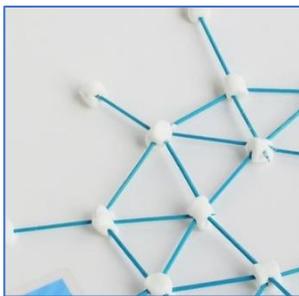


Snowflake Design Challenges

The shape of a snowflake depends on how cold the weather is, how much water is in the air and how hard the wind is blowing. Snowflakes can look like stars, columns, plates. Most often the ice crystals freeze together and make a six-pointed star. The shape of the ice crystals determines if the snowflake will make light and fluffy powder - great for skiing. Or, if it will make the thick and heavy snow that is perfect for making a snowman.

The next time you are in snow, let a few flakes fall onto something that is dark colored and examine closely what shape the snowflake makes. Not all snowflakes look like six pointed stars. Many do, but there are also quite a few odd-looking crystals falling from the winter clouds. You will see them if you go out looking, but it helps if you know what to look for.



Challenge #1

The snowflake shape challenge is to create a unique snowflake that contains at least three different geometric shapes using 30 toothpicks and 30 mini-marshmallows. You can also adapt the challenge by using cotton balls, Q-tips, popsicle sticks, twist ties...get creative.

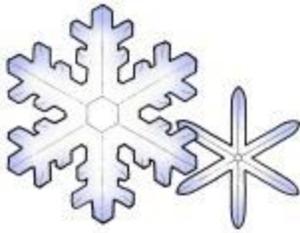
Challenge #2

Not all snowflakes look like six pointed stars. Many do, but there are also quite a few odd-looking crystals falling from the winter clouds. You will see them if you go out looking, but it helps if you know what to look for. On the following pages you'll find a few examples. When you go outside to look at the falling snow, magnifier in hand, you are more likely to spot a triangular crystal, a bullet rosette, or a double plate, if you know it exists. Using the chart to the right and the examples of ice crystal below, design and draw 2,3 more snowflakes. Remember no two snowflakes are alike.



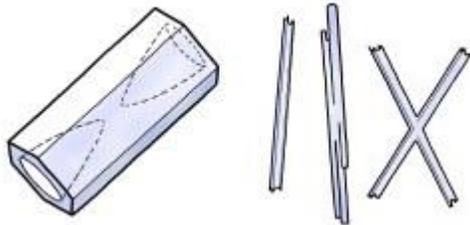
Source: Ken Libbrecht's Field Guide to Snowflakes.





Stellar Dendrites

These are the most recognizable snow crystals, as you can see from the examples on the right. Their name comes from their star-shaped appearance, along with their branches and sidebranches ("dendrite" means tree-like). Stellar dendrites are also quite large and common, so they are readily spotted on your sleeve, especially if you are wearing a dark fabric. The best specimens usually appear when the weather is quite cold -- about -15 C , or $+5\text{ F}$.

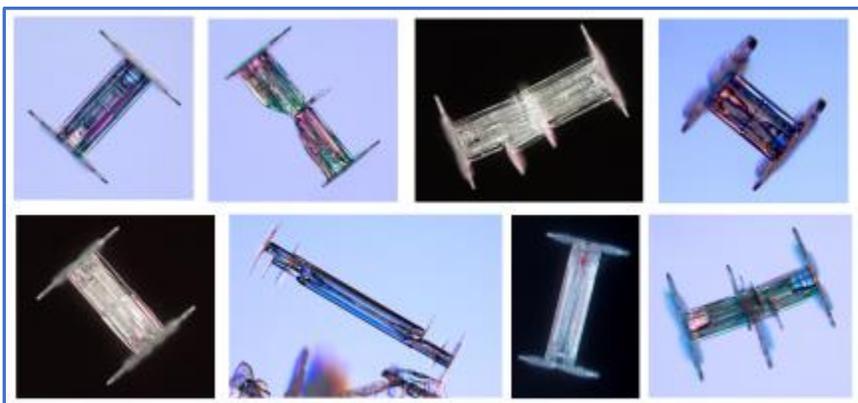


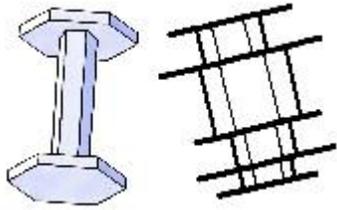
Columns and Needles

Columnar snow crystals appear when the temperature is around -6 C (21 F), and they can be quite common. They are small and easy to miss,

however, as they look like small bits of white hair on your sleeve.

Especially long, slender columnar crystals are often called needle crystals. "Hollow columns" have conical hollow regions in both ends, as shown in the drawing and several of the examples.

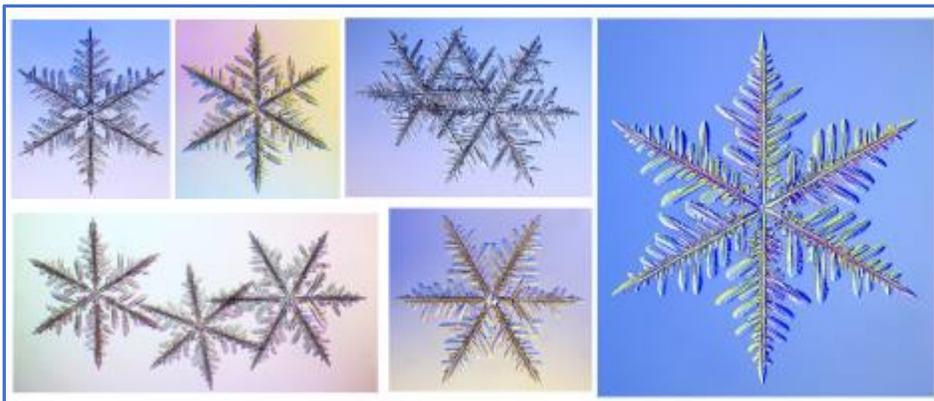




Capped Columns

These are my favorite snow crystal type that no one seems to know about. They are not common, but they are actually pretty easy to find if you go looking for them. A basic capped column is shaped like two wheels on an axle, or an empty spool. Multiply capped columns have additional plates between the outer two. Think empty spool when you look at the image on the upper-right corner, and you will get the idea.

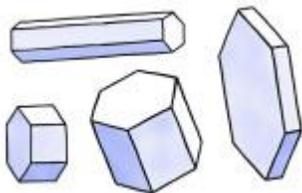
A capped column forms when it travels through different temperatures as it grows. First a column forms (around -6 C , or 21 F), and then plates grow on the ends of the columns (around -15 C , or 5 F). Next time it snows, consider it a challenge to get a magnifier, go outside, and see if you can spot some capped columns!





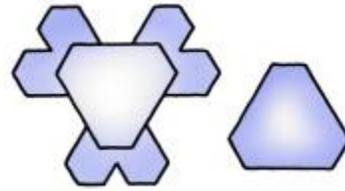
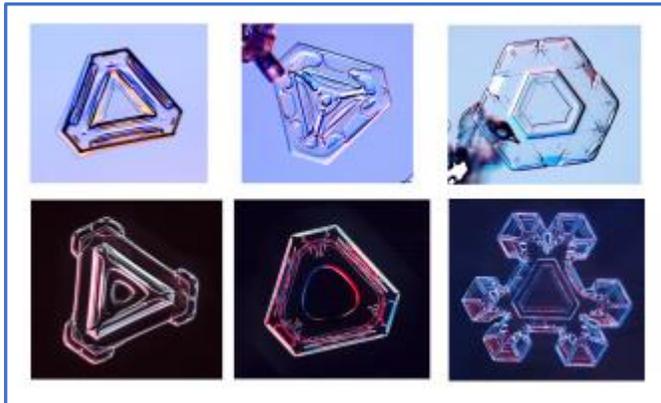
Fernlike Stellar Dendrites

These crystals are like Stellar Dendrites (above), but larger and leafier, with many sidebranches that resemble the branches of a fern. If you look carefully, you will see that the sidebranches mostly run parallel to their neighboring branches. You will also see that these crystals are not perfectly symmetrical. The sidebranches on one arm are not the same as those on the other branches. These are also the largest snow crystals, and specimens up to 5mm in diameter can be found.



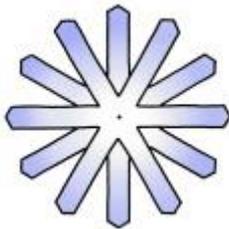
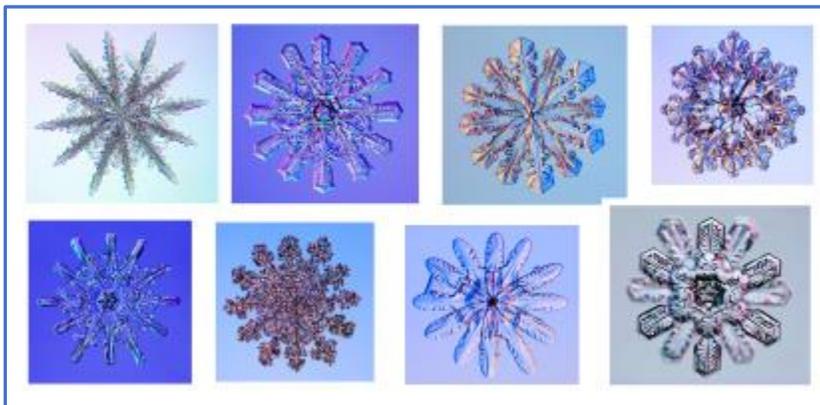
Diamond Dust Crystals

These tiny snow crystals look like sparking dust in the sunlight, which is where they get their name. They are the smallest snow crystals; many are no larger than the diameter of a human hair. They are most often seen in bitter cold weather.



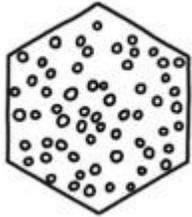
Triangular Crystals

It appears that aerodynamical effects help produce these unusual snow crystals. They are typically small, shaped like truncated triangles. Sometimes branches sprout from the six corners, yielding an unusual symmetry.



Twelve-branched Snowflakes

If two small six-branched snow crystals collide in mid-air, they might stick together and grow into a twelve-branched snowflake. You might think such ideal collisions would be rare, but twelve-brancheders are actually not too hard to find if you keep an eye out for them.



Rimed Snowflakes and Graupel

Snow crystals grow inside clouds made of water droplets. Often a snow crystal will collide with some water droplets, which freeze onto the ice. These droplets are called *rime*. A snow crystal might have no rime, a few rime droplets, quite a few, and sometimes the crystals are completely covered with rime. Blobs of rime are called *graupel*, or soft hail.