Winchester Science Centre
By Wonderseekers

Solid. Liquid. Squish!

Pre-visit resources for KS3

Solid. Liquid. Squish! KS3 Pre-visit Activities

These activities are designed to be completed before you visit for your workshop. We recommend working through the activities from 1 to 3 but you are welcome to pick and choose depending on your group's prior knowledge and any ideas they may spark along the way.

Through these activities, you will be exploring the particle models of solids, liquids and gases. The students will then explore how the particles of gases and liquids experience diffusion.

Teacher Guide:

Learning Objectives:

- Explore the particle model of solids, liquids and gases.
- Understand how the particles of gases and liquids spread out due to diffusion.
- Explore how we can use evaporation and filtration to create clear water.

Key Science:

We define anything in our world that has mass and takes up space as matter. All matter is made up of particles. We tend to group matter into three main groups; solids, liquids and gases. We group them because their particles are all arranged in different structures and this causes them to behave differently. The particles in a solid are bonded together in a strong structure. They can be held in our hands and often keep their shape unless we change it. This could be done by cutting or squeezing. Some solids include sand, stone and most metals. The particles in a liquid are still bonded but have weaker bonds than those of a solid. This means there is more space between the particles allowing them to move around more. This allows liquids to flow or be poured. They can also change their shape to fit any container, although they will always take up the same amount of space. The most common liquid we have on Earth is water. The particles in a gas are much freer, having lots of space because the bonds they have are very weak. This allows gases to change their shape and their volume to fill any container they are in. Most are invisible but are really important to us here on Earth. Gases like oxygen allow us to breathe and make up a part of our atmosphere. Particles in liquids and gases can move through diffusion. This is where they move from an area of high concentration to an area of low concentration. This is how smells travel around a room, or how squash mixes with water.

Some things in our world can change their state of matter when exposed to different conditions like temperature. The best example of this is water. Water usually exists as a liquid but it can be frozen into ice to become a solid or evaporated into water vapour or steam.

Curriculum links:

- The properties of the different states of matter (solid, liquid and gas) in terms of the particle model.
- Diffusion in terms of the particle model.
- Simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography.

Key Definitions:

- **Solid** - Something that stays in place and can be held. Solids keep their shape and do not flow. Solids take up the same amount of space, they do not spread out like gases. Solids can be cut or shaped. Even though they can be poured, sugar, salt and flour are all solids.
- **Liquid** - Liquids can flow or be poured easily, they are not easy to hold in your hand. Liquids change their shape depending on the container they are in. Even though they can change their shape, they always take up the same amount of space.
- **Gas** - Gases are often invisible, they do not have a fixed shape, they spread out and change their shape and volume (space they take up) to fill up whatever container they are in. Gases can be squashed.
- **Materials**: Matter or substance that objects are made from. Different materials have different features, or properties, which make them suitable for different uses.
- **Freezing** - Freezing is when the state of matter changes from a liquid to a solid, usually accompanied by a loss of energy in the particles. Can be triggered by a change in temperature.
- **Melting** – The change in state of matter from a solid to a liquid, accompanied by a gain of energy in the particles. Can be triggered by a change in temperature.
- **Evaporating** – The change in state of matter from a liquid into a gas, accompanied by a gain of energy in the particles. Can be triggered by a change in temperature.
- **Condensing** - The change in state of matter from a gas to a liquid
- **Non-Newtonian fluid** - A non-Newtonian fluid is a fluid that does not follow Newton's law of viscosity, that is, it has variable viscosity dependent on stress
- **Diffusion** – The net movement of particles from an area of high concentration to an area of low concentration.
- **Filtration** – Used to remove insoluble solids from a liquid
- **Soluble** – can dissolve in a liquid.
- **Insoluble** – cannot dissolve in a liquid

Activity 1: The Particle Simulation (10 mins)

Overview

This activity will focus on the particle model for solids, liquids and gases and how the particles change with the state of matter. The class will build their own example of the particle model using balloons and beads.

You will need

- 1 balloon or sealable plastic bag.
- 10 beads or buttons.

Instructions

1. Firstly the students will create the model of a solid. To do this, the children will need to add their beads to the inside of their balloon.
2. Have the children squeeze their balloon to feel the beads inside. They should feel the beads pushed together, like the particles in a solid.
3. Then change the solid into a liquid. To simulate this have the children let go of the beads and hold the top of the balloon. Swirling the balloon around lets the beads move around and change shape without occupying more space, like the particles in a liquid.
4. Finally change the liquid into a gas. To simulate this, have the children inflate their ballon using a pump. After inflating the balloon, have the children shake it around to hear the beads rattling around. Here the gas particles are occupying more space and can move around more freely.

Activity 2: Diffusion Race (10 mins)

Overview

This activity has the class exploring diffusion. Using food colouring they will see how the particles in liquids spread out from an area of high concentration to an area of low concentration. They will be experimenting to see how the temperature of the water influences diffusion.

You will need (per pair)

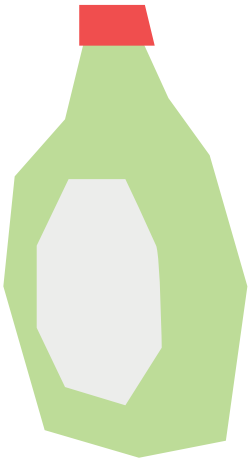
- 2 clear cups.
- Warm and cold water.
- Food colouring (2 colours).
- Timer.

Instructions

1. Group the students into pairs. Have the pairs fill one cup with cold water, the other with warm water.
2. Explain that they will be adding a drop of food colouring to each cup and the students will need to time how long it takes to spread out and dye the whole cup.
3. Add in the food colouring to both cups. Have the students start the timer and record how long it takes for the dye to spread throughout the cup.
4. Bring the class back together and introduce diffusion to the class. Ask them which of the cups of water had diffusion occur faster. This should be the warm water as when the particles have more energy they move around inside the liquid more. This causes the particles of the food colouring to be spread out at a faster rate.

Take it further

Ask the class if they can think of anywhere they have seen diffusion happening out in the world? Explain that it can also work with gases, as this is how smells travel.



Activity 3: Mixture Investigation & Separation Challenge (20-25 minutes)

Overview

This activity sets the class on a challenge to see if they can get everything out of a mixture and into its component pieces – sand, salt and water. They will have to use filtration and evaporation to retrieve the sand and salt from the mixed-up solution.

You will need (per group)

- Sand, salt, and water mixed in a beaker.
- Coffee filter or paper.
- Stirring stick.
- Sieve.
- Spare cups.
- Bunsen burners.

Instructions

1. Have the mixture prepared or have the students create it in their groups. Set them the challenge of trying to get out the salt and the sand using the equipment on their table. Give the groups free reign to try different approaches.
2. To successfully remove the sand, the students can use the paper, as the water and with the dissolved salt can travel through while the sand is left behind
3. Then to remove the dissolved salt, the students will need to heat up the solution with a Bunsen burner. This causes the water to boil and evaporate leaving the solid salt behind.
4. Once they have successfully given collected the sand and salt, bring the class back together to explain their choices and share what they found.

Take it further

If your school has access to a distillation apparatus, you could also use this to collect the clean water.