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The New York Times For Kids

EDITORS' NOTE:
THIS SECTION SHOULD NOT BE READ BY GROWN-UPS

FIREFLIES! GEYSERS! BISON! CAVES!

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A DOZEN NATIONAL-PARKS SUMMER ADVENTURES JUST FOR YOU

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ILLUSTRATION BY JOHN HERSEY

OOOOH! AHHHH! THE SCIENCE OF

FIREWORKS

CHRYSANTHEMUM

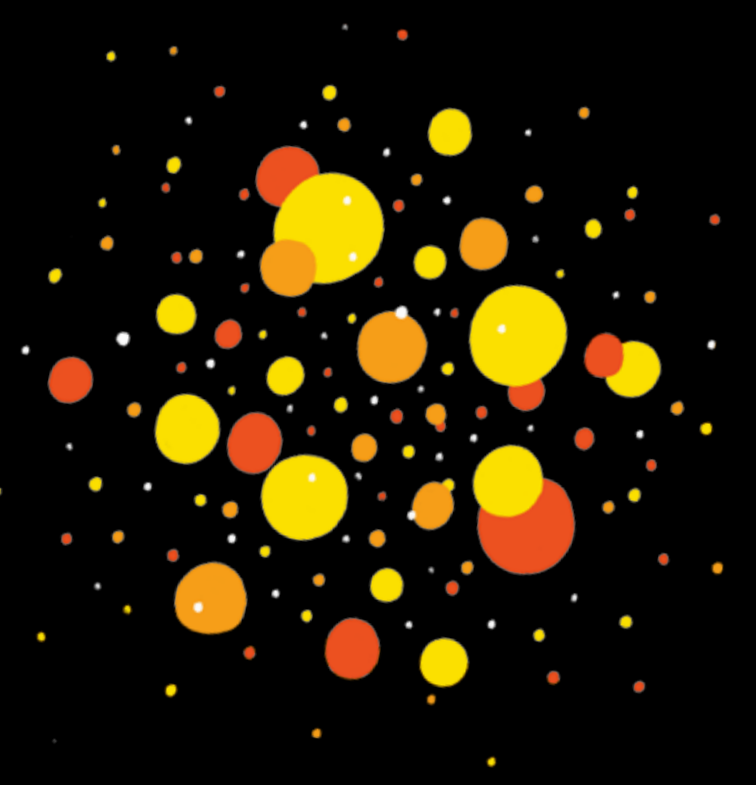
In this classic flower shape, the firework's main components, called stars, are arranged within the shell as a sphere. They're often layered like a jawbreaker with color effects so that the firework will be red one second (from chemicals that contain the element strontium) and sparkly (magnesium or aluminum) the next.

COMET

Unlike other fireworks, comets give off sparks as they leave the ground, creating a clear trail as they shoot hundreds of feet into the air. Blue, made from copper compounds, is infamous in the pyrotechnics industry for being the trickiest color to achieve: Burn it at too high a temperature, and it will look white; if it's not hot enough, it won't light up at all.

FISH

This crowd-pleasing effect looks like a bunch of fish squirming away from each other. Each "fish" is a little cardboard tube filled with chemicals containing aluminum or titanium to make it burn a silvery-white. Light just one end of those tubes, and they'll all shoot away, spinning wildly.

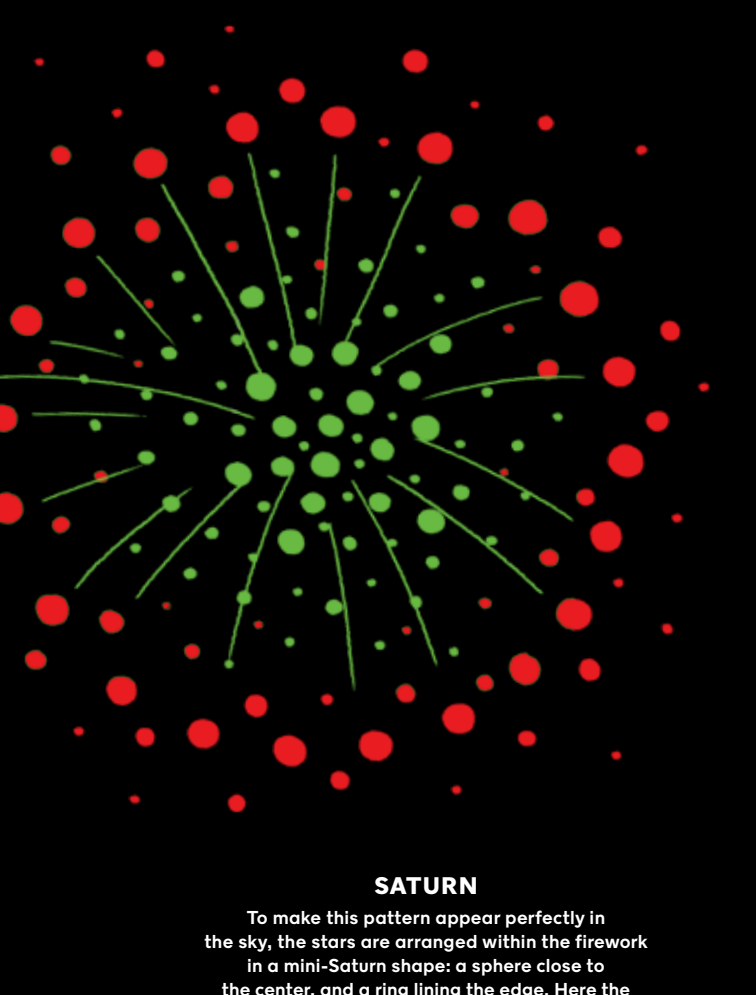


CRACKLE

An effect that's often used in other shapes as a finishing touch, this loud sizzling effect comes from hundreds of thousands of teeny tiny spheres of a metal called bismuth that melt at high temperatures and form zillions of popping bubbles. The orange comes from calcium!

HORSETAIL

To get this delicately curving effect, the firework is engineered to explode at only one end, near the peak of its ascent into the sky. The stars — which include sodium compounds, to make the firework yellowish-gold — ignite and fall out of the firework gradually.



SATURN

To make this pattern appear perfectly in the sky, the stars are arranged within the firework in a mini-Saturn shape: a sphere close to the center, and a ring lining the edge. Here the "planet" is green because of an element called barium, but fireworks designers often make the ring a different color so it will stand out.

BY CHELSEA LEU · ILLUSTRATIONS BY SUPER FREAK

FIREWORKS WERE invented more than 2,000 years ago in China — and humans are still obsessed with them. Americans alone spent more than a billion dollars on fireworks last year. But a fireworks show isn't just a colorful way to celebrate the Fourth of July. It's also a dazzling display of carefully calibrated chemistry. A firework's core elements are round pellets called stars that can be as big as baseballs and as small as peas — lit on fire, they're what you see arcing through the night sky, says Phil Grucci, whose company has been making fireworks for six generations. Stars are a blend of chemicals and certain metal-containing compounds. When ignited, those compounds absorb energy and release it by emitting light at specific wavelengths. The result: brilliant blues, glowing oranges and other dazzling hues. To set off a firework, you need two explosions — one to send the stars into the sky and another to set them on fire. Technicians use gunpowder to shoot the stars, which are wrapped in a cardboard shell with more gunpowder, into the air from a tube. When that package bursts in the air, the explosion simultaneously sets the stars ablaze and flings them out in all directions — and, if everything goes right, sparks oohs and aahs from the audience below. ◆

THE TICK TAKEOVER

BY KAT LONG

THE SIZZLING SUMMER sun means pool time! Hiking! Playing in the backyard and barbecues! But do you know who else loves summertime? Ticks, those tiny arachnids (related to spiders and mites) that suck blood for their food. "Ticks are the vampires of the mite world," says Kirby Stafford, a scientist at the Connecticut Agricultural Experiment Station. They like to hide in bushes and long grass and then grab onto a passing animal — like a deer, a rat or you. As they bite, chemicals in their spit reduce itching, so you might not even notice if one has latched on and started sucking.

Roughly 30 percent of ticks carry a germ that can cause Lyme disease. When the tick bites your skin, it can transfer the germ, and you might get a bull's-eye rash, fever, aches and sore joints. A new study from the Centers for Disease Control and Prevention shows that the number of people who have become sick from ticks more than doubled in 12 years: from 22,000 cases in 2004 to 48,000 in 2016. It's unclear why infectious tick bites are on the rise. One possible reason is the spread of deer, rats and other small mammals that carry ticks into new areas. Antibiotics usually take care of Lyme disease, but it's best to avoid being bitten altogether. That doesn't mean you have to stay indoors. Follow this checklist to protect yourself outside.

THE TICK-HATER'S CHECKLIST

- ☐ Put on light-colored clothes. Ticks will be easier to spot.
- ☐ Wear pants and tuck the hems into your socks, so the arachnids can't crawl up your legs.
- ☐ Wear clothes containing a bug repellent called permethrin — ticks hate it.
- ☐ Ask an adult to help you apply an E.P.A.-approved insect repellent.
- ☐ Avoid tall grass, bushes and leaf piles, where ticks hang out.
- ☐ Check your entire body for ticks when you come inside, especially your armpits, scalp and belly button, where they like to hide. ◆

HOW I BECAME A

COMPUTER ENGINEER

BY ERICA JOY BAKER

WHEN I WAS a freshman in high school, in 1994, I was sitting in the school library with three other girls, gathered around a computer and looking at the magic of the internet for the first time. For them, it was a temporary "whoa!" but for me, it was life-changing. I learned how to make websites, and during my senior year, I took a programming class for no credit. People still thought the internet and computers were a fad, but I knew it was what I wanted to do for my career.

When I got to college, I was the only black woman in my computer-science class. I didn't see anybody who looked like me, and my professor treated me as if I shouldn't be there. I went back home to go to the University of Alaska and switched to a computer-support degree. I got an internship working on the computer systems at the university, and they offered me a full-time job, so I dropped out of school. A few years later, I worked on systems and desktop support for Home Depot in Atlanta, then for a company that made the machines that make lottery tickets. I also worked as a computer engineer at Google and the messaging company Slack, and now I'm a senior engineering manager at Patreon, which helps creators earn money for their work.

My life goal is to use my skills to reassemble the family trees that slavery tore apart. Often, African-Americans don't know what country their ancestors came from. But we have the technology to start putting that tree back together by using existing genealogical data and new information captured online.

As told to Elise Craig

Tick illustrations: Kyle Hilton. Baker illustration: QuickHoney; source photo: Helena Price.