MADE WITH LITTLE STORYBOOK

The Snowflake’s Secret Map

Follow one tiny ice crystal from cloud dust to a quiet, glowing snow blanket.



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CHAPTER 1

A Speck in the Cloud

Snow does not begin as a tiny white star. High in a cold cloud, water hides in the air. It gathers around a speck so small you could never spot it. Let’s zoom in and meet the snowflake’s very first home.

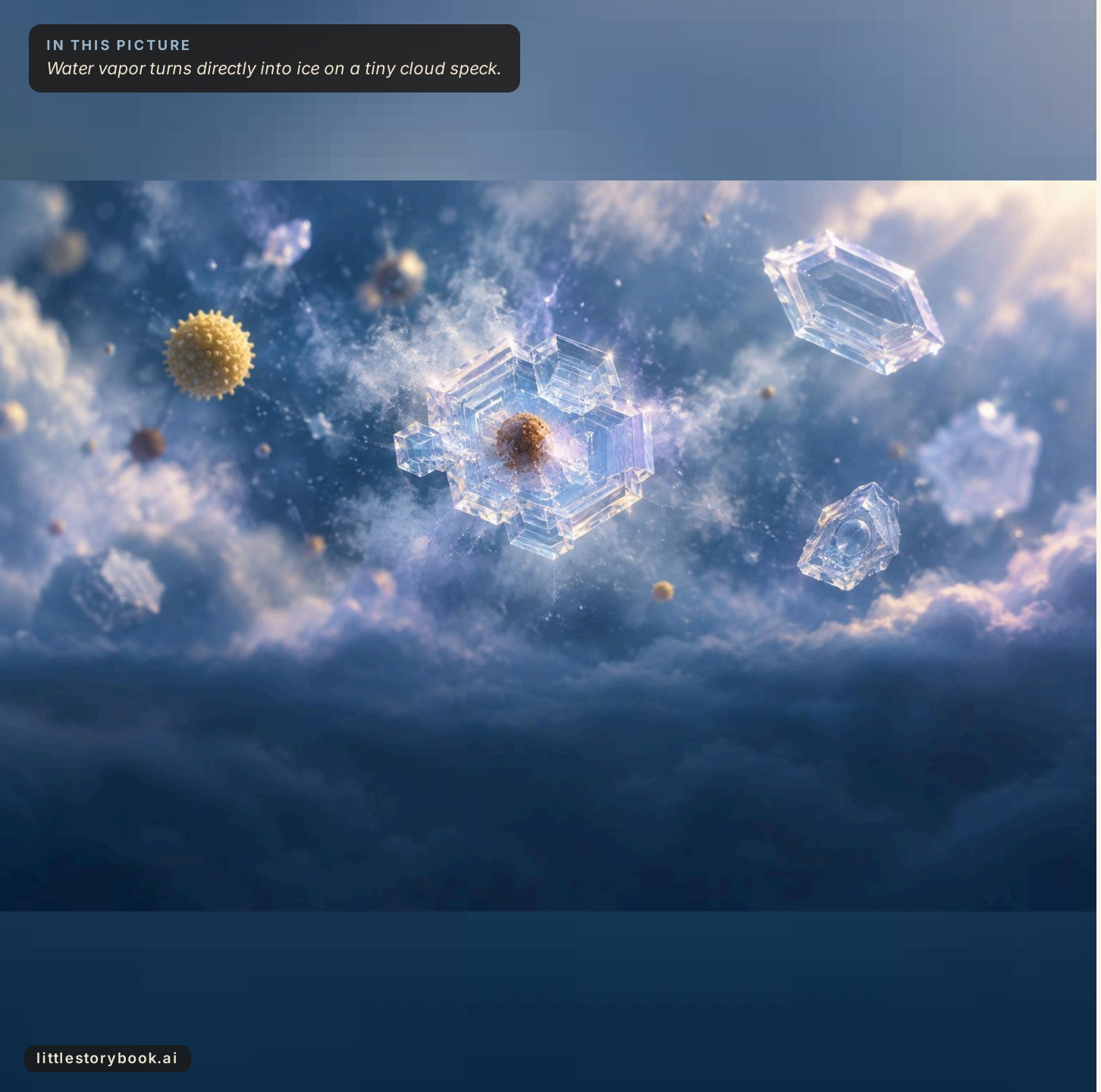
Water Wears Three Coats

Think of water as a shape-shifter. In your warm breath, it can be invisible water gas. Scientists call this water vapor. On a window, it can be liquid drops. Outside, cold turns it into solid ice, like an icicle. It is still water each time. What changes is how much warmth it has.

> **WOW FACTS**
> The water vapor in your breath is invisible before it cools into a misty cloud.



IN THIS PICTURE
Breath, drops, and ice show water in three forms.



IN THIS PICTURE
Water vapor turns directly into ice on a tiny cloud speck.

The Tiny Landing Place

Up in a freezing cloud, water vapor needs a place to begin. It may settle on dust, smoke, pollen, or a grain of sea salt. Instead of becoming a raindrop first, the vapor turns straight into ice. This change is called deposition. Like frost growing on a cold window, a tiny ice crystal begins on its little landing place.

> **WOW FACTS**
> A snow crystal usually does not begin as a frozen raindrop.



IN THIS PICTURE *Water molecules form repeating six-sided ice patterns.*

Why Six?

Ice is built from pieces far too small to see. Each piece is a water molecule, a tiny group of atoms. When water freezes, these molecules link in a pattern like a honeycomb cell: six sides. That six-sided shape is a hexagon. So a growing snow crystal has six corners or arms. Not five. Not eight. Its secret map is built into ordinary ice.

> **WOW FACTS**
> Snow can grow as plates, columns, needles, or branches, but its basic ice pattern is six-sided.



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CHAPTER 2

The Crystal Grows a Diary

High in a cold cloud, a tiny ice hexagon is growing. Invisible water vapor lands on it, sticks, and turns to ice. New bits gather fastest around its corners. Soon, the little crystal begins stretching six bright arms into the cloudy sky. Its shape will become a diary of the weather it meets.

Edges Grow First

Think of a wet mitten collecting snow on its fuzzy threads. A snow crystal collects water vapor, too. Its sharp corners and edges often catch the vapor fastest. There, it freezes into more ice. The middle grows more slowly, while the corners push outward. That is how a flat plate can begin growing arms.

> WOW FACTS
> More moisture in the cloud usually helps a crystal grow extra lacy branches.



IN THIS PICTURE
Water vapor freezes fastest on the crystal's sharp outer edges.



IN THIS PICTURE *One crystal changes as cloud air changes around it.*

Cloud Weather Makes Shapes

A falling crystal passes through cloud pockets, like rooms with different weather. Cold, drier air can make simple plates or small columns. Colder, wetter air can make fancy branches. A long skinny shape is called a needle. A branching, tree-like crystal is a dendrite. Each new layer changes how the crystal grows. Its final shape records that journey.

Six Sister Arms

Why do the arms often match? They grow side by side in nearly the same cloud air. If one arm meets damp, cold air, the others usually meet it too. So matching branches sprout at nearly the same time. They are not always perfect copies. A tiny bump or warmer patch can change one arm’s path. Still, the six arms often look like sisters.



IN THIS PICTURE

Nearby arms grow through nearly the same chilly, moist air.

Not Every Flake Is a Fairy Star

1. Snow can fall as flat plates, tiny columns, long needles, clumps, or broken crystal bits.
2. A snow crystal’s six-sided ice pattern can sometimes grow into a surprising triangle-like shape.
3. Two flakes can look very similar, but their exact tiny details are extremely unlikely to match.
4. The famous lacy star is real, but it is only one of many snow crystal shapes.





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CHAPTER 3

White, Hushed, and Full of Air

A snowy hill looks bright white. But look closely: its ice crystals are mostly clear! This chapter follows sunlight and sound through a snowbank. You will discover why clear crystals make white snow, and why fresh snowfall makes a busy world feel hushed.

Billions of Tiny Mirrors

Hold one ice cube to the light. It is mostly clear. Now imagine a snowbank packed with countless tiny crystals. Sunlight hits their many flat faces and bounces in every direction. This spreading-out bounce is called scatter. All the sunlight colors come back to your eyes together, so the snow looks white. Snow is not white paint. It is a dazzling pile of clear ice and air.

> **WOW FACTS**
> A fresh snowbank can look blue in a shadow because less direct sunlight reaches it.



IN THIS PICTURE
Clear crystal faces scatter sunlight into bright white snow.

IN THIS PICTURE

Airy fresh snow softens sounds from boots, paws, and cars.



The Giant Sound Sponge

After fresh snow falls, listen. Cars, paws, and voices may seem softer. Fluffy snow has thousands of tiny gaps filled with air. Sound wiggles into those gaps and loses energy as it bumps around. The snow absorbs and scatters the sound, a bit like a soft pillow muffles a clap. That is why a snowy street can feel wonderfully hushed, even when life is still moving.

> WOW FACTS
>
> New snow is often mostly air, not solid ice.

When Snow Gets Crunchy

Fresh snow is loose, soft, and full of air. But sun or warmer weather can melt its surface a little. When it freezes again, crystals stick together into a hard, icy crust. Your boots may crunch loudly there. Unlike fluffy snow, hard ice has fewer air gaps. Sound can bounce off it instead of getting soaked up. So snow can be quiet one day and noisy the next!



IN THIS PICTURE
Fluffy snow absorbs sound; hard refrozen snow bounces it back.



CHAPTER 4

The Secret Room Under Snow

Snow feels cold on your mitten. Yet deep snow can make a hidden room below. Tiny air spaces slow warmth from escaping, like fluff in a blanket. Voles can race through tunnels there. Some frogs rest near the muddy ground. Even a grouse may tuck into soft snow for the night. Let’s peek beneath the sparkling roof.



IN THIS PICTURE *Air pockets in snow slow warmth from escaping.*

How Cold Snow Holds Warmth

Think of a puffy coat. Its fluffy spaces hold air, and that air slows heat from leaving your body. Snow works similarly. Between its ice crystals are tiny air pockets. They slow warmth rising from the ground. This hidden under-snow space is called the subnivean zone. Traditional Inuit snow shelters, called igluit, also use packed snow's trapped air to help hold warmth inside. Snow is still cold, but it can block the sharper cold outside.

> **WOW FACTS**
> Ground heat can keep the hidden space under deep snow near the freezing point, even when the air above is much colder.

TRY IT!

Catch a Crystal Safely

With an adult, catch fresh snow on cold dark paper and look before it melts.

1. Ask an adult to chill a sheet of dark paper outside or in the freezer.
2. Go together to a safe spot away from roads, ponds, thin ice, and severe storms.
3. Hold the paper flat while fresh snow falls onto it.
4. Use a magnifying glass to look quickly, without breathing on the flakes.
5. Notice the shapes before warm fingers or air melt them.

Do this together with a grown-up.



Check your wonder

1 **How does a snow crystal usually begin in a cold cloud?**

- **A.** Water vapor sticks to a tiny speck and turns straight into ice.
- **B.** A raindrop falls and freezes into a star shape.
- **C.** Wind presses loose snow into a tiny crystal.

2 **Why do many snow crystals have six sides or six arms?**

- **A.** Wind blows from six directions.
- **B.** Ice grows in a repeating six-sided pattern.
- **C.** Snow clouds always have six layers.

3 **What helps make one snow crystal a plate, needle, column, or branchy star?**

- **A.** Its trip through air with changing temperature and humidity.
- **B.** The color of the cloud it falls from.
- **C.** How loudly the wind blows near the ground.

4 **Why can deep, fluffy snow help small animals stay warmer underneath?**

- **A.** The snow makes heat by itself.
- **B.** Tiny air spaces slow warmth from escaping.
- **C.** The ice crystals turn into warm water underground.

ANSWERS 1-A 2-B 3-A 4-B

1. Invisible water vapor can freeze onto a tiny speck, beginning a snow crystal. 2. Water molecules line up in ice in a pattern that makes six-sided shapes. 3. Different cold, damp parts of a cloud help shape the growing crystal. 4. Trapped air works like a blanket and helps hold warmth near the ground.

New words

water vapor
Invisible water gas floating in the air.

deposition
When water vapor turns straight into ice without becoming liquid.

humidity
How much invisible water vapor is in the air.

column
A small ice crystal shaped like a six-sided pillar.

scatter
To bounce light or sound in many directions.

crystal
A solid whose tiny pieces line up in a repeating pattern.

hexagon
A shape with six sides.

dendrite
A snow crystal with branches like a tiny tree.

needle
A long, skinny ice crystal.

subnivean zone
The hidden space under snow where trapped air helps animals and ground stay less cold.

Where we looked

We used web research from trusted science and education sources, including NOAA, NSIDC, Caltech, and wildlife educators, to check the snow facts in this book.

How Do Snowflakes Form? | NESDIS | National Environmental Satellite, Data, and Information Service
nesdis.noaa.gov

860 K G Libbrecht
its.caltech.edu

The Subnivean Zone
dnr.illinois.gov

Science of Snow | National Snow and Ice Data Center
nsidc.org

A Snow Crystal Primer
its.caltech.edu

How do snowflakes form? Get the science behind snow | National Oceanic and Atmospheric Administration
prod-01-alb-www-noaa.woc.noaa.gov

Aerodynamic Stability and the Growth of Triangular Snow Crystals
cco.caltech.edu

On the Geometry of Aggregate Snowflakes
doi.org

Now you know that every snow crystal carries a tiny map of its cloud journey. You know why snow can look white, sound quiet, and make a snug space below. Next time snow falls, look closely and wonder: what weather story did it bring?

THE END

What secret journey is written in the next snowflake that lands on your sleeve?

Make this book about your child

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