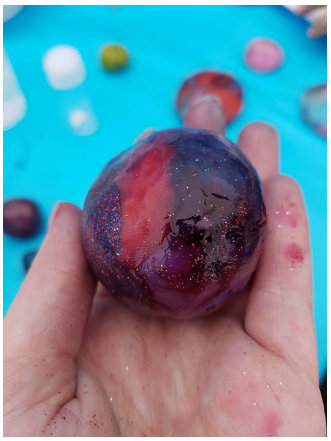
Activity: Nanopolymer Bouncy Balls



Ages: 7 and up – Adult supervision required.
Do not eat or drink any of the materials in the activity.
Bicarbonate of soda can be a mild skin irritant – if it comes into contact with skin, wash well with water.

Watch Our Nanopolymer Bouncy Ball video here:

https://youtu.be/Xc_9vR-TCCE

How to make you own

You will need:

- Contact lens solution (Must contain boric acid/sodium borate – check the contents on the label)
- PVA glue
- Bicarbonate of Soda (also called baking soda or sodium bicarbonate)
- Food colouring (optional)
- Glitter (optional)
- Cup
- Tablespoon and teaspoon
- Tape measure

Instructions:

1. Add 3 Tablespoons of PVA glue to a cup.

2. Add 5 - 10 drops of food colouring to the PVA Glue and stir well. You can also add some glitter at this point if you are using it.

3. Add 1 teaspoon of bicarbonate of soda to the PVA glue and stir well. Has the glue changed at all?

4. Add 2 teaspoons of contact lens solution to the PVA glue and bicarbonate of soda mixture. Stir well. What has happened to the mixture?

5. Once stirred thoroughly, remove the mixture from the cup.

6. Roll into a ball with your hands. If the ball is still sticky, pour a little more contact lens solution over it.

7. You will have now made your own nanopolymer bouncy ball!
   Now it is time to test how high your bouncy ball can bounce (This part will be easier with a least two people)!

8. Measure 1 m from the ground using a measuring tape. One person can hold the bouncy ball from a height of 1m and drop it allowing it to bounce off the ground in front of the measuring tape. Another person can be in position to be able to see how high the ball bounces.
   Top tip: You can use the slow-motion camera on your phone to get a more accurate reading!

9. Record the height of the first bounce on the results sheet. Repeat the previous step three times so that an average bounce height can be calculated.

10. Optimisation! Repeat steps 1-9 two more times. Try changing the PVA/contact lens solution/sodium bicarbonate amounts to see if you can improve the formula and get a bouncier bouncy ball!

Results:

	Pilot	**Trial 1**	**Trial 2**
PVA Glue	3 tablespoons		
Sodium bicarbonate	1 teaspoon		
Contact lens solution	2 teaspoons		
Food colouring	5 - 10 drops		
Glitter	Half a teaspoon		
Bounce 1			
Bounce 2			
Bounce 3			
Average			

The Science:

PVA Glue is a **polymer**. A polymer is a special type of molecule which exits as long chains of repeating units. Think of a long string of beads!

Polymers are important chemicals and are all around us! Natural polymers are things like wool, silk and protein and synthetic (human-made) polymers are things like plastics, glues, bulletproof vests and even the coating on frying pans!

In this experiment, we see a crosslinking reaction – this means that the long chins of PVA polymer are being joined (crosslinked) together. Joining the chains together makes them stronger. Therefore, the PVA glue changes from a sticky liquid into a rubbery, bouncy solid!

ReallySmallScience:

ReallySmallScience is a group of researchers from the Department of Chemical and Process Engineering at the University of Strathclyde in Glasgow. Our aim is to bring chemical engineering research to people of all ages through fun, hands-on science activities.
At Strathclyde, researchers in Chemical and Process Engineering work on **nanoengineering** – science on a really small scale!

We develop new polymers including gels and adsorbents which can be used in water treatment, carbon capture and storage.

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