What is Matter?

What is matter? **Matter** is everything around you. Matter is defined as anything that has **mass** and takes up space. If you are new to the idea of mass, it is the amount of stuff in an object.

Even though matter can be found all over the Universe, you will only find it in a few forms on Earth. There are many other states of matter that exist in extreme environments. Scientists will probably discover more states of matter as we continue to explore the Universe.

States of Matter

You should know about solids, liquids, and gases, but matter can also be in a form called plasma.

What makes a state of matter? It's about the **physical state** of the molecules and atoms. Think about solids. They are often hard and brittle. Liquids are fluid, can move around a little, and fill up containers. Gases are always around you, but the molecules of a gas are much farther apart than the molecules in a liquid. If a gas has an odor, you'll be able to smell it before you can see it.

Solids, liquids, gases, are different states that have different physical properties. Elements and compounds can move from one phase to another when specific physical conditions change. For example, when the temperature of a system goes up, the matter in the system becomes more excited and active. If enough energy is placed in a system, a state change may occur as the matter moves to a more active state.

Think about it this way. Let's say you have a glass of water (H_2O). When the temperature of the water goes up, the molecules get more excited and bounce around a lot more. If you give a liquid water molecule enough energy, it escapes the liquid phase and becomes a gas. Have you ever noticed that you can smell a turkey dinner after it starts to heat up? As the energy of the molecules inside the turkey heat up, they escape as a gas. You are able to smell those molecules that are mixed in the air.

It's About the Physical

"Phase" describes a physical state of matter. The key word to notice is **physical**. Things only move from one phase to another by physical means. If energy is added (like increasing the temperature) or if energy is taken away (like freezing something), you can change the state.

States of Matter Examples

A Liquid Ocean

There are many liquids around you. Oceans, rivers, lakes, and rivers are good examples of liquid water (H_2O). Planetary scientists are looking for other planets that have liquid water, but planets require very specific conditions to have water as we know it.

Solids in Ceramics

Ceramic bowls are a great example of a solid. Did you know that many of the items found from ancient civilizations are pieces of pottery? Ceramic materials are usually made from soft clay that is heated up and then slowly cooled. The clay becomes very hard because **water** (H_2O) is removed.

Gases in Balloons

Balloons aren't technically gases. They are little pieces of rubber. However, the helium (He) inside the balloon is a gas. In its gaseous state, it is lighter than air. That lightness is why balloons float.

Changing States of Matter

All matter can move from one state to another. Sometimes a substance doesn't want to change states. You have to use all of your tricks when that happens. To create a solid, you might have to decrease the temperature by a huge amount and then add pressure. For example, oxygen (O_2) will solidify (become a solid) at -361.8 degrees Fahrenheit (-218.8 degrees Celsius) at standard pressure.

Points of Change

Phase changes happen when you reach certain special points. Sometimes a liquid wants to become a solid. Scientists use something called a **freezing point** or **melting point** to measure the temperature at which a liquid turns into a solid. There are **physical** effects that can change the melting point. **Pressure** is one of those effects. When the pressure surrounding a substance increases, the freezing point and other special points also go up. It is easier to keep things solid when they are under greater pressure.

Generally, solids are more **dense** than liquids because their molecules are closer together. The freezing process compacts the molecules into a smaller space.

Examples of Phase Changes

Melting Ice

You can watch phase changes at home when you put a piece of ice (solid) on a counter. As long as the temperature is above 0 degrees Celsius, that ice cube will warm and melt. That melted puddle of water (H_2O) is a liquid. Heat makes the phase change. Have a towel ready to clean up the mess.

Smelling Steak

Let's say you're cooking when you go camping or at a barbecue at home. When you put the food on the grill, you don't smell much. As the food heats up, aromatic molecules begin to escape the surface of the food and diffuse through the air. Those volatile molecules are heated up and become a gas when they evaporate. Heat makes the phase change.

Chemistry Term	State Change	Examples
Melting	Solid to Liquid	
Freezing	Liquid to Solid	
Boiling	Liquid to Gas	
Condensation	Gas to Liquid	
Deposition	Gas to Solid	
Sublimation	Solid to Gas	