Density Formula

-For liquids density is measured in g/mL or g/L

-For solids density is measured in g/cm^3

Density of water is 1.00 g/mL

2.85 > 1.00

A substance that had a density of 2.85 g/mL would Sink in water. It is More dense than water.

0.82 < 1

A substance that had a density of 0.82 g/mL would float in water. It is less dense than water.

Which substance would float or sink in water?

Substance	Density of substance	Sink or Float
A	1.35 g/mL > 1g/ml	Sink
B	0.32 g/mL < 1g/ml	float
C	2.68 g/mL > 1g/mL	Sink

Changing States

Change of state is when the physical state of a substance is transformed into another state.

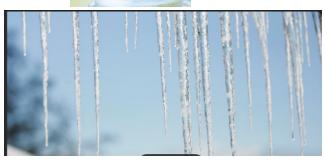
Requires an increase of heat

Melting is a change from solid to liquid 

Vaporization is a change from Liquid to gas 

Requires a Loss of heat

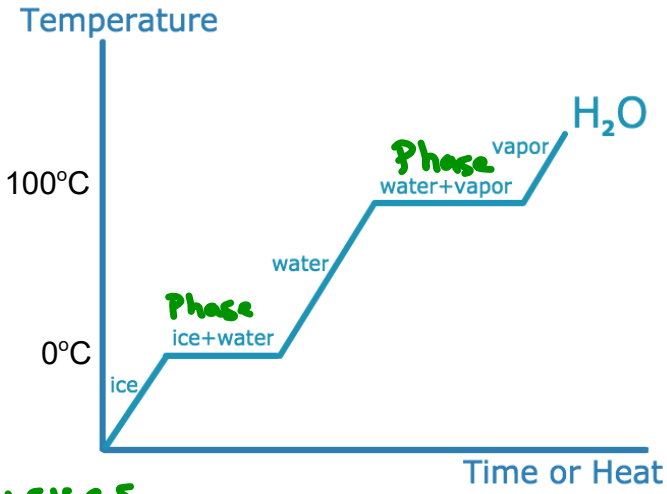
condensation - change from gas to liquid 

Freezing - change from liquid to solid 

Heating Curves

What happens to the temperature of a block of ice when you put a Bunsen burner underneath it?

You might think that the temperature goes up smoothly, but that's not what happens. The graph of temperature against time is called a heating curve. Let's look at the heating curve for water.



Heating Curves

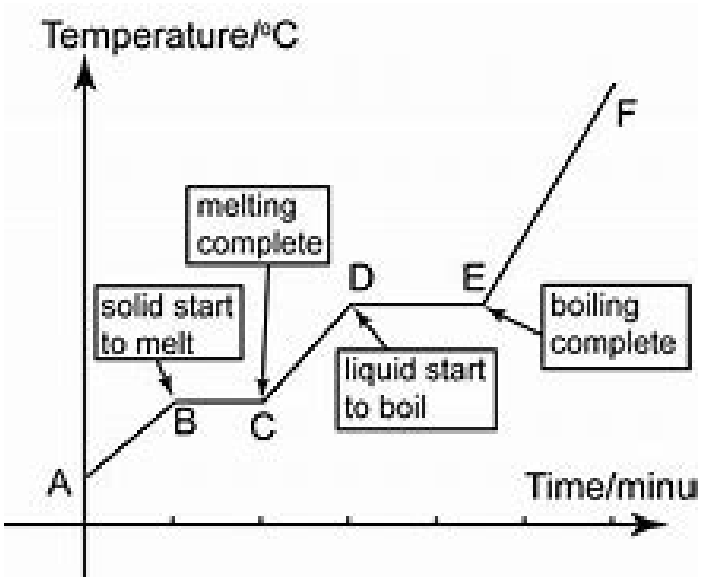
Notice that, in general, the temperature goes up the longer the heating continues. However, there are two horizontal flat parts to the graph. These happen when there is a change of state. The plateaus are also called phase changes

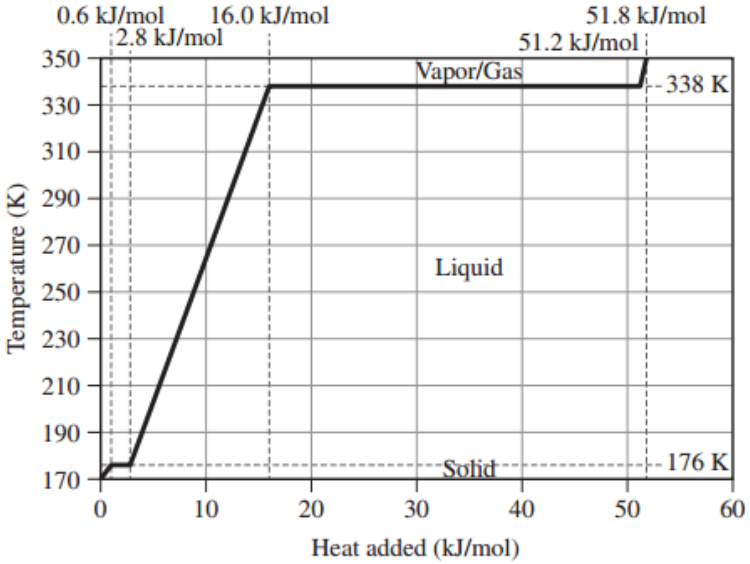
The first change of state (ice+water) is melting (changing from a solid to a liquid). The temperature stays the same while a substance melts.

> For water, this temperature is 0°C because the melting point for water is 0°C. Over the course of this line segment, both liquid and solid exist in various ratios, starting at 100% solid and ending at 100% liquid.

The second change of state (water +vapor) is boiling (changing from a liquid to a gas). The temperature stays the same while a substance boils.

> For water, this temperature is 100°C because the boiling point for water is 100°C. Over the course of this line segment, both liquid and gas exist in various ratios, starting at 100% liquid and ending at 100% gas.

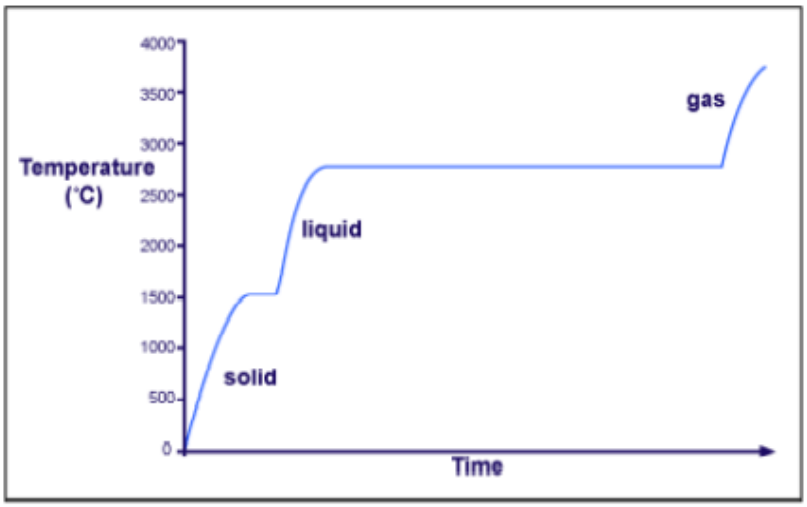

Temperature/°C
F
melting complete
D
E
solid start to melt
boiling complete
liquid start to boil
B
C
A
Time/minu


0.6 kJ/mol
2.8 kJ/mol
16.0 kJ/mol
51.8 kJ/mol
51.2 kJ/mol
Vapor/Gas
338 K
Liquid
Solid
176 K
Temperature (K)
350
330
310
290
270
250
230
210
190
170
0
10
20
30
40
50
60
Heat added (kJ/mol)

0.53 How much energy in kilojoules is released when 25.0 g of ethanol vapor at 93.0 °C is cooled to −10.0 °C? Ethanol has mp = −114.1 °C, bp = 78.3 °C, ΔH_{vap} = 38.56 kJ/mol, and ΔH_{fusion} = 4.93 kJ/mol. The molar heat capacity is 112.3 J/(K · mol) for the liquid and 65.6 J/(K · mol) for the vapor.

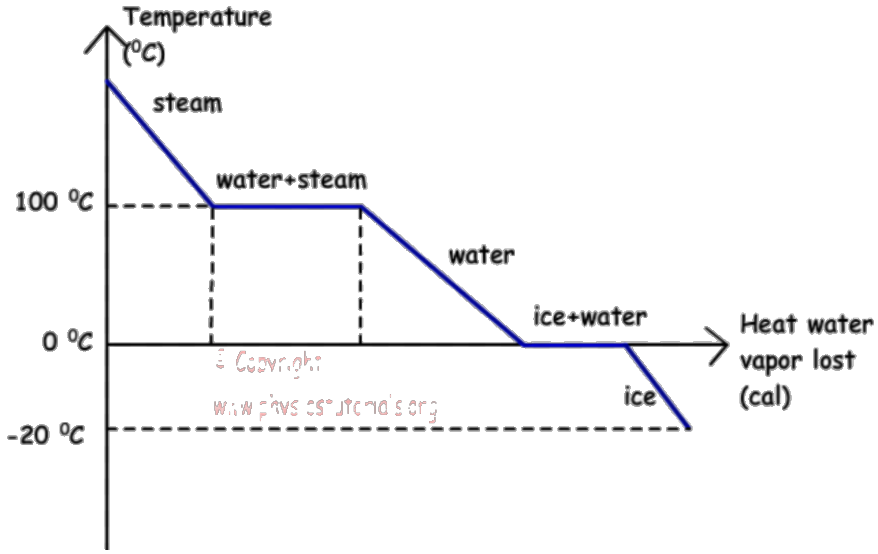
What we do in CHEMISTRY CLASS later on (High school)

Different substances have different melting points and boiling points, but the shapes of their heating curves are very similar. For example, this is the heating curve for iron, a metal that melts at 1538°C and boils at 2861°C.



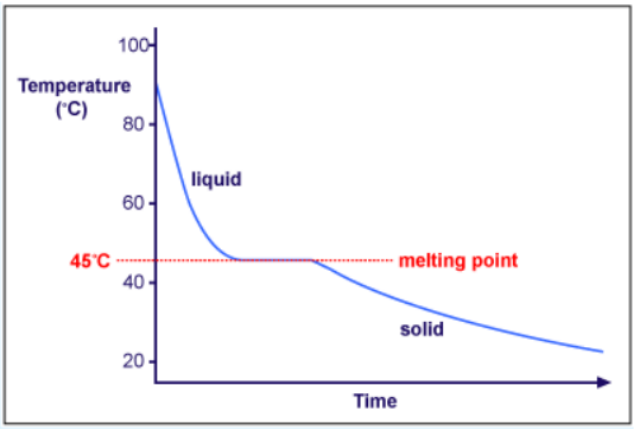
Cooling Curves

Heating curves show how the temperature changes as a substance is heated up. Cooling curves are the opposite. Cooling curves show how the temperature changes as a substance is cooled down. Just like heating curves, cooling curves have horizontal flat parts where the state changes from gas to liquid, or from liquid to solid. These are mirror images of the heating curve.



Example of Lucric Acid

Lauric acid has a melting point of about 45°C and is easily melted in a test tube placed in a beaker of hot water. The temperature can be followed using a thermometer or temperature probe connected to a data logger. The liquid may be cooled by putting the boiling tube in a beaker of cold water or just leaving it in the air.



*****Note- The melting and freezing occur at the same temperature.** During freezing, energy is removed and during melting, energy is absorbed.

Energy Changes

Since Temperature is a measure of "Average Kinetic Energy", any change in temperature is a change in Kinetic Energy. **All of the diagonal line segments on a heating or cooling curve show a temperature change and therefore a change in kinetic energy**. During these regions, a single state of matter exists and the sample is either getting hotter or cooler.

During the horizontal line segments, there is no change in temperature, so kinetic energy remains constant. However, all the energy that is absorbed or released is related to changes in potential energy.

Remember the 3 Ps:

Plateau,

Phase change

Potential Energy Change