## Heat. It’s the element of transformation. Heat takes food from raw to cooked, flabby to firm, pale to golden brown. Sizzles, splatters, crackles, steam, and aromas are all the results of applying heat to food.

## **What are the main types of cooking?**

### **Frying**

Frying is the cooking of food in oil or fat. Usually, foods that have been fried have a characteristic crisp texture. This is because oils and fats can reach higher cooking temperatures than water, which results in the food being seared. Common types of foods that are fried include; battered or breaded fish or vegetables, crisps, chips and doughnuts.

There are several different types of frying: Stir-frying, Deep-frying, Shallow-frying.

When heated, fats are modified by the combination of the oxygen in the air and the increasing temperature. The most visible modifications are an increase of the coloration (browning) and the viscosity, the apparition of foam and the formation of off-flavors. The smoke point of an oil or fat is the temperature at which it gives off smoke. The smoke point generally refers to the temperature at which a cooking fat or oil begins to break down to glycerol and free fatty acids.

**Baking**

Baking is the process of cooking foods in the dry heat of an oven. During baking, moisture within the food is converted to steam, which combines with the dry heat of the oven to cook the food. Common types of foods that are baked include; bread, cakes, jacket potatoes, and pastries.

**Boiling**

Boiling is the cooking of foods in a liquid (e.g., water, milk or stock), which is at boiling point. Common types of foods that are boiled include; vegetables, rice and pasta.

Blanching is a very similar cooking technique to boiling and involves immersing food into a boiling liquid for a very short period of time, before being removed and plunged into ice water to stop the cooking process. Common types of food that are blanched include; vegetables and fruits.

### **Simmering**

Simmering is also a similar cooking method to boiling, except that the food is cooked in a liquid, which is held below boiling point. The simmering point of most liquids is between 85-95oC, and compared to boiling, is a gentler, slower method of cooking. Common types of foods that are simmered include; vegetables, soups and sauces.

Poaching is a comparable cooking technique to simmering, except that the temperature of the liquid the food is cooked in is slightly cooler than simmering point (around 70-85oC). This makes poaching an ideal method of cooking fragile foods such as eggs and fish.

### **Grilling**

Grilling is the cooking of food using a direct, dry heat. There are several sources of dry heat that may be used for grilling including; charcoal, wood, gas or electric heated grills. Common types of food that are grilled include; fish, meat, vegetables and bread.

### **Steaming**

Steaming is the cooking of foods by steam. Steam is generated by boiling water, which evaporates and carries the heat to the food. Typical foods that are cooked by steaming include vegetables and fish.

### **Roasting**

Roasting is the cooking of food using dry heat. This may include cooking in an oven, or over an open flame. Normally, the food is placed in a roasting pan, or rotated on a spit to ensure an even application of heat. Typical foods that are cooked by roasting include meat and vegetables.

## ***What happens to food when it is cooked?***

Heating causes a complex series of physical and chemical changes to occur. These changes vary depending on the type of food being cooked and the method used to cook it. The changes may be advantageous e.g., improving the flavor, texture and color of the food, or they may be disadvantageous e.g., reducing the nutrient value of the food, or the generation of undesirable compounds. The main physical and chemical changes that occur during the cooking of foods are discussed below.

**Flavor**

#### **Caramelization -** produces the desirable flavors and colors, that are characteristic of many food products such as dark beer, coffee, confectionery and peanuts. The caramelization reaction occurs when foods containing a high concentration of carbohydrates are cooked at high temperatures using a dry-heat e.g., roasting peanuts, setting-off a chain of chemical reactions:

1. As the food is heated, the sucrose in the food melts and starts to boil. The temperature at which this occurs is known as the caramelization temperature, which (depending on the types of carbohydrates present in the food), is generally between 110oC – 180oC.
2. Once the caramelization temperature has been reached, the sucrose begins to decompose into its component monomer molecules, glucose and fructose.
3. A further series of complex chemical reactions take place between the molecules, which, ultimately results in the generation of flavor compounds.

In actual fact, caramelization generates hundreds of flavor compounds. One of the most important flavor compounds produced is diacetyl. Diacetyl is generated during the initial stages of caramelization and has a butterscotch flavor, which provides one of the characteristic flavors of caramelized foods. Other important flavor compounds produced during the caramelization reaction include the furans hydroxymethylfurfural and hydroxyacetylfuran, and maltol from disaccharides and hydroxymaltol from monosaccharides, which together contribute to give the sweet, slightly burnt flavor of the caramelization reaction.

The flavors generated during caramelization can vary substantially, depending on the type of carbohydrate undergoing the reaction. However, in general, there is a decrease in sweetness and an increase in burnt, bitter notes in all caramelization reactions as the temperature is increased.

**Color**

***Caramelization* -** As well as the generation of important flavor compounds, the caramelization reaction is one of the most important types of browning processes in foods. During the caramelization reaction, molecules known as caramels are generated. Caramels can be divided into three groups; Caramelans, Caramelens and Caramelins, and it is these compounds that are responsible for the characteristic brown color of caramelized foods. As with flavor generation during the caramelization reaction, the color of caramel also varies depending on the type of carbohydrate undergoing the reaction. However, for all caramelization reactions, the color becomes darker as the temperature is increased.

## **Texture**

### ***Protein denaturation* -** Many foods contain proteins, such as meat, fish, eggs, vegetables, nuts and pulses. Proteins are large molecules, composed of strands of amino acids, which are linked together in specific sequences by the formation of peptide bonds. Proteins form different 3-dimensional structures, by the folding and subsequent bonding of the amino acid strands. Generally, the bonds which link the folded amino acid strands together (mostly hydrogen bonds), are much weaker than the strong peptide bonds forming the strands.

During cooking, the heat causes the proteins to vibrate violently, which results in the breakage of the weak hydrogen bonds holding the amino acid strands in place. Ultimately, the protein unravels to re-take its initial form of amino acid strands.

The denaturation of protein molecules in foods usually causes a substantial change to the texture of the product. For example, egg white is composed of two key proteins; ovotransferrin and ovalbumin. As the egg white is heated, ovotransferrin begins to denature first, entangling and forming new bonds with the ovalbumin. As the temperature increases, ovalbumin then starts to denature, unravelling and forming new bonds with the ovotransferrin, until denaturation and rearrangement of the protein molecules are complete. In this case it results in the change of a runny, fluid texture to a rigid, firm texture.

Conversely, protein denaturation can also cause the formation of softer textures. For example, the protein collagen, which is the major component of the connective tissue in meat, has a tough, chewy texture. However, during cooking, the weak hydrogen bonds are broken and the protein begins to decompose and react with water molecules to form gelatin. This tenderizes the meat, giving it a softer, more palatable texture.