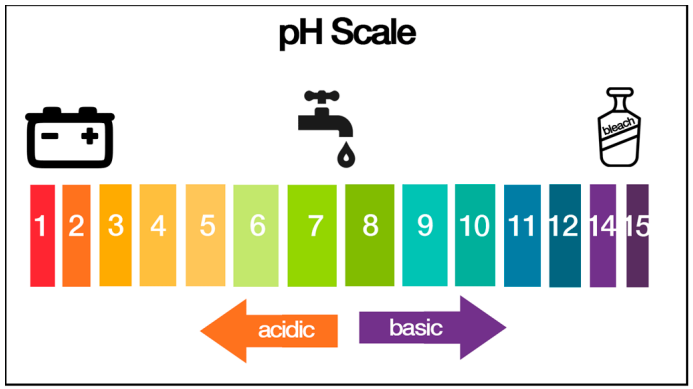
Food Preparation and Nutrition
GCSE
Food Science

Fats
Some **solid** at room temperature,
others, with less hydrogenation
are **liquid**
Dissolve certain **flavour** compounds, **fat-soluble vitamins**, and colours that water cannot **dissolve**
Tenderise foods
Fat smokes at 191°C
Oils smoke at 232°C

Proteins
Determine the **texture** of food
Proteins shaped like coils that react to certain items
Heat, salt, and acids make coils unwind, producing a **soft texture and loose bonds**
Tight bonds result in **coagulation**, forming a denser texture (like custard)
Kneading proteins produces **tight bonds (bread dough)**
Coagulation causes proteins to **loose water**

Carbohydrates: Starch
Breads, pasta, grains, starchy vegetables, fruits
Starch molecules soften in moisture
Absorb moisture and **swell**, causing liquids to **thicken**
Starch cells stick to one another and **trap moisture**
Carbohydrates: Sugar
Water molecules are **attracted** to **sugar** so the presence of significant **sugar** in a cake **will** help capture and hold on to liquid.
This results in a moister cake.
Leavening – When **sugar** is creamed with butter, the **sugar** crystals help drive air into the mixture



Conduction
The transfer of heat from one object to another by direct contact.
Examples of how heat transfer via conduction works:
Touching a burner on a stove and being burned
Pancakes
Grilling steak, chicken breasts, or pork chops
Using ice water to blanch vegetables after steaming to keep them from losing their colour.

Radiation
Radiation is the process where heat and light waves strike and penetrate your food through electromagnetic energy.
There is no direct contact between the heat source and the cooking food.

Acids and alkalis
pH range measures level of acid/alkali in food
pH scale is 1–14,
1 being the most acidic
7 is neutral (water)
1–6 acid
8–14 alkaline
Foods being close to either end are not usually considered potentially hazardous

Convection
Examples of how heat transfer via convection works:
Water coming to a boil and circulating in the pot
Running cold water over frozen food, which transfers heat into the food to thaw it more quickly
Room temperature air moving around frozen food to thaw it.

Infrared Radiation
Utilises an electric or ceramic heating element that gives off **electromagnetic energy waves.**
These **waves travel** in any direction at the **speed of light** to quickly heat food, and are mainly **absorbed** at the **surface** of whatever you're preparing.
Examples of things that create infrared radiation are:
Glowing coals in a fire
Toaster
Grills

Microwave Radiation
Utilises **short, high-frequency waves** that **penetrate** food, which a**gitates its water molecules** to create **friction** and **transfer heat.**
If you're heating a solid substance, this heat energy is transferred throughout the food through **conduction**, while liquids do so through **convection**.
Microwave heat transfer usually **cooks** food **faster** than infrared radiation, as it is able to penetrate foods **several inches** deep.
Keep in mind that microwave radiation works best when cooking **small batches** of food.

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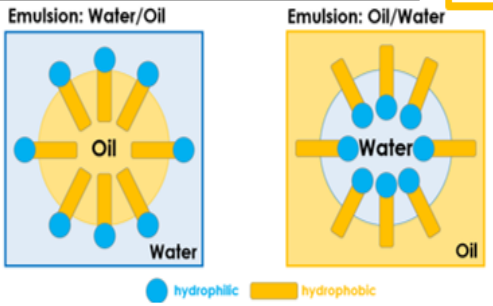
Emulsification



Vegetable oils do not dissolve in water. If oil and water are shaken together, tiny droplets of one liquid spread through the other liquid, forming a mixture called an emulsion.

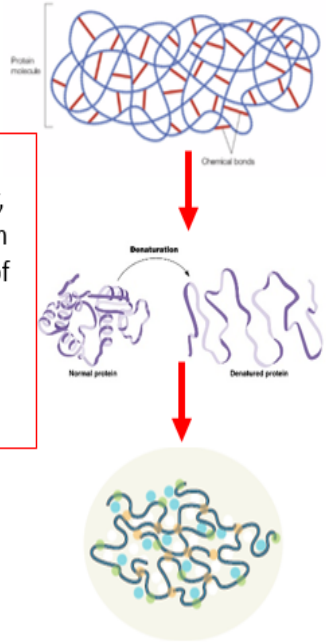
Emulsions are **thicker** (more viscous) than the oil or water they contain. This makes them useful in foods such as **salad dressings and ice cream**. Emulsions are also used in **cosmetics** and **paints**. There are two main types of emulsion:
Oil droplets in water (milk, ice cream, salad cream, mayonnaise)
Water droplets in oil (margarine, butter, skin cream, moisturising lotion).
If an emulsion is left to stand, eventually a layer of oil will form on the surface of the water. **Emulsifiers** are substances that **stabilise** emulsions, **stopping them separating** out.

Egg yolk contains a natural emulsifier. Mayonnaise is a stable emulsion of vegetable oil and vinegar with egg yolk.

Emulsifier molecules have two different ends:
a **hydrophilic end** - **'water-loving'** - that forms chemical bonds with water but not with oils
a **hydrophobic end** - **'water-hating'** - that forms chemical bonds with oils but not with water.

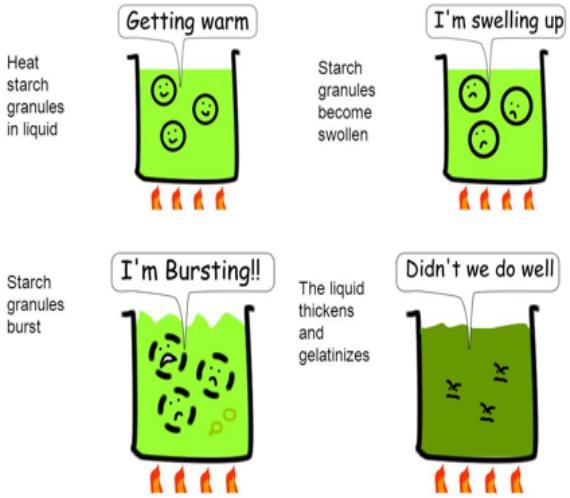
Denaturation and Coagulation

The structure of protein changes when heat or mechanical action (beating) is applied. This causes the tangled up protein molecules to unravel.



When proteins denature, they tend to **bond** together, or **coagulate (set)**, and form **solid clumps**. An example of this is a cooked **egg white**, which changes from a transparent fluid to an opaque **solid**.

Gelatinisation



Starch gelatinizes when heated in a liquid, producing a thickened liquid

Starch particles do not dissolve in water

They form a 'suspension'

If the suspension is not stirred, the starch particles sink to the bottom and stick together to form lumps

If heated to **60°C** the starch particles will begin to absorb the water and swell

If heated to **80°C** the particles will absorbed up to 5 times their volume of water, until eventually they burst, releasing starch and thickening the liquid.

Dextrinisation

When a starch (e.g. flour) is cooked in a dry heat (example oven), **dextrins** are produced. This process is called dextrinisation.
Dextrins are a *monosaccharide*- a type of sugar. This means they have a ***sweeter*** *taste* than starch.
Dry heat (oven/grill) causes starch to change colour, texture and flavour.
Starch changes to **dextrin**.