

# Phases and Changes

## Directions:

You will set up your notes as you see below. Read the following reading selection and take notes in your notebook. When you are done you will answer some practice problems to make sure you understood the concepts. These terms will be used in our labs a lot so they are important to learn!

<b>Target: I can identify different types of phases and changes</b>		
<u>Physical Properties</u> - Phases of matter	<u>Physical Changes</u> - Phase changes	
<u>Chemical Properties</u>	<u>Chemical Changes</u>	
<u>K</u>	<u>C</u>	<u>Q</u>

## REMEMBER THE PHASES OF MATTER!

### Solid

- Definite volume
- Definite shape
- Atoms barely vibrating
- Atoms packed close

### Liquid

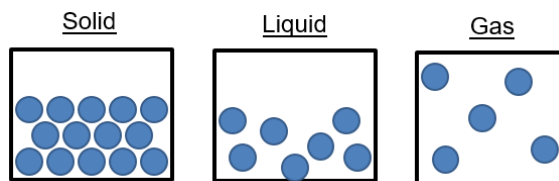
- Definite volume
- Indefinite shape
- Atoms vibrating more than a solid
- Atoms close together, but can move past each other

### Gas

- Indefinite volume
- Indefinite shape
- Atoms vibrating a lot
- Atoms very far apart

### Plasma

- High temperature state
- Atoms loose most of their electrons



**PHASE CHANGES** – When you change from one phase of matter to another phase of matter

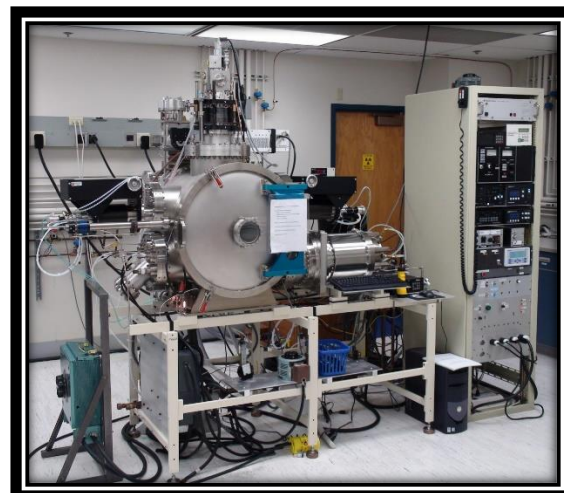
Phase changes that absorb energy, molecules are spreading further away from each other.

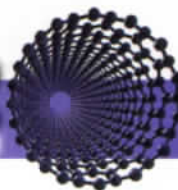
Solid → Liquid    *melting*  
 Liquid → Gas    *vaporizing*  
 Solid → Gas    *sublimation*

Phase changes that release energy, molecules are getting closer to each other.

Liquid → Solid    *freezing*  
 Gas → Liquid    *condensing*  
 Gas → Solid    *deposition*

*Sublimation and deposition are not very common phase changes that we would see in real life. Dry ice going from a solid block to the white cloud of vapor is sublimation. When water vapor in the atmosphere is at the exact right pressure and temperature the gas water molecules will instantly turn into snowflakes. That is an example of deposition. This is a picture of a deposition chamber that is used in the lab. Mrs. Farmer used to use one of these in graduate school to make computer chips that had very specific properties. It is about ¼ the size of our classroom! There are gas elements inside and you can change the pressure and temperature to instantly have them “deposit” down onto a silicon wafer to form a solid row of atoms. This allows you to layer different elements onto the wafer in layers that are one atom thick, two atoms thick, etc.*





## Physical properties and physical change

Physical properties

Properties that you can measure or see through direct observation are called **physical properties**. For example, water is a colorless liquid at room temperature. The quality of “color” is a physical property. Temperature is another physical property.



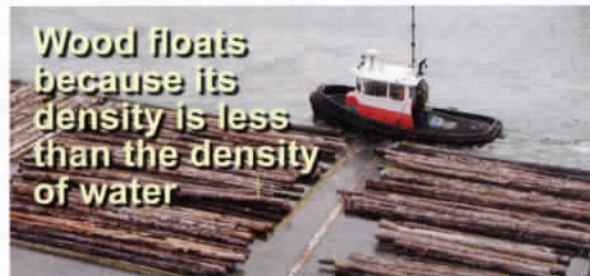
Brittleness and malleability are physical properties



Gold is a shiny, *malleable* solid at room temperature. Malleable means gold can be hammered into thin sheets without cracking. The opposite is *brittle*. Glass is brittle. Brittle materials break if you hammer or bend them. Malleability and brittleness are examples of physical properties of solid materials.

Density and phase are physical properties

The density of a material is a physical property. Wood is less dense than water, which is less dense than rock or steel. Wood floats on water because its density is lower than the density of water. The phase (solid, liquid, gas) of a material is also a physical property.



Physical changes are reversible

**Physical changes include**  
heating  
cooling  
melting  
freezing  
boiling  
dissolving  
bending  
evaporating



**Physical changes** are changes in the physical properties of matter. Physical changes can be reversed without changing one substance into another. Heating, cooling, dissolving, melting, freezing, boiling or bending are all physical changes. When water freezes, it undergoes a physical change from a liquid to a solid. This does not change the water into a new substance. The change can easily be reversed by melting the water. Bending a steel bar is another physical change. Bending changes the shape of the bar, but it is still steel.

### Chemistry terms

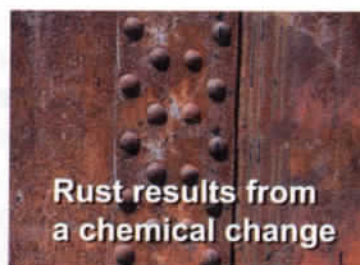
**physical property** - property such as mass, density or color that you can measure or see through direct observation.

**physical change** - a change in physical properties, such as shape, phase or temperature; for example, grinding, melting, boiling, dissolving, heating or cooling.

## Chemical properties and chemical change

Chemical properties

Properties that can only be observed when one substance changes into a different substance are called **chemical properties**. For example, if you leave an iron nail outside, it will eventually rust. A chemical property of iron is that it reacts with oxygen in the air to form iron oxide (rust).



Rust results from a chemical change

Chemical changes are hard to reverse

Any change that transforms one substance into a different substance is called a **chemical change**. The transformation of iron into rust is a chemical change. Chemical changes are not easily reversible. For example, rusted iron will not turn shiny again even if you take oxygen away.

Using chemical changes

We use chemical changes to create useful materials. The slime you made in an experiment is an example of a chemical change. The polyvinyl acetate (PVA) in the glue was a viscous liquid. Adding the borax links adjacent molecules together like rungs on a ladder. That made the liquid into a semi-solid mass, a polymer, that is more able to hold its shape.

The glue and borax together created a chemical change



Recognizing chemical change

Chemical changes are created by **chemical reactions**. A chemical reaction is any process in which one substance changes into a different substance.

A chemical reaction occurs when you mix baking soda with vinegar. The mixture bubbles violently as carbon dioxide gas, a new substance, is formed. The temperature of the mixture also gets noticeably colder. Bubbling, new substances, and temperature change can all be evidence of a chemical change.

Bubbling



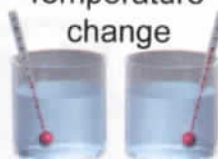
A new gas is forming

Turns cloudy



A new solid is forming

Temperature change



Chemical bonds are changing

Color change



A new substance is forming

### Chemistry terms

**chemical property** - property that can only be observed when one substance changes into a different substance - such as iron's tendency to rust.

**chemical change** - transforms one substance into another substance.

**chemical reaction** - the process that creates chemical changes.