food CHANGES

Types of food changes

The different forms that food takes are called **states of matter**. Solid, liquid and gas are all states of matter. When food is made, prepared or cooked, it goes through physical or chemical changes – or a combination of both. There are clues that you can look for to tell that a change is happening.

Physical changes to a food's state of matter involve a change from one form to another. For example, when an ice cube melts, there is a physical change because energy was added in the form of an increase in temperature. The ice cube changed from a solid to a liquid.

Matter can change by adding or removing heat. A substance's state of matter can be changed by adding heat – this includes melting or boiling.

A substance's state of matter can be changed by removing heat – this includes condensation or freezing.

Food Change Clues

A change in a food's temperature. When you see steam rising from a hot drink or a pot of boiling water, a physical change in its state of matter is happening.

A change in the food's volume or shape. When you see a square block of ice cream melting into a flat puddle if it's left out of the freezer, a change in its state of matter is happening.

A change in the appearance of a food. Think about cooking a piece of chicken or turkey. You can see changes to its colour, size, texture and smell. Or think about frying onions. When we heat onions, the natural sugars inside them start to break down and change their colour and smell.

Another clue is bubbles. Think about frying pancakes or baking a cake. The bubbles that form on the pancake are filled with gas. The small holes you see in a baked cake were filled with gas when it was a batter. These bubbles are a sign that a chemical reaction or change has happened.

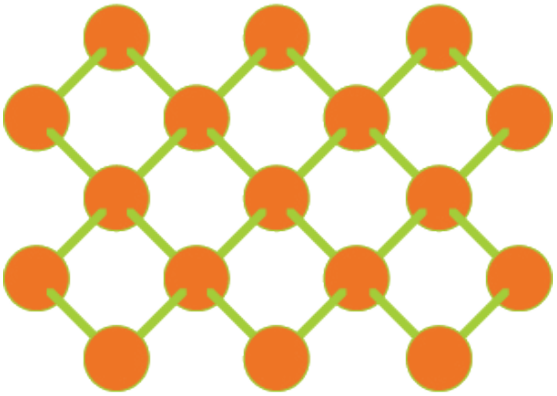
Chemical changes can often be seen when food is prepared or cooked. Chemical changes happen when the substances in a food interact and create a different substance that has new properties. These new properties can include different smells, tastes, textures and colours.

Digging deeper into food changes

The physical and chemical changes that foods go through when they are prepared or cooked can be explained by looking much, much closer at what foods are made of. The foods we eat are made up of tiny, invisible **particles**.

These particles are always moving, even if we can't see them. However, the speed the particles move at depends on the state of matter of the food starts in!

The particles in all matter are attracted to each other, something like a magnet. This is called **particle attraction**. The arrangement of particles in solids, liquids and gases is affected by particle attraction.



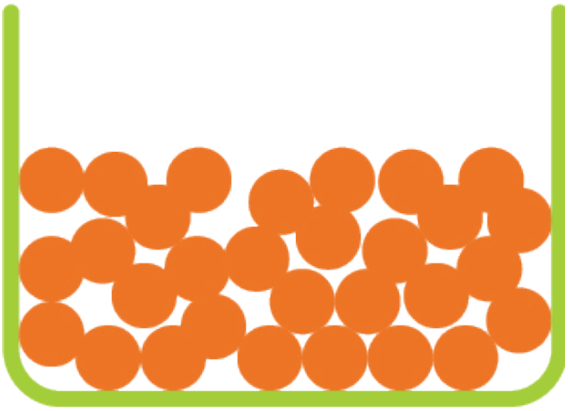
Solids, like butter and bread, have a fixed shape and volume. They hold their shape.

The particles in solid food are closely packed together. They do not move very much.

The particle attraction is strong in solids. It keeps the particles close together in a regular pattern that forms a definite **shape and volume**.

Liquids, like milk and juice, take the shape of the container they are in. That's because the particles in liquids are still close together, but they can slide or move past each other.

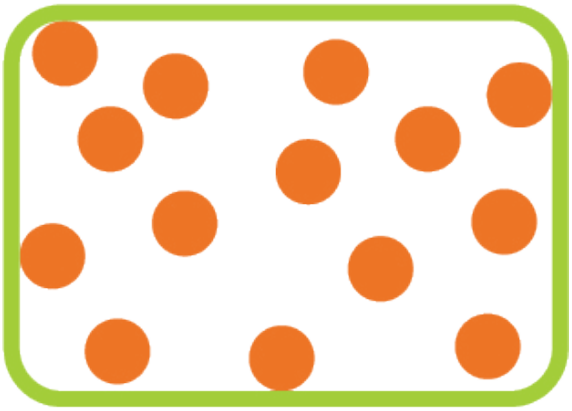
The particle attraction in liquids is weaker than it is in solids. This allows the particles to move more freely and flow past each other.



Gases, like the bubbles that rise from carbonated drinks, or the air bubbles in an egg white meringue, or the steam rising from food cooking in a pot, do **not** have a definite shape or volume.

The particles in gases are spread far apart and move around freely and randomly. They can go anywhere and fill up any space.

The particle attraction in gases is weak or doesn't exist at all. This allows the particles to move at great speeds and in any direction.



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When you pour milk into a glass, it takes the shape of the glass. How would you use the idea of particle attraction to explain why this happens?

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When you heat water to make pasta, you bring the water to a boil. How would you use the idea of particle attraction to explain why this happens?

Heating and cooling food

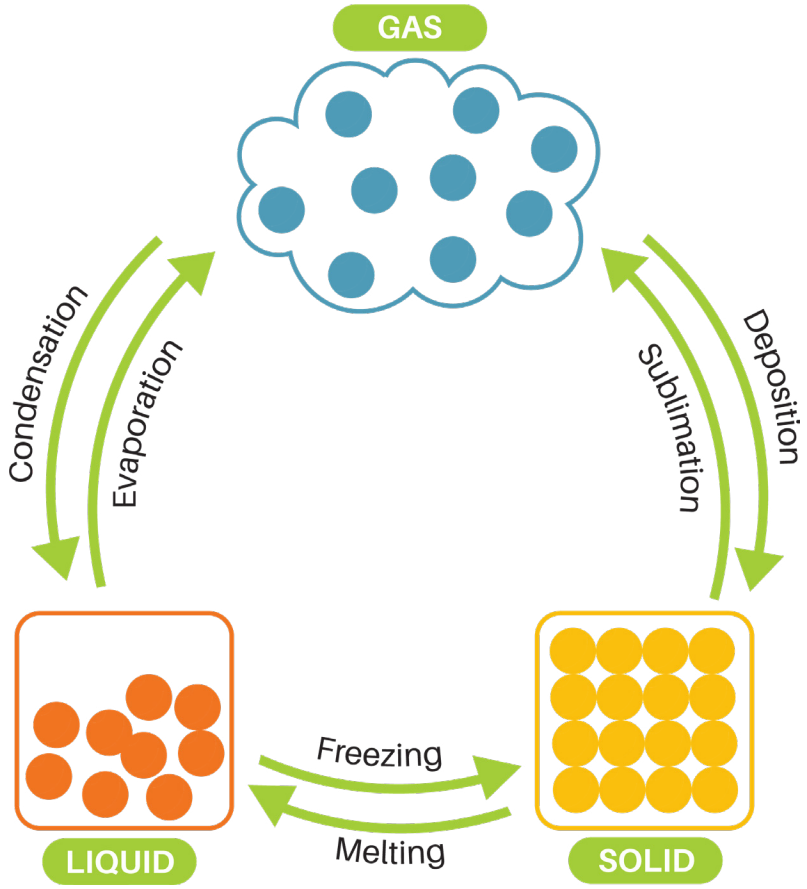
An understanding of temperature is important when cooking foods. Temperature affects how fast particles move and how tightly they stick together. When it's cold, particles move slower and stick together tightly, so substances are more likely to be in a solid state, like ice.

However, when it's hot, particles move faster and spread out more, so substances are more likely to be in a liquid or gas state.

Think about how changes in **temperature** are involved in these examples:

- Making ice cream – the cream changing from a liquid to a solid
- Roasting chickpeas – the water in the chickpeas changing from a liquid to a gas
- Melting chocolate – the chocolate changing from a solid to a liquid

There are names for the processes that change the state of matter of substances. Explore the explanations and images of these processes that follow.



DID YOU KNOW that smoothies involve changes in state of matter? For example, when you freeze a banana and then blend it, its state of matter changes. A fresh banana is solid and squishy, but when frozen, it becomes a solid, hard piece of fruit. After blending the frozen banana, it turns into a smooth and semi-solid texture, almost like ice cream. This happens because the blending process breaks down the frozen pieces and incorporates air, changing its texture and consistency.

Melting is the process that causes a solid to change to a liquid. When heat is applied to a solid, its particles start vibrating faster and gain enough energy to overcome the attraction that is holding them in a fixed position. As a result, the particles break free, causing the solid to become a liquid.

The temperature at which melting occurs is called the **melting point**.

Boiling or **vaporization** is the process that causes a liquid to change into a gas. When a liquid is heated enough, the particles gain enough energy to overcome the forces of attraction between them. This allows the particles to escape from the surface of the liquid and become a gas.

The temperature at which boiling occurs is called the **boiling point**.

Evaporation is similar to vaporization. However, the heating that causes the change to a gas occurs on the surface of the liquid, rather than throughout it.

Condensation is the process that causes a gas to change into a liquid. When a gas is cooled, its particles lose energy and move more slowly. The particles move closer together and are unable to overcome the forces of attraction between them. This causes the gas to condense into liquid droplets.

Think about steamed vegetables in a covered skillet. The steam from the cooking vegetables touches the cooler lid and condenses into water droplets.

Freezing is the process that causes a liquid to change into a solid. When a liquid is cooled to its freezing point, the particles in the liquid lose energy and slow down.

The particles come closer together and eventually arrange themselves in a fixed, orderly pattern, forming a solid. The temperature at which freezing occurs is called the **freezing point**.

Deposition happens when a gas turns directly into a solid without first becoming a liquid. For example, when the air is full of invisible water vapour, a gas, and gets very cold, this vapour can change directly into tiny ice crystals on a surface. These tiny ice crystals are a solid. Think about frost forming on a windows on a cold morning or the frost that appears on berries when they are first taken out of the freezer. This frost is an example of water vapour in the air directly turning into ice on the surface of the berries.

Sublimation happens when a solid turns directly into a gas without first becoming a liquid. A good example is dry ice, which is solid carbon dioxide. When you leave dry ice out, it doesn't melt into a liquid but instead turns straight into carbon dioxide gas, making it look like it's "disappearing" into the air.