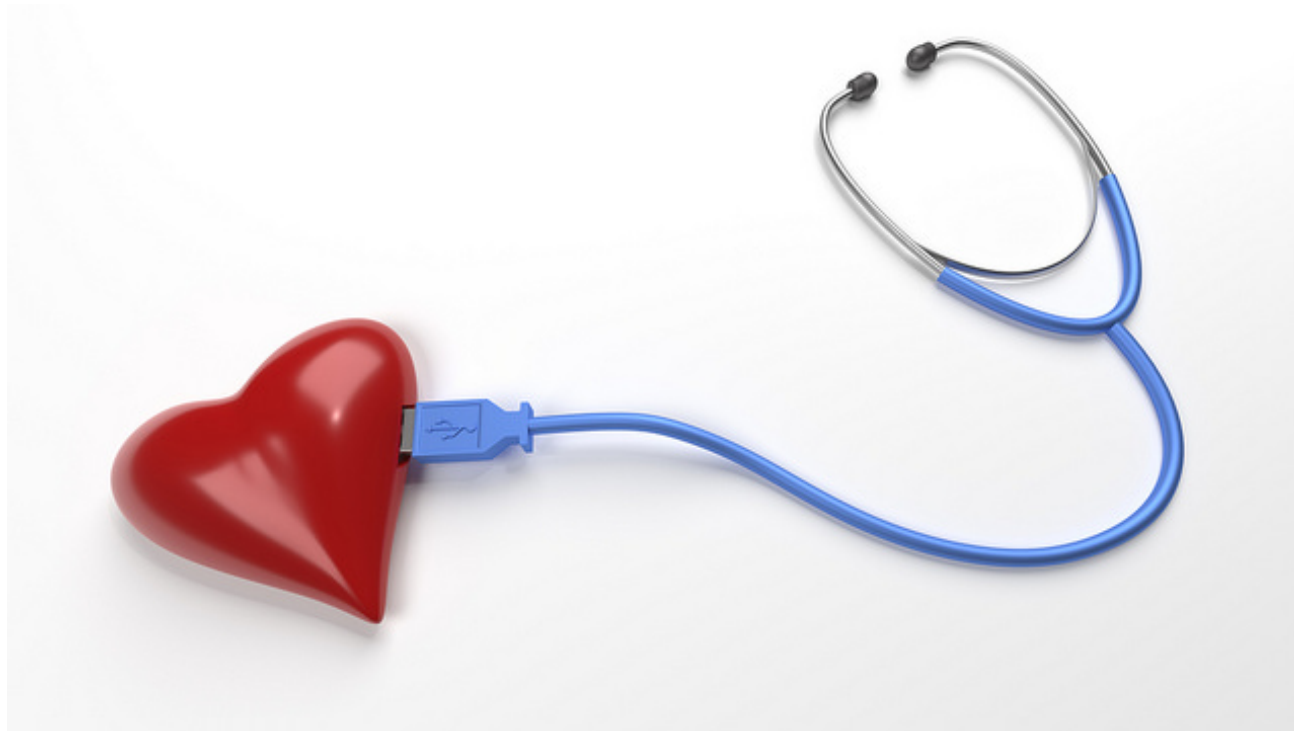
The Human Body

Our bodies contain seven octillion atoms. (That's 7,000,000,000,000,000,000,000,000!) 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?



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?



Activity: Brainstorm

It's time to brainstorm! Get your creativity flowing and think of all the different types of molecules.

Remember these "rules" when throwing out your idea.

1. There are no wrong answers
2. Try to get as many ideas as possible
3. Record all ideas
4. Do not express your evaluation on any idea presented



Activity: Design

Use your favorite idea(s) from your brainstorm to research and sketch a design for your 3D molecule.

