## EXPERIMENT MANUAL



WARNING - Chemistry Set. This set contains chemicals and parts 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.

## SAFETY INFORMATION

## WARNING!

Not suitable for children under 3 years. Choking hazard - small parts may be swallowed or inhaled. Read the information on this page and on pages 3 and 4 together with the child who will be performing the experiments, follow it, and keep it on hand for reference. Always perform the experiments together with your child and provide supervision.

Poison Control Centers (United States)

In case of emergency, your nearest poison control center can be reached everywhere in the United States by dialing the number:

## 1-800-222-1222

 Keep the packaging and instructions as they contain important information.
## Information about handling the experiment materials

$\rightarrow$ Do not swallow.
$\rightarrow$ Only perform the experiments described in the manual.
$\rightarrow$ Do not bring material into contact with mouth or eyes.
$\rightarrow$ Wash hands thoroughly after performing the experiments.
$\rightarrow$ Do not eat or drink where you perform the experiments.
$\rightarrow$ All materials should only be used for the experiments described in the manuals. Do not use them in the kitchen.
$\rightarrow$ Keep the experiment materials locked away and out of the reach of small children and animals.

Be careful when you use the snow, as it can stick to materials such as carpets and tables. These materials can be cleaned with water.

Wear old clothing, as the experiment materials (such as dye tablets and dyed snow) can cause stains.

Any packets should be completely used up during the experiments. Empty packets, snow, and other solid waste should be disposed of with other household waste.

After the experiments, the snow will dry out again after a few days. Please use paper towels to clean it up and dispose of it in the household waste.

## Information about the Instant Snow Powder and starch powder

Instant Snow Powder: Sodium Polyacrylate (Superabsorbent Polymer),
5 packets of 4.5-6.0 g (0.15-0.21 oz.), Item No. 721616
Corn Starch Powder: 2 packets of $9.5-10.5 \mathrm{~g}$ (0.33-0.37 oz.), Item No. 723163
Do not get in eyes, into the mouth or on clothing. Wash hands thoroughly after handling.
Do not ingest. Do not inhale.
Use only as instructed. Keep instant snow out of reach of small children.
Use the materials carefully, as they may stick to or stain fabric, wood, carpet, or other materials.
Clean with water.

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$\qquad$
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## First aid information

$\rightarrow$ If any instant snow or starch powder gets into the eyes: Wash out eye with plenty of water, holding eye open, if necessary. Seek immediate medical advice.
$\rightarrow$ If swallowed: Wash out mouth with water, drink some fresh water. Do not induce vomiting. Seek immediate medical advice.
$\rightarrow$ In case of doubt, seek medical advice without delay. Take the instant snow or starch, its packet, and this manual with you.

## (53) TiP

YOU CAN FiND ADDITIONAL iNFORMATION IN THE "CHECK IT OUT" SECTIONS ON PAGES 13 AND 14


## ${ }_{-1}^{\text {fals }} \mathrm{SNOW}$

How big is the largest snowflake ever measured? >> 38 cm ( 15 inches)

Does every snowflake really have a unique shape? >> Nobody knows for sure, because there are too many snowflakes to count. But the chances of finding two identical snowflakes are very slim.

How many points do snow crystals have >> Six! Snowflakes always have a hexagonal shape.

Does snow really make the environment quieter? >> Yes. The air in snow absorbs sound waves.

## Good to know

If you are missing any parts, please contact Thames \& Kosmos technical support.

## What's in your experiment kit



## Checklist:

| $J$ | No. | Name | Quantity | Item no. |
| :---: | :---: | :---: | :---: | :---: |
| $\bigcirc$ | 1 | Die-cut cardboard sheet | 1 | 727377 |
| $\bigcirc$ | 2 | Sticker sheet | 1 | 727376 |
| $\bigcirc$ | 3 | Snow station base | 1 | 727363 |
| $\bigcirc$ | 4 | Vertical rod | 2 | 727387 |
| $\bigcirc$ | 5 | Snow shovel | 1 | 727362 |
|  |  | Snow station accessories: |  | 727361 |
| $\bigcirc$ | 6 | Vertical rod support (holds rod in station base) | 2 |  |
| $\bigcirc$ | 7 | Snow shaker lid for big test tube | 1 |  |
| $\bigcirc$ | 8 | Big test tube holder clip | 1 |  |
| $\bigcirc$ | 9 | Paper holder clip | 1 |  |
| $\bigcirc$ | 10 | Snow globe bottom | 1 |  |
| $\bigcirc$ | 11 | Snow globe dome | 1 | 722972 |
| $\bigcirc$ | 12 | Big test tube ( 140 mm ) | 2 | 717120 |
| $\bigcirc$ | 13 | Lid for big test tube | 2 | 717686 |
| $\bigcirc$ | 14 | Petridish | 1 | 723751 |
| $\bigcirc$ | 15 | Pipette | 3 | 714772 |
| $\bigcirc$ | 16 | Set of dye tablets (red, yellow, orange) | 1 | 776151 |
| ) | 17 | Set of dye tablets (blue, green) | 1 | 776152 |


| $J$ | No. | Name Qu | Quantity | Item |
| :---: | :---: | :---: | :---: | :---: |
|  | 18 | Measuring cup ( 80 ml ) | 1 | 715 |
| $\bigcirc$ | 19 | Measuring cup ( 30 ml ) | 2 | 71 |
|  | 20 | Plastic spatula ( 140 mm ) | 1 | 72 |
| $\bigcirc$ | 21 | Packet of corn starch (10 g) | g) | 72 |
| $\bigcirc$ | 22 | Packet of instant snow powder (5g) | 5 | 72 |
| $\bigcirc$ | 23 | Large resealable bag (not shown) | 2 | 72 |
| $\bigcirc$ | 24 | Snowball mold ( 3 cm ) | 1 | 727 |
| $\bigcirc$ | 25 | Pair of googly eyes | 1 | 727 |
| $\bigcirc$ | 26 | Carrot for snowman | 1 | 72 |
| $\bigcirc$ | 27 | Buttons for snowman | 2 | 72 |
| $\bigcirc$ | 28 | Mittens for snowman | 2 | 72 |
| $\bigcirc$ | 29 | Penguin figurine ( 5 cm ) | 1 | 72 |
| $\bigcirc$ | 30 | Stand for cardboard die-cut parts (transparent) | t) 6 | 72 |
| YOU WiLL ALSO NEED: Water, scissors, adhesive tape, large bowl |  |  |  |  |

The parts not included in the kit are marked in italics in the YOU WILL NEED lists.

## Dear parents and adults!

Children want to explore, understand, and create new things. knowledge! They can do all of this with Thames \& Kosmos experiment kits. With every single experiment, they grow smarter and more knowledgeable.

This snow is a superabsorbent polymer called sodium polyacrylate. Do not ingest or inhale the instant snow powder: It expands to hundreds of times its original size and can be harmful if ingested or inhaled.

Please help, support, and accompany your child during the experiments. Before starting the experiments, read through the manual together, and be sure to follow all the safety advice and experiment steps.

Please be sure not to let any of the experiment kit parts get into the hands of small children.

Only perform those experiments that are described in the manual.

This experiment kit is designed for children 6 years and older, and must be used under adult supervision. Keep the experiment kit, the powder packets, the prepared snow, and other experiment materials out of the reach of children under 6 years of age.

This experiment kit will let your child perform simple experiments. Because the capabilities of children within any age group can vary quite a lot, you should carefully select just those experiments that are safe and suitable for your child. This manual will help you choose the ones that are appropriate.

The dyed snow can stain clothing, so old clothes should be worn during the experiments, and
tablecloths and rugs should be removed from the experiment area. For the workplace, choose a solid table with a surface that can be cleaned easily.

The area around the experiments should be well lit, free of any obstacles, and away from any stored foods. Keep paper towels handy in case anything gets tipped over or spilled.

The work area, along with all equipment, containers, and the snow station itself, should be cleaned immediately after completing the experiments.

Thoroughly wash hands after completing the experiments. Do not return any leftover materials to their original packages. Each packet should be completely used up in the course of an experiment. Always open the packets with a pair of scissors never use your teeth.

Please be careful not to create dust during the experiments, and don't let any powder or granules get into your mouth or eyes.

Do not eat or drink anything in the experiment area.
After the experiments, you can leave the instant snow to dry out for a few days. Make sure that you put it in a place where small children or pets cannot reach it. Instant snow powder can be stored and reused. Dispose of all materials in this kit in the household trash. Do not pour the instant snow down the drain.

## Dear Instant Snow Researcher,

## Read through the rules and instructions carefully. This way, you can avoid potential risks.

## Basic rules for safe experiments (safety information)

$\rightarrow$ Before starting the experiments, read this information, follow it, and keep it on hand for reference.
$\rightarrow$ Only perform the experiments described in this manual. Also note the tips that accompany each experiment.
$\rightarrow$ Keep small children and animals away from the experiment area.
$\rightarrow$ Keep this experiment kit out of the reach of children under 6 years of age.
$\rightarrow$ While experimenting, wear old clothing that can get dirty.
$\rightarrow$ Clean all equipment after use. Also clean the snow station and your work table.
$\rightarrow$ Wash your hands after completing the experiments.
$\rightarrow$ Only use equipment included with the kit or explicitly suggested in the manual.
$\rightarrow$ Only use scissors to open the packets containing the snow granules - never open the packets with your teeth. Be sure not to let any granules or powder get into your eyes or mouth.
$\rightarrow$ Do not eat or drink in the experiment area.
$\rightarrow$ Do not bring snow granules, snow powder, or prepared snow into contact with your eyes or mouth.
$\rightarrow$ Always work slowly and carefully. Always avoid creating dust with the granules or powder and spraying or spilling liquids.
$\rightarrow$ Get all additionally required materials ready before starting an experiment.
$\rightarrow$ Disposal: Put any disposable components of the kit into the household trash. Do not rinse any snow granules or powder, or prepared artificial snow, down the sink drain - it can expand to hundreds of times its size and clog the drain.

## Assembling the snow station

Before starting the experiments, set up your lab:

## You will need

- All the parts of your snow station


## Here's how

1. Assemble the rod supports and vertical rods into the snow station base as shown.
2. Label your station, test tubes, and the remaining equipment with the stickers included with the kit. Place the labels on the test tubes and resealable bags as shown in the illustration.
3. Place the die-cut cardboard items into the stands.
4. Assemble the snow station with its parts as shown to the right. You can also assemble it in any way you choose.
5. Decorate your station with the stickers.

## Pipette practice

1. Squeeze the upper part of the pipette between your thumb and forefinger and dip the tip of the pipette into the liquid.
2. As soon as you relax the pressure, the liquid will rise up into the pipette.
3. Gently squeeze the upper part again and the liquid will slowly drip back out.

## Using the dye tablets

1. Take an unopened packet of dye tablets and break the tablets into smaller pieces with the rounded part of a spoon. Do not crush the tablets into powder.
2. Open the packet with a pair of scissors and take out a small piece of a tablet. Close the packet again with a strip of adhesive tape.

## About the snow

The snow gives off a plastic-like smell when expanding. This is normal and will dissipate.

You can store the expanded granules, which look very similar to snow, in the two enclosed resealable bags. Separate colorful snow from white snow.


## Making your first instant snow

## You will need

- Packet of instant snow powder
- Bottom part of Petri dish
- Test tube with lid
- Pipette, spatula
- Scissors, water


## Here's how

1. Cut open the top of the packet of instant snow powder with a pair of scissors. Do not use your teeth! Make sure not to get any powder in your eyes or mouth.
2. Place the lower part of the Petri dish on your station. Put a few granules in the dish to make a small pile. Put the rest of the powder into the large labeled test tube and close it with the lid. Place the test tube in the holder. You will be needing it in one of the following experiments.
3. Use the pipette to drip 10-15 drops of water onto the powder in the Petri dish. The snow granules will completely absorb the water, which will make the pile grow as the granules expand.
4. Now use the pipette or the spatula to create a depression in the middle of the pile and dribble a little more water into it. The water will be completely absorbed by the snow powder.


## Making colorful snow

## You will need

- Petri dish with your snow
- Pipette, spatula
- Dye tablets
- Small measuring cup
- Scissors, water, spoon


## Here's how

1. Use the spatula to spread the snow evenly over the bottom of the Petri dish.
2. Take the unopened packet of dye tablets and break the tablets into a few smaller pieces with the rounded part of a spoon. Then cut open the packet with a pair of scissors. Take out a small piece of a tablet and dissolve it in 10 ml of water in the small measuring cup.
3. Now use the pipette to put some drops of the colored water onto the surface of the snow in the Petri dish (making little dots or drawing a line). The dye will gradually spread across the entire surface.
4. Leave the Petri dish to sit in a warm, secure spot for several days. Do you think the water will evaporate from the powder?


## What'S HAPPENiNe?

Your artificial snow is a water-retaining powder. It can absorb and hold a lot of water, becoming very large and expanding in the process. If the water is colored with a soluble dye, the powder absorbs the dye along with the water. Then you can let it dry. What do you think will happen? Do you think it will reabsorb water after you let it dry?

## Rainbow snow in a test tube

## You will need

- Test tube with dry instant snow powder
- Empty test tube
- Dye tablet pieces
- Pipette, spatula, small measuring cup
- Water


## Here's how

1. Fill the empty test tube with 80 ml of water and place it in the station.
2. Sprinkle a bit of dry instant snow powder from the labeled test tube into the water and stir it with the spatula. It will look like a little snow storm in a tube.
3. Continue to sprinkle powder until there is a solid mass of snow and all the water has been soaked up. Stir again.
4. Take a small piece of a dye tablet and dissolve it in a small measuring cup with 10 ml of water. Draw some dyed water up into the pipette.
5. Insert the pipette with the colored water all the way to the bottom of the test tube and squeeze it out. The bottom layer of the artificial snow will now be colored.
6. Now take another dye table of a different color and proceed in the same way: use the pipette to squeeze the different-colored water into the undyed layer above the first one. That way, you will get different-colored layers.
7. Can you create different colors by combining dye tablets? Keep going until you have a rainbow.


## *TiP

YOU CAN USE THE DYED WATER AND THE PIPETTE TO CREATE COOL 3D PICTURES IN THE TEST TUBE. CAN YOU "PAINT" A FLOWER?

## Snowball production

## You will need

- Test tube with dry instant snow powder
- Packet of corn starch
- Measuring cups, spatula
- Snowman parts
- Scissors, water


## Here's how

1. Cut open the starch powder packet with a pair of scissors. Do not use your teeth! Then pour it into the large measuring cup. Add 10 ml of water and stir well.
2. Add two spatula tips of snow powder. Very quickly, the mass will turn solid, as the powder absorbs the water from the gooey mass. Now add another 20 ml of water and stir the mixture. You will get a malleable snow-like material. If it is too runny, add a bit more snow powder.
3. Fill the pit in your snow station with your artificial snow and use the spatula to shape a snowy landscape.
4. Try making some miniature snowballs!


## Snowman

## Here's how

1. Make three little snowballs and use them to build a snowman. Carefully decorate the snowman with the buttons, carrot nose, mittens, and eyes. Place the snowman in your snowy landscape wherever you think it looks best.


## Stuffed snowball

## You will need

- Snow mixture from previous experiment
- Dye tablet pieces
- Small measuring cup
- Petri dish
- Pipette, snow shovel
- Water


## Here's how

1. Make a snowball with a diameter of about 4 cm from your snow mixture.
2. Take a small piece of a crushed dye tablet and dissolve it in the small measuring cup with 10 ml of water. Take some dyed water up into the pipette.
3. Now push the pipette with the dyed water into the center of the snowball and squeeze out the colored liquid.
4. Now you will have a stuffed snowball. Place it in the Petri dish and cut it in half with the snow shovel to reveal its colorful center.

1


## Powerful snow

## You will need

- Test tube with dry instant snow powder or a new packet of instant snow powder
- Snowball mold
- Measuring cup ( 80 ml )
- Snow shovel
- Water


## Here's how

1. Use the rest of the powder from the test tube or cut open a new packet of instant snow powder with a pair of scissors.
Do not use your teeth! If you open a new packet, store the remainder of the contents in the labeled test tube.

Fill the large measuring cup with water.
2. Press the two halves of the snowball mold together and transfer four spatula tips of snow granules into the mold.
3. Now lower the mostly-empty mold slowly into the water, holding it by the upper edge.

## (9) WHAT'S HAPPENing?

The powder quickly absorbs water and exerts a lot of force in the process. After a few seconds, the two halves of the snowball mold will burst open because there is too little room for the granules inside the mold. You can use the artificial snow you made here in the next experiment.


## ? <br> CHECK IT OUT

## KEYWORD <br> Instant snow powder

Instant snow powder is a material called sodium polyacrylate. It is a superabsorbent polymer. Superabsorbent means that it can absorb hundreds of times its weight in water, and expand to hundreds of times its dry size. A polymer is a material made of long chains of stretchy molecules, like plastics. Superabsorbent polymers have a special chemical property: Inside, they have areas that strongly attract water. They are permeable, which means that water can enter them. Once inside, the water gets trapped there.

The elastic polymer can expand and stretch out, which allows it to hold a lot of water. Water can evaporate from the polymer. As the polymer dries, it shrinks again. Superabsorbent polymers like this are used in everyday products like baby diapers, bandages, and spill control products.

## sTRONG STARCH

You mixed starch, water, and dye to make a mud-like material commonly known as oobleck. The name oobleck comes from the Dr. Seuss book Bartholomew and the Oobleck, a fictional story in which a boy must save his kingdom from a slimy substance called oobleck. Oobleck is a
"non-Newtonian" fluid suspension that behaves like a solid when pressure is applied to it and like a liquid when no pressure is applied.


Sir Isaac Newton was a famous scientist who came up with a law about the behavior of fluids. Non-Newtonian fluids are fluids that don't follow Newton's law of viscosity, which is a measure of how a fluid flows and resists deformation.

Most fluids get less viscous (more like a liquid) when force is applied to them, but oobleck gets more viscous (more solid), because the starch molecules in it get all tangled up and trap water molecules between them when they are pushed together under force.

## ?! CHECK IT OUT

## WHY Doss liee VOLUME? HAVE GREATR

Water is made of lots of little individual particles called molecules. When water freezes, however, these particles do not arrange themselves in the most efficient way.


Each snowflake is composed of many ice crystals, which work like tiny mirrors. When light falls on them, they reflect back the beam of light that hits them. Since sunlight - composed of all of the colors of the visible light spectrum - appears white, the little ice crystal mirrors in the snowflakes reflect white light. Try shining a red flashlight on some snow at night. What do you see?


## Whydoes ${ }_{\text {S }}^{\text {CRRUCHE? }}$

No two snowflakes are exactly the same. Snowflakes are formed when ice crystals fall to Earth. The composition of the ice crystals depends on atmospheric conditions, like temperature, humidity, and wind.
Each tiny ice crystal, however, always has six points like a six-pointed star. In piles of snow, these little stars get hooked together. And as you walk on snow, the tips of the stars break, making a crunching sound.
 So in frozen form, the same number of molecules require more space than they did in liquid form.
Ice therefore has a considerably lower density and takes up a correspondingly greater volume. This property plays an important role in nature. When water penetrates tiny cracks or crevices in rocks, then freezes and increases in volume, those rocks will burst apart. That is one of the geological effects that forms our landscape.


## CAN A POLAR BEAR EVER MEET A PENGUIN?

In nature, polar bears and penguins can never encounter each other, because polar bears only live at the North Pole (the Arctic), while penguins only live at the South Pole (the Antarctic).

Penguins are flightless birds, and they love it when it's really cold, even down to - 65 degrees Celsius - a lot colder than it gets in the Arctic. Most penguin species live primarily along the coast of Antarctica.

The South Pole itself is the coldest, driest, and windiest location on Earth - a giant, lifeless desert of ice.

## Snow shaker instead of salt shaker

## You will need

- Artificial snow from Experiment 7
- Test tube
- Snow shaker lid
- Snow shovel


## Here's how

1. For this experiment, your artificial snow needs to be very loose - in other words, you don't want it to absorb too much water. Fill the test tube with the measurement marks one-third of the way with artificial snow, and screw on the snow shaker lid.
2. When you twist the lid clockwise and counterclockwise, small quantities of snow will sprinkle out of your shaker, so you can make it snow on your snow station.


## Snow globe with penguin

## You will need

- Artificial snow from Experiment 7
- Penguin figurine
- Bottom and dome of the snow globe


## Here's how

1. Place the bottom part of the snow globe in the snow station base. Use the spatula to shovel some snow onto it.
2. Place the penguin in the middle of the base plate and put the lid on.
3. The penguin should now be firmly held in the snow globe. Shake the globe to make it snow.
4. If you want, clip the snow globe into the vertical rod as a decoration.


## How many granules do you need?

## You will need

- Test tube with dry instant snow powder
- Large measuring cup
- Small measuring cup (2x)
- Pipette
- Water


## Here's how

1. Fill the large measuring cup with water, and use that to fill the small measuring cup all the way to the rim. To create a bulge of water at the top, use the pipette to drip a few extra drops of water into the completely-filled small measuring cup.
2. How much instant snow powder do you think you can add to the filled measuring cup before it overflows? Shake the estimated quantity of instant snow powder into the second small measuring cup.
3. Now carefully sprinkle the powder little-bylittle into the measuring cup that is filled with water.


## (c) WHAT'S HAPPENING?

How much powder were you able to add? And did the water overflow?
The powder quickly absorbed all of the water, which was therefore unable to escape over the rim of the measuring cup.
Instead, it created a giant mound of snow extending beyond the cup's rim!

## Special properties of starch

## You will need

- Packet of corn starch powder
- Small and large measuring cups
- Spatula, pipette
- Water, scissors


## Here's how

1. Add 5 ml water to the small measuring cup.
2. Cut open the corn starch packet with a pair of scissors. Do not use your teeth! Pour the corn starch powder into the large measuring cup. Add the measured quantity of water and stir well. You should get a gooey mass. If it is too stiff, use the pipette to add 3 drops of water. If it is too runny, add one or two granules of snow powder, which will absorb water from the mixture and make it thicker.
3. Now you can perform a few experiments with the mixture. Try immersing the spatula quickly or slowly into it, tap on its surface with your finger, or try to use the spatula to collect some of it.

## (8.9) WHAT'S HAPPENing?

If pressure is rapidly applied to the mixture, as when you tap on it with your finger, it behaves like a solid. If you move more slowly, however, it acts like a liquid.


2


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