

Let's Learn

What Are Gaseous Substances?

In Stage 3, you have learnt that substances can exist as solids, liquids and gases. Substances that are gases are said to be in the gaseous state.

When you squeeze a sponge under water, you will observe bubbles. The bubbles are made of air. The air around us is a mixture of gases such as nitrogen, oxygen, and small traces of carbon dioxide, water vapour and hydrogen. These substances exist as gases at room temperature, which is the temperature of our surroundings.



Why is the room temperature different in different parts of the world?



The air you blow into a balloon is a mixture of gases.

Can you name other substances that are gases at room temperature?



Word Boost

squeeze
traces

How Can the Particle Model Be Used to Describe Gases?

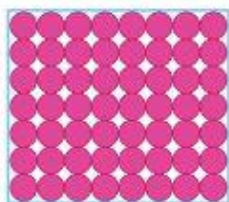
You have learnt that the particle model can be used to explain the properties of solids and liquids. The particle model can also be used to describe gases.



Scientists use the particle model to explain the behaviour of each type of matter. The particles in solids, liquids and gases differ in the way they are arranged and how they move about.

Solids

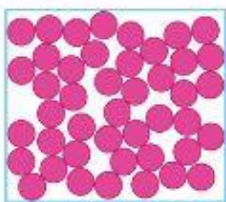
- Particles are packed very closely together in a regular pattern.
- Particles vibrate about a fixed position.



Solids have a fixed shape and volume. They cannot be compressed.

Liquids

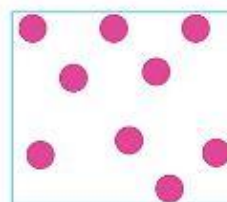
- Particles are packed less tightly together and are randomly arranged.
- Particles move around each other.



Liquids have a fixed volume but no fixed shape. They cannot be compressed.

Gases

- Particles are far apart and are randomly arranged.
- Particles move quickly in all directions.



Gases have no fixed volume or shape. They can be compressed.



Word Boost

arranged
pattern
vibrate
randomly
compressed

Let's Learn

What Happens During Evaporation?

On a rainy day, puddles of water form on the ground. After some time, they seem to disappear. Where do they go?

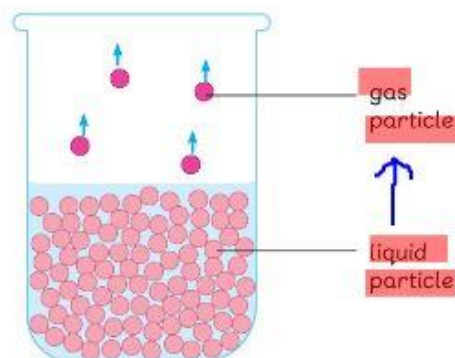
When the water in the puddles gains heat from the surroundings, it changes into a gas called water vapour. The water vapour escapes into the air. This process of a liquid changing into a gas is known as **evaporation**. Evaporation happens at all temperatures.



Puddles will dry up after some time due to evaporation.

The particle model can be used to explain what happens during evaporation.

During evaporation, the particles on the surface of the liquid gain heat to escape into the surroundings. The substance has changed from a liquid to a gas.





Evaporation takes place around us every day. When using a hair dryer, the water from our hair gains heat from the hot air and evaporates to become water vapour.

Before an injection is given, alcohol is rubbed on our skin to disinfect the skin. The alcohol gains heat and evaporates quickly. This removes heat from our skin, making our skin feel cooler.



When we hang wet clothes to dry, the water in the clothes evaporates to become water vapour. Our clothes become dry.



Have you noticed that wet clothes dry more quickly on some days than others? Do you know why?

What Factors Affect the Rate of Evaporation?

How fast or slow evaporation takes place is known as the rate of evaporation. Various factors can affect the rate of evaporation.

We can plan an investigation to find out the factors that affect the rate of evaporation. Look at the scenarios below.



Do clothes dry more quickly on a hot day or a cool day?



Do clothes dry more quickly on a day with wind, compared to a day without wind?



Do clothes dry more quickly when hung close together or when spread out?



Word Boost

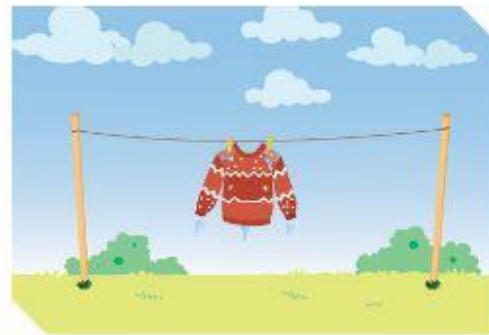
rate
scenarios

In Stage 4, we have learnt about variables that need to be taken into account to carry out a fair test.

When planning a fair test investigation, we change only one variable at a time. The changed variable is also known as the **independent variable**. It is what we are investigating in the experiment.



clothes drying at 35°C



clothes drying at 25°C

The variable that we measure in an experiment is known as the **dependent variable**.



In a fair test to find out if the temperature of the surroundings affects the rate of evaporation, the temperature is the independent variable.

The time taken for the shirt to dry completely is the dependent variable in this investigation.



Word Boost

taken into account

To ensure that experiment is fair, we need to keep some factors the same. These are called **control variables**.

For this investigation, the control variables include the amount of water in the shirt, the type of material of the shirt and the place where the shirt is hung to dry.



How would you plan an investigation to determine if the presence of wind affects the rate of evaporation?

Consider the following when planning your investigation:

- What are the independent, dependent and control variables in this investigation?
- What is the equipment required for the investigation and how would you use it appropriately?
- What are some possible risks in your investigation and how would you ensure that the investigation is carried out safely?
- What do you think the results of your investigation are going to be? Make a prediction.
- Do you need to repeat your observations in order to get more reliable results?

Carry out the investigation safely. Ensure that all measurements are taken accurately. Collect and record your observations in a table or diagram and present your findings to your classmates.

Which type of scientific enquiry is being used for this investigation?
What are the features of this type of scientific enquiry?



Science at Work

Have you ever had dried fish such as *ikan bilis*?
Do you know that evaporation is used to dry the fish?



Evaporation is commonly used in the food industry to reduce the water content in food and make it last longer. Many people also love the flavour of the dried food.

Visit your local grocer or supermarket and identify some dried food items. Carry out research to find out how they are dried.

What Happens During Condensation?

Look back at the picture on page 55. What causes the mirror in the bathroom to become foggy after you take a hot shower?

The hotter water vapour in the bathroom comes in contact with the cooler surface of the mirror. When that happens, the water vapour loses heat and changes into water droplets. This process of a gas changing into a liquid is called condensation.

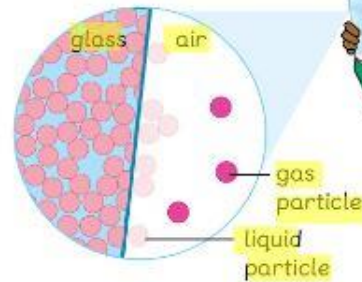


Word Boost

foggy
contact
droplets

Look at the surface of the glass of iced water. Where do the water droplets come from?

The freely moving gas particles in the air lose heat when they touch the cooler surface of the glass. The particles slow down to the point where they can only move around one another. The water vapour then turns into water droplets on the glass.



The fog on glasses and mirrors is made up of tiny droplets of water that are formed when water vapour condenses.

Have you noticed 'mist' near the spout of a boiling kettle? What causes the mist?

When the hotter water vapour near the spout comes in contact with the cooler water vapour in the surrounding air, it loses heat and condenses into tiny water droplets. The mist is made up of these tiny water droplets.



Can you think of other examples of condensation taking place in your daily lives?

Activity Book
Activity 4B, p. 35



Word Boost

mist
spout