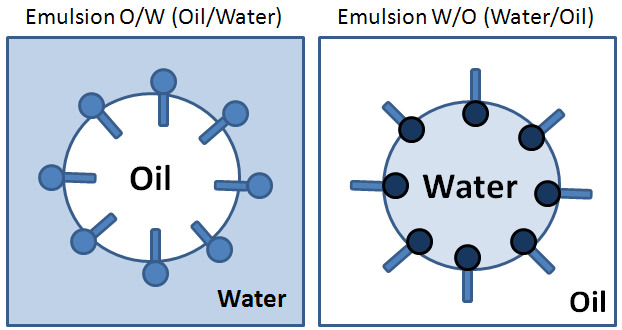
**Review Theory**

1. **Important definitions**

**Change of State:** Matter can change from one state to another by increasing or decreasing temperature or pressure.

**Emulsion**: Emulsions are a type of suspension composed of different substances or the same substances in different phases, as solid ice and liquid water. When two liquids such as oil and water – which do not usually mix together - are forced to do so by the addition of an emulsifier, the result is an emulsion. Each molecule of the emulsifier has a hydrophilic (water-loving) head and a hydrophobic (water-hating) tail. The hydrophilic head attaches itself to the water/vinegar molecules. The hydrophobic tail attaches itself to the fat/oil molecule and holds them together. Emulsions will settle into layers when they are left standing alone.



The first picture shows oil emulsion in water, the second picture shows water emulsion in oil.

For these emulsions to form certain parts of water or oil molecules have to be aligned. The parts that align are those that are the hydrophobic or hydrophilic. Examples: milk; Italian salad dressing; cheese; mayonnaise. The salad dressing is a mixture of oil, water, and other spices. The world's most naturally occurring emulsion is milk.

**Fermentation:** in food processing typically is the conversion of carbohydrates to alcohols and carbon dioxide or organic acids using yeasts, bacteria, or a combination thereof, under anaerobic conditions.

**Hydrophile:** from the [Greek](http://en.wikipedia.org/wiki/Greek_language) (hydros), meaning water, and (philia), meaning love, is a [molecule](http://en.wikipedia.org/wiki/Molecule) or other [molecular entity](http://en.wikipedia.org/wiki/Molecular_entity) that is attracted to, and tends to be dissolved by, water. A hydrophilic molecule or portion of a molecule is one that has a tendency to interact with or be dissolved by water and other polar substances. Sugar, is hydrophilic, and like salt is sometimes used to draw water out of foods.

**Hydrophobic:** from the Greek (phobos), meaning fear, is the physical property of a [molecule](http://en.wikipedia.org/wiki/Molecule) (known as a hydrophobe) that is repelled from a mass of water.

**Matter:** Matter is anything that takes up space and has mass.

**Temperature:** Temperature is a degree of hotness or coldness the can be measured using a thermometer. It's also a measure of how fast the atoms and molecules of a substance are moving. Temperature is measured in degrees on the Fahrenheit, Celsius, and Kelvin scales.

**Melting:** To melt means to change a substance from a solid to a liquid state (at a pressure of one atmosphere) by heating it to the melting point. Different substances melt at different temperatures. Water melts at 0°C or 32°F.

**Melting Point:** The temperature at which a solid turns into a liquid. When determining the melting point of a substance the temperature at which liquid is first seen is the lower end of the melting point range. The temperature at which the last solid disappears is the upper end of the melting point range. A pure substance normally has a melting point range no larger than 1-1.5 oC so a pure substance may be identified by its melting point.

The following are the approximately melting points for Margarine 30-34°C, coconut oil 24°C, cocoa butter 34-48°C.

**Mixture:**  A mixture is formed when two or more substances physically but not chemically combine and therefore can be separated again by physical methods. A mixture consists of two or more pure substances. There are two terms that are generally used when describing mixtures. Homogeneous – meaning that the mixture looks the same throughout. Example: a cup of coffee with sugar. Heterogeneous – meaning that you can see more than one color or type of matter in a mixture. Example: vegetable soup.

**Suspensions:** are mixtures in that combines a solid and a liquid. The solid does not dissolve. The solid will separate from the liquid when left standing. Suspensions are heterogeneous. An example of a suspension is sand and water. When mixed, the sand is suspended in the water, but it will settle to the bottom of the container when left alone.

1. **Things to know about Chocolate**

**Best form of chocolate:** The fats in cocoa butter can crystallize in six different forms ([polymorphous crystallization](http://en.wikipedia.org/wiki/Polymorphism_(materials_science))). The primary purpose of tempering is to assure that only the best form is present. The six different crystal forms have different properties.

|  |  |  |
| --- | --- | --- |
| **Crystal** | **Melting temperature** |  |
| I | 17 °C (63 °F) | Soft, crumbly, melts too easily |
| II | 21 °C (70 °F) | Soft, crumbly, melts too easily |
| III | 26 °C (79 °F) | Firm, poor snap, melts too easily |
| IV | 28 °C (82 °F) | Firm, good snap, melts too easily |
| V | 34 °C (93 °F) | Glossy, firm, best snap, melts near body temperature (37°C) |
| VI | 36 °C (97 °F) | Hard, takes weeks to form |

Making chocolate considered "good" is about forming as many type V crystals as possible. This provides the best appearance and texture and creates the most stable crystals, so the texture and appearance will not degrade over time. To accomplish this, the temperature is carefully manipulated during the crystallization. Generally, the chocolate is first heated to 45 °C (113 °F) to melt all six forms of crystals.[[60]](http://en.wikipedia.org/wiki/Chocolate#cite_note-temp-59) Next, the chocolate is cooled to about 27 °C (81 °F), which will allow crystal types IV and V to form. At this temperature, the chocolate is agitated to create many small crystal "seeds" which will serve as nuclei to create small crystals in the chocolate. The chocolate is then heated to about 31 °C (88 °F) to eliminate any type IV crystals, leaving just type V.

**How chocolate is made:** Cacao beans come from a large pod that grows on a tropical tree. Cacao beans are cleaned, (removing twigs, stones, and other debris) and then [roasted](http://en.wikipedia.org/wiki/Dry_roasting), and graded. Next, the shell of each bean is removed to extract the center of the cocoa bean also known as the nib. Finally, the nibs are ground and liquefied, resulting in pure chocolate in fluid form: [chocolate liquor](http://en.wikipedia.org/wiki/Chocolate_liquor). The liquor can be further processed into two components: cocoa solids and cocoa butter.

**How to Melt Chocolate:** The melting point of cocoa butter is just below 98.6°F, the body’s average temperature. In order to melt chocolate properly, use gentle heat (115°F or less) to avoid scorching it. Here are two simples way to get the job done:

* **Double Boiler Method**

Put chopped chocolate into a double boiler or heatproof mixing bowl set over a pot of gently simmering water and stir gently until the chocolate is completely melted and smooth. (Make sure the bowl doesn't touch the boiling water or the chocolate may burn.)

* **Microwave Method**

Heat chopped chocolate in a heatproof bowl at half power, stopping to stir it gently every 30 seconds, until completely melted and smooth.

**Types of chocolates:** Chocolate liquor is blended with the cocoa butter in varying quantities to make different types of chocolate. The basic blends of ingredients for the various types of chocolate (in order of highest quantity of cocoa liquor first), are as follows:

* **Raw chocolate**: often referred to as raw cacao, is always dark and a minimum of 75% cacao. Because the act of processing results in the loss of certain vitamins and minerals (such as magnesium), some consider raw cacao to be a more nutritious form of chocolate.
* **Unsweetened or baking chocolate:** pure [chocolate liquor](http://en.wikipedia.org/wiki/Chocolate_liquor), contain only cocoa butter (55%) and cocoa solids (45%). It has an intense bitter chocolate flavor and only used for baking.
* **Unsweetened cocoa powder:** contains only cocoa solids separated from the cocoa butter, can provide the most intense chocolate flavor of all, without the fat.
* **Bitter or Bittersweet chocolate:** contains at least 35% chocolate liquor with some sugar (typically a third), more cocoa butter, vanilla and sometimes [lecithin](http://en.wikipedia.org/wiki/Lecithin) have been added. The higher the chocolate liquor percentage, the darker and more bitter the chocolate.

**The most popular in the market:**

* **Dark or semisweet chocolate**: usually contains 15% to 35% chocolate liquor, low sugar, cocoa butter, and (sometimes) vanilla.
* **Milk chocolate**: sugar, cocoa butter, cocoa liquor, milk or milk powder, and vanilla
* **White chocolate:** sugar, cocoa butter, milk and/or milk powder replace some of the chocolate liquor and vanilla.

**Storage:** If refrigerated or frozen without containment, chocolate can absorb enough moisture to cause a whitish discoloration, the result of fat or sugar crystals rising to the surface.

1. **Bell work:**

While water often mixes with other liquids to form solutions, oil and water does not. Water molecules are strongly attracted to each other, this is the same for oil, and because they are more attracted to their own molecules they just don't mix together. They separate and the oil floats above the water because it has a lower density. If you really think oil and water belong together then try adding some dish washing liquid or detergent. Detergent is attracted to both water and oil helping them all join together and form something called an emulsion. This is extra handy when washing those greasy dishes; the detergent takes the oil and grime off the plates and into the water.

1. **Additional resources**

For more information about this topic visit the following links:

<http://en.wikipedia.org/wiki/Chocolate>

<http://www.wholefoodsmarket.com/recipes/guides/chocolate.php>

<http://suebailey.hubpages.com/hub/HOW-TO-MAKE-CHOCOLATE-AT-HOME>

<http://en.wikipedia.org/wiki/Coconut_oil>

<http://en.wikipedia.org/wiki/Margarine>

<http://en.wikipedia.org/wiki/Cocoa_butter>