

# BOUNCY BALL PLANETS

**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.

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

Clean all equipment 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.

Clean any household items (e.g. jars and spoons) before reusing them.

Open the bags with scissors — never with your teeth.

Conduct the experiment on a clean table that can be easily cleaned afterward.

The work area should be cleaned up immediately after carrying out the activity.

Wear suitable clothes that can get stained and keep the materials away from table clothes, curtains, and carpets.

You can dispose of all used materials in this kit in the household trash.

## 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 colored polyvinyl alcohol-containing powders:

May cause eye irritation.

Avoid breathing dust. Do not get in eyes.

Wash hands thoroughly after handling.

Do not ingest. Use only as instructed.

## WARNING.

Not suitable for children under 3 years.

Choking hazard — small parts may be swallowed or inhaled.

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

## EXPERIMENT 1: BOUNCY BALL PLANET

1. Get a glass, jar, or tub large enough to hold the bouncy ball mold. Fill it with warm water. Cover your tabletop work area with paper towels.



2. Put the two halves of the ball mold together. Decide what colors you want your planet to be. Cut open the packets of bouncy ball powder (polyvinyl alcohol granules) with scissors, not with your teeth.



3. Pour some of the first powder color into the mold.



4. Shake the mold from side to side gently to get the powder to settle.

5. Repeat steps 3 and 4, creating layers of your desired colors until the powder fills the mold all the way to the dotted line shown here.



6. Gently shake the mold one last time to make sure the powder doesn't settle any more. If it does, add some more powder.

7. Place the filled mold in the container of water. Make sure it is completely submerged. Swirl the mold a little and then rest it on the bottom of the container.





8. Let the mold sit in the water for two minutes.

9. After two minutes, remove the mold from the water and let it sit for another three minutes.



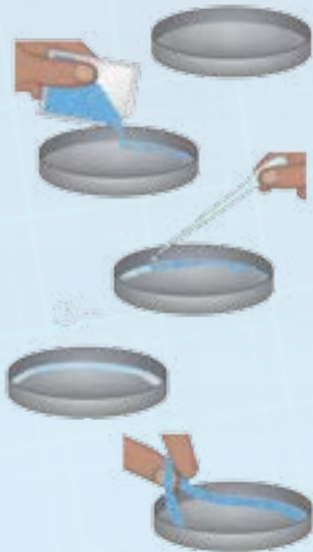
10. Now you can remove your bouncy ball planet from the mold. Carefully separate the two halves of the mold and BANG! You have a squishy planet!



The planets may have taken billions of years to form, but you made yours in just a few minutes! If they dry out and harden over time, try soaking them again. What happens?

## EXPERIMENT 2: SATURN'S RINGS

1. Find a round lid to a jar.
2. Pour some of the bouncy ball powder around the edge of the lid.
3. With a stick or pencil, push the granules to the edge.
4. Wet the granules with water using a spoon or dropper pipette.
5. Let the granules dry for a few hours.
6. Peel the ring off the lid and place it around your planet!



## WHAT'S HAPPENING?

The bouncy ball granules are mostly composed of **polyvinyl alcohol (PVA)**, which is a water-soluble polymer with elastic properties. Polymers are long, tangled chains of carbon, hydrogen, and oxygen atoms. When the granules are moistened, their surfaces start to dissolve slowly, they swell up a little, and they become sticky. The long polymers get tangled up in each other. In this way, the granules stick together inside the mold.

The balls are bouncy because the PVA material is elastic, which means it springs back to its original shape after being compressed or stretched. This elastic property comes from the shapes of the polymer chains. The long, tangled chains have extra space around them (think of the space between the strands of long noodles in a pasta bowl). When the force from hitting the floor causes the ball to compress, the polymers squish more tightly into the empty spaces. But at a point, the bonds between the polymers cannot compress any more, and they start to expand again, releasing the force they absorbed, pushing the ball off the floor and causing the ball to bounce up.

## THE SOLAR SYSTEM TO SCALE

Unlike the bouncy balls in this kit, the actual planets in our solar system are not all the same size.

If Earth was the size of a **golf ball** (1.7 in) ...

... Mercury would be the size of a **small grape** (0.7 in)!

... Venus would be the size of a **ping pong ball** (1.6 in)!

... Mars would be the size of a **small plum** (1 in)!

... Jupiter would be the size of a **beach ball** (20 in)!

... Saturn would be the size of a **globe** (16 in)!

... Uranus and Neptune would both be the size of a **large grapefruit** (6 in)!

... Pluto would be the size of a **small candy-coated chocolate** (0.3 in)!

... and the Sun would be enormous! It would be the length of a **midsize car** (15.5 ft)!

