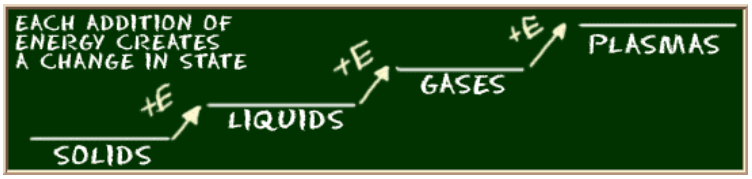
Chp3 Lect 2: Change of States 1 pt ec print

Review: 1. What are the 5 states of matter? 2. How do the molecules move in the 3 main states?

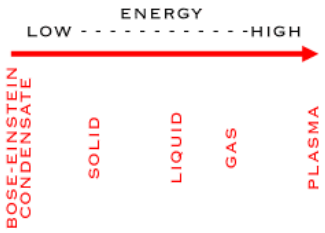
States & Phases

Each of the 5 states is also known as a _____. Elements and compounds can move from one phase to another phase when special physical forces are present. One example of those forces is temperature. The phase or state of matter can change when the temperature changes. Generally, as the _____ rises, matter moves to a more active state.



It's All About the Energy

It's totally possible to go from a solid to a liquid to a gas, and back again. These are called state changes or phase changes. But it's all about the energy. Which state you go to depends on whether you are adding or removing energy. During a change of state, the energy of the substance _____. This is related to how the particles move. If you add energy to a substance, the particles _____. If you remove energy from a substance, the particles _____. In fact, _____is a measure of the speed of particles. Each state has a different energy "requirement". In order to be a plasma, you need a ton of energy because your particles better be moving! In order to be a solid or BEC, the particles are fine just chilling - so they don't need as much energy.



Two Types of Energy Change

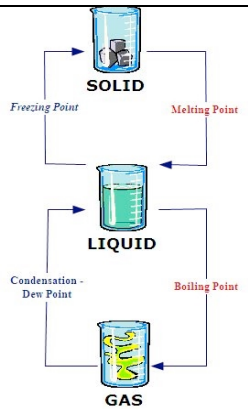
1. _____: energy is absorbed, or taken in, by a substance (absorbs heat – feel _____
2. _____: energy is removed, or taken out, of a substance (releases heat – feels _____

Melting: _____ *to* _____

Let's start with an ice cube. This ice cube starts off as a solid. When we add heat (energy), it begins to melt into a liquid.

How does melting work?

When a substance is heated, it absorbs energy and its atoms and molecules begin oscillating, or moving. Eventually, they move so much that they break some of their bonds of attraction which are holding them tightly in place. They move *so* vigorously that they begin to move past one another, flowing like a liquid. Thus, as energy is being absorbed, this is an _____ change.



Melting Point

The _____of a substance is the temperature at which a substance changes from the solid to liquid. Melting points range from low temps to very high temps. The melting point is typically a very unique property of a substance. We can use melting points to determine the identity of a substance.

Vaporization: _____*to* _____

Now let's take that water and put it into a pot over flame. Eventually, the water will start to boil and turn into a gas. _____ is the name of this process. Boiling is vaporization that occurs throughout a liquid. The temperature at which a liquid boils is its _____. The boiling point of water = _____

A special kind of Vaporization

_____ is vaporization that occurs at the surface of the liquid, below its boiling point. This happens because as the liquid is heated, some particles manage to escape early, before the boiling point is reached. When they escape, they leave the surface of the liquid to become a gas. Sweating is a natural process used by humans to cool off. When we sweat, the water absorbs the heat (energy) and gives the sensation of cooling.

How does Boiling work?

When you're heating a pot of water, the heat energy is making the water molecules move faster and faster. When enough thermal energy (heat) is added, the intermolecular forces in the substance are completely overcome and the liquid becomes a gas.

Condensation: _____to _____

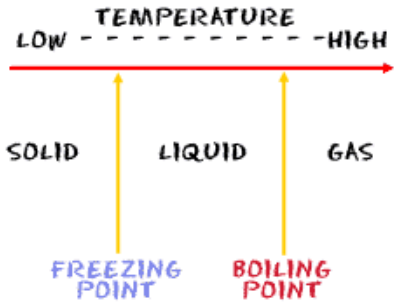
Condensation happens when several gas molecules come together and form a liquid. It all happens because of a loss of energy. Gases are really excited atoms. When they lose energy, they slow down and begin to collect. They can collect into one drop. Water condenses on the lid of your pot when you boil water. It cools on the metal and becomes a liquid again. You would then have a condensate.

Freezing: _____ to _____

Now let's reverse melting. Let's take our liquid water and put it in the freezer - where it will turn into a solid. The temperature at which a liquid changes into a solid is its _____point. Freezing is an _____change, because energy is taken out of the substance.

How does freezing work?

As energy leaves, the particles begin to slow down. They become pulled into a more ordered arrangement, or a locked position. Or basically, into a solid!



Sublimation: _____ Directly to _____

This phase change totally bypasses the liquid state. This is an _____ change, because the only way this can happen is if the atoms are suddenly moved very far apart (think of how much space a gas wants to take up). And the only way the atoms can be moved far apart from one another is if the attraction between particles is completely overcome…which requires lots of energy!

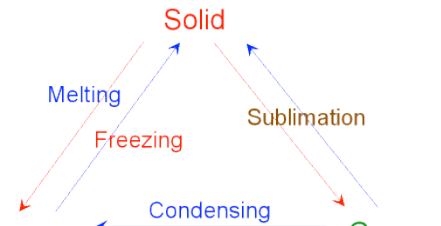
Example of Sublimation

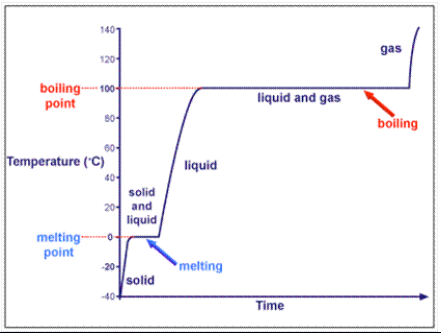
_____is an example of sublimation. Dry ice is solid carbon dioxide (CO_2). Carbon Dioxide is typically found as a gas. When it is frozen into a solid, it turns directly into a gas and totally skips the liquid stage.

Two More Really Important Points…

First, all phase changes are _____changes, not chemical changes. This is because the substance stays the same before and after the state change. It is just changing its shape, not itself!

Second, the temperature of a substance does NOT change during a phase change. It only changes before or after the change.





Summarizing the Changes of State

Change of state	Direction	Endothermic or exothermic?	Example
	solid → liquid	endothermic	Ice melts into liquid water at 0°C.
	liquid → solid		Liquid water freezes into ice at 0°C.
Vaporization	liquid → gas	endothermic	Liquid water vaporizes into steam at
Condensation	→ liquid	exothermic	Steam condenses into liquid water at 100°C.
Sublimation	solid → gas		Solid dry ice sublimes into a gas at –78°C.