SLIME Pre-Lab - **Read the following passages below out loud with your partner. After you are done reading answer the questions that follow in complete sentences.**

WHAT EXACTLY IS SLIME???

The mixture of Elmer's Glue with Borax and water produces a putty-like material called a polymer. In simplest terms, a polymer is a long chain of molecules (molecules being two or more atoms combined). "Poly" means "many" and "mer" means "part" or "segment". "Mono" means "one". So, monomers are those itty bitty molecules that can join together to make a long polymer chain.

Polymers are made up of many, many, molecules all strung together to form really long chains (and sometimes more complicated structures, too). What makes polymers so fun is that how they act depends on what kinds of molecules they're made up of and how they're put together. The properties (physical or chemical) of anything made out of polymers really reflect what's going on at the ultra-tiny (molecular) level. So, things that are made of polymers look, feel, and act depending on how their atoms and molecules are connected, as well as which ones we use to begin with! Some are rubbery, like a bouncy ball, some are sticky and gooey, and some are hard and tough, like a skateboard

- What are the three ingredients used to make our slime?

- What are molecules?

- What does the word "Polymer" mean?

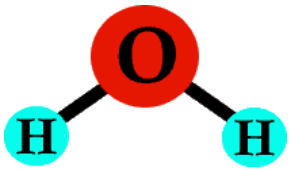
- What is a Polymer?

- What are the two things that determine the physical and chemical properties of a polymer?

- Name three places we see polymers.

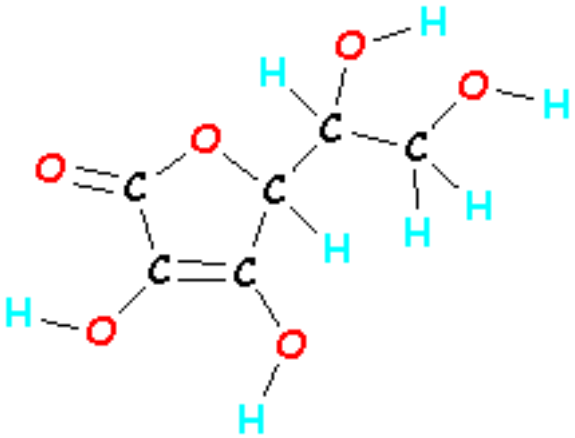
MORE ABOUT MOLECULES:

Each type of atom typically forms the same number of bonds (they tend to be stubborn that way). For example, a hydrogen atom forms one bond, an oxygen atom forms two, and carbon forms four bonds. Look at that molecule of water again - each hydrogen has one bond, and the oxygen in the middle has two bonds.



BUT Molecules can be actually be much bigger than that Water molecule shown above. Below this paragraph is ONE molecule of vitamin C, which is made up of 20 atoms (6 carbons, 8 hydrogens, and 6 oxygens - that's $C_6H_8O_6$). If you take those 20 atoms of vitamin C and mix them around, bonding them together in a different order, you'll have a totally different molecule that not only looks different, it acts different. (Its like sticking your legs out of your head, you'd act kind of different too!!)

Vitamin C:

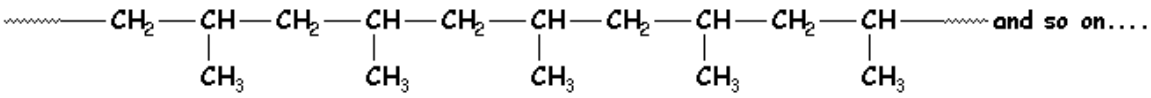


(This is only ONE molecule!)

So, molecules are atoms stuck together, but not just any old way. Changing which atom is bonded to which can change the properties of a molecule, that is, how it looks and acts - and that changes how a whole BUNCH of molecules hanging out together will look and act. For example, water is a liquid, hydrogen is a gas, and vitamin C is a solid.

"SO WHAT?!!" you ask. Well, when we talk about polymers, how the atoms are bonded to each other can have a HUGE impact on what something made out of those polymers feels like and reacts when you bash it or step on it or throw it against the wall. Like, will it stick to the wall or bounce off?

Example of a Polymer Chain: (Notice that it is the SAME molecule repeated over and over and over and over and over….)



- Which is bigger, a monomer, or a polymer? How do you know this?

- Carbon likes to form how many bonds per atom? How does this relate to the number of valence electrons Carbon has?

- If we rearranged the structure of the vitamin C molecule around and bonded the atoms differently would we still have vitamin C? Why?

- What does the word BOND mean?

- What are two types of Bonds?

SO WHY CAN SLIME DO, WELL, WHAT IT DOES?

The slime we are creating today has many things going on at the molecular (meaning: molecules and compounds). You have bonds that are holding the individual atoms together in order to make individual molecules, but then you have different bonds holding each molecule together. For example, we have covalent bonds holding the atoms of each molecule (monomer) together. But with the slime that we are creating we will bond those individual molecules together using Hydrogen Bonds. Hydrogen bonds are bonds that connect one hydrogen atom to another different atom, this happens because when hydrogen bonds it tends to become positive. As we know opposites attract and therefore hydrogen's positive is attracted to the negative of another atom holding them together. Think of it like taking a balloon and creating static electricity with your hair. Your hair is attracted to the balloon, but is easily pulled away from it. Hydrogen bonds are not created by giving up electrons or gaining electrons, nor the sharing of electrons – its only by sheer attraction of positive to negative that draws molecules together (with of course Hydrogen being the middle man). This is the weakest bond in chemistry.

- What are the three types of bonds (two were discussed in class, one in this passage)

- What are the two types used to create our slime?

- Put the bonds in order from the greatest strength to the weakest.

- When we create Hydrogen bonds, are any electrons being shared, given, or taken?

THE HISTORY BEHIND THE PUTTY:

The history of Silly Putty is quite amusing. In 1943 James Wright, an engineer, was attempting to create a synthetic rubber. This was because rubber was

becoming more and more scarce as the United States was using all of its extra resources (including rubber) to send over to their troops during WWII. He was unable to achieve the physical and chemical properties he was looking for in order to simulate rubber and put his creation (later to be called Silly Putty) on the shelf as a failure. A few years later, a salesman for the Dow Corning Corporation was using the putty to entertain some customers. One of his customers became intrigued with the putty and saw that it had potential as a new toy. In 1957, after being endorsed on the "Howdy Doody Show", Silly Putty became a toy fad. Recently new uses such as a grip strengthener and as an art medium have been developed. Silly Putty even went into space on the Apollo 8 mission. The polymers in Silly Putty have covalent bonds within the molecules, but hydrogen bonds between the molecules. The hydrogen bonds are easily broken. When small amounts of stress are slowly applied to the putty, only a few bonds are broken and the putty "flows." When larger amounts of stress are applied quickly, there are many hydrogen bonds that break, causing the putty to break or tear.

- Who created the original silly Putty formula?
- What was he trying to originally create?
- Why was he trying to create this?
- Why is Silly Putty able to stretch out when slowly pulled? Why does Silly putty break or tear when a lot of stress is quickly applied?
- Why was the original creation of silly putty considered a failure?