



The Effect of Heat on Food Knowledge Organiser

Key Term	Explanation
denature	Altering protein structure or properties through heat, enzyme or chemical.
coagulate	Change of protein from liquid to solid (irreversible).
foams	Mousse, whipped cream, cappuccino foam.
gluten	The protein found in wheat flour.
caramelisation	Browning of sugar and changing of its flavour when heated.
dextrinisation	Starch breaks down into dextrin in dry heat.
gelatinisation	Starch swells and thickens.
plasticity	Ability to be shaped.

Heat Effects on Proteins

Gluten

When water is mixed with flour, it forms a dough. As the dough is kneaded, it wakes up the gluten which becomes stretchy and strong.

When it reaches a high temperature, it coagulates whilst keeping the dough stretched. This forms a well risen bread with a light airy texture.

Foams

Foams are formed when air is trapped inside the liquid. If air is then allowed to coagulate (whisking egg whites), it will form a foam. Over-whisking will allow air to escape and foam will collapse.



Heat Effects on Proteins

During cooking, protein denatures and coagulates. Heat causes loss of moisture, shrinkage and the product to become firm. Most proteins coagulate between 71-85°C.

Examples of protein reacting with heat:

- egg whites changing from clear liquid to solid;
- meat fibres becoming firm;
- wheat proteins in bread (gluten) changing during baking.

Denature

This is when proteins unravel and their chemical bonds break down.

Ways in which proteins can be denatured:

- **physical** – whisking, beating and kneading;
- **changing their temperature** – heating, freezing;
- **adding chemicals** – acids, lemon juice and marinades.

Coagulate

This means water becomes trapped in between the protein molecules which have been broken down. Coagulation happens when proteins are denatured and changes appearance and texture of food.

Heat Effects on Carbohydrates

Gelatinisation

The change in starch is called gelatinisation. When starch and liquid are heated together, starch granules absorb water to soften and swell. This occurs at 66°C and above.

The thickness of a starch-based sauce depends on the ingredient ratio. It must be stirred continuously to prevent lumps forming.

When cooled, the liquid solidifies, e.g. lemon pie filling.

Dextrinisation

This is a chemical change to the starch molecule caused by the breakdown of sugars. It gives food a browner colour, crispier texture and different taste.

The longer food is cooked, the more starch is converted into dextrin, resulting in a darker and crispier food.

Caramelisation

As sugar is heated, it first turns runny and very sweet, followed by becoming a caramel and sticky. As it cools, it solidifies into a solid candy.

Most heat methods cannot get the sugar at a high enough temperature, therefore it is caramelised through the dry heat method.



Heat Effects on Fats - Plasticity

Fat cannot evaporate; it softens and liquefies when heated. However, different fats melt at different temperatures, meaning a variety of fats are used for different processes.

The more plasticity a fat has, the easier it is to spread. Unsaturated fats tend to be softer than saturated fats and therefore have more plasticity.

The plasticity of fat has many uses:

- decorating cakes with buttercream;
- rubbing fat into flour to make pastry;
- spreading butter on toast;
- cream cheese on crackers.

Heat Effects on Water - Evaporation

- Some foods are made up of almost entirely water.
- As these foods are heated, the molecules move faster until the water turns into steam and evaporates.
- When too much water evaporates from food, it causes it to become dry.