

MOLECULE MADNESS

WARNING — THIS SET CONTAINS CHEMICALS THAT MAY BE HARMFUL IF MISUSED. READ CAUTIONS ON INDIVIDUAL CONTAINERS AND IN MANUAL CAREFULLY. NOT TO BE USED BY CHILDREN EXCEPT UNDER ADULT SUPERVISION.

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SAFETY

Safety Rules

Read these instructions before use, follow them and keep them for reference.

Keep young children, animals and those not wearing eye protection away from the experimental area.

Always wear eye protection.

Store this experimental set out of reach of children under 7 years of age.

Clean all equipment after use.

Make sure that all containers are fully closed and properly stored after use.

Ensure that all empty containers are disposed of properly.

Wash hands after carrying out experiments.

Do not use any equipment which has not been supplied with the set or recommended in the instructions for use.

Do not eat or drink in the experimental area.

Do not allow chemicals to come into contact with the eyes or mouth.

Do not replace foodstuffs in original container. Dispose of immediately.

First Aid

In case of eye contact: Wash out eye with plenty of water, holding eye open if necessary. Seek immediate medical advice.

If swallowed: Wash out mouth with water, drink some fresh water. Do not induce vomiting. Seek immediate medical advice.

In case of inhalation: Remove person to fresh air.

In case of skin contact and burns: Wash affected area with plenty of water for at least 10 minutes.

In case of doubt, seek medical advice without delay. Take the chemical and its container with you.

In case of injury always seek medical advice.

CAUTION!

For the 0.5% sodium alginate solution and the 1% calcium chloride solution:

May cause eye and skin irritation.

Do not get in eyes, on skin, or on clothing.

Wash hands thoroughly after handling.

Do not ingest. Use only as instructed.

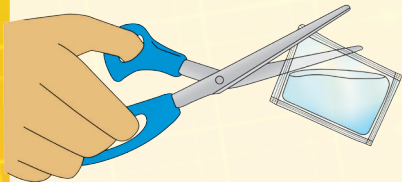
WARNING!

Not suitable for children under 3 years.

There is a risk of choking due to small parts that can be swallowed or inhaled.

Keep the packaging and instructions, as they contain important information.

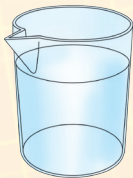
EXPERIMENT: POLYMER BALLS



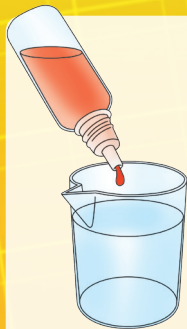
1. Cut open the packet of calcium chloride solution.



2. Pour the calcium chloride solution into the measuring beaker.

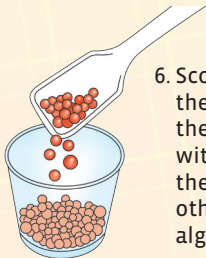
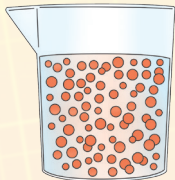


3. Add water to the calcium chloride solution to fill the beaker.



4. Drip the sodium alginate solution from the bottle into the calcium chloride solution. Try larger and smaller drops. Try squirting a longer string of solution.

5. As soon as the sodium alginate solution hits the calcium chloride solution, a reaction will happen that hardens the exterior of the sodium alginate drop, forming a small ball with a firm but squishy shell.

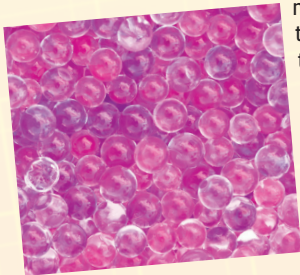


6. Scoop the balls out of the solution and store them in the smaller cup with lid. Now repeat the procedure with the other color of sodium alginate solution.

WHAT IS A MOLECULE?

A **molecule** is a relatively stable group of two or more **atoms** that are held together by **chemical bonds**. A molecule made of only one type of atom is referred to as an elemental molecule. For example, at room temperature two atoms of oxygen usually bond together into an elemental molecule called dioxygen. Molecules can also be made from more than one type of atom.

A molecule is the smallest indivisible unit of a compound that still has the same **properties** of the compound. A **compound** is a substance that consists of molecules made of more than one type of atom, and therefore, more than one element. Compounds can be broken down into the elements that compose them. Molecules always contain the same ratio of elements as the compounds they compose.

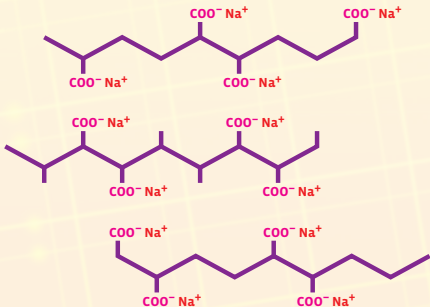


WHY DO THE POLYMER BEADS FORM?

The beads you made with this kit consist of a **polymer** called **gelatin**. Gelatin is often called “gel” for short. A polymer is a long repeating chain of many molecules that are all the same. Imagine it like a chain of paper clips all linked together.

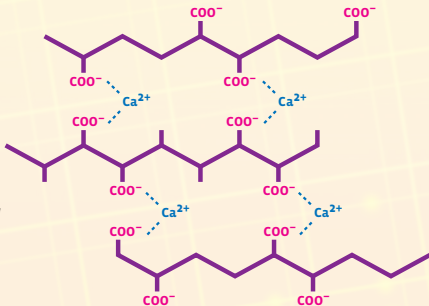
The sodium alginate solution contains a polymer with **sodium ions (Na^+)** taken from seaweed, or marine algae. Many polymers come from algae including carrageenan.

Sodium alginate before the reaction: Three polymer strands are not connected and can therefore move around each other in a liquid state.



The sodium alginate solution changes from a liquid to a solid the moment it touches the calcium chloride solution. This solution contains **calcium ions (Ca^{2+})**. The calcium ions replace the sodium ions and serve as a linking agent to link two polymer chains together. This creates a gelatin mesh that has qualities of both a solid and a liquid. Scientists call this bonding process **cross-linking**. The cross-linked polymer is insoluble in the solution and forms a thin skin that encases the liquid to turn it into a gel bead.

After the reaction: Calcium ions have replaced the sodium ions, cross-linking the three polymer strands together. They can no longer move freely. They are now in a solid gel.



PLASTICS ARE POLYMERS

Plastics are made of giant molecules, also called **macromolecules**. The special thing about macromolecules is that they are formed when many smaller molecules forming the building blocks of the giant molecule are coupled together. The building blocks are called **monomers**, and the macromolecules are called **polymers**.

This process can be illustrated very well using **ethylene** as an example, from which the common macromolecular plastic **polyethylene** (abbreviation: PE) is manufactured. PE is the plastic used for shopping bags, films, and bottles.

Under appropriate experimental conditions, it is possible to make the ethylene molecules line up one after the other like train cars with the help of broken double bonds, forming polyethylene:

