



Science of Style

“Fashion is not something that exists in dresses only. Fashion is in the sky, in the street . . . fashion has to do with ideas, the way we live, what is happening.”

—Coco Chanel,
fashion designer

Imagine farming silkworms to make raw silk, engineering a biodegradable fabric, or using chemistry to develop a cover-up that hides and heals acne scars. Fashion and beauty are glamorous businesses, but it’s the science behind these industries that makes their products cutting edge and desirable. In this badge, use the science of style to create—and imagine—your own products.

Steps

1. Test skin care and makeup
2. Examine the science behind fabrics and accessories
3. Explore the science behind hair products and perfume
4. Investigate the sociology of style
5. Formulate future style

Purpose

When I’ve earned this badge, I’ll know the science behind makeup, perfume, fashion fabrics, and skin care products.

Questions for a Skin Care Expert

- What causes acne and other skin disorders? What are some issues with acne medications?
- What types of makeup and skin care products are best for teenage skin, and why?
- What's the difference between natural and manufactured ingredients?
- What's the difference between an antiperspirant and a deodorant?
- What are parabens, and why are companies developing paraben-free cosmetics?

“Cochineal beetles, if you squish them, give you a beautiful carmine red that is used in some lipsticks. Why would you want to eat that, right? It's gross.”

—Dr. Chi-Ting Huang,
biochemist

In 2005, the average age a woman began using beauty products was 17; today, it is 13.7.

—The NDP Group,
marketing research
specialists

STEP

1 Test skin care and makeup

If you've ever looked at beauty-product labels, you've noticed a long list of chemical or natural ingredients. Most products are created in a lab by cosmetic chemists, technicians, and analysts, who devise and test the formulas. In this step, get a little closer to the process (and try it yourself).

CHOICES – DO ONE:

- ☐ **Interview a dermatologist or cosmetic chemist—then develop a beauty product idea.** Find out some principles of skin care and skin care products. (Check out the sidebar for questions you might ask.) As you chat, think about a product you might develop. Do you want to play up a feature, go for the natural look, or create a cream that helps skin look great without makeup? Then come up with a product idea, and design an exciting logo and sample packaging. On the packaging, list the problems it would address and the key active ingredients.

OR

- ☐ **Evaluate and compare two similar beauty products from different brands.** Choose one product and research what the ingredients do. For instance, sodium lauryl sulfate creates the lather in bubble bath. (Some manufacturers provide toll-free numbers that consumers can call for product information.) Then compare your product to a similar one from another brand. Try each three times and record data about them. Do the physical properties or ingredients affect product performance?

FOR MORE FUN: Compare the ingredients in an ultra-expensive brand with the two you tried. (You don't need to buy it—check online or ask someone in beauty care at a department store.)

OR

- ☐ **Make and test a homemade product.** Find a skin-care or makeup recipe online—perhaps a cranberry-flavored lip balm or an oatmeal facial scrub—and make it at home. Ask your friends to rate your product, but don't let them know it's homemade. If possible, have them compare your product in a blind test against a store-bought brand. Record the results.

Every step has three choices. Do ONE choice to complete each step. Inspired? Do more!

More to Explore

Take a beauty-product idea to a chemist or cosmetics expert and find out what ingredients it would take to make your product.

If possible, make it at home. Test your product by getting feedback from friends and family.

STEP 2 Examine the science behind fabrics and accessories

Inventions in fashion strive to meet our busy lifestyles and demands. As an alternative to scratchy, heavy wool, scientists came up with synthetic fleece. They also developed waterproof outerwear and no-iron shirts. Some gems are even engineered in a lab! Explore the emerging aspects of the science of fashion.

CHOICES – DO ONE:

- ☐ **Test sunglasses.** Sunglasses are more than a fashion statement—they also block UV rays, which can damage your eyes. Many glasses claim to absorb or block UV rays, but it's not always true. First, find out what U.S. regulations are for UV protection. Also learn about different types of lenses. Then visit an eyeglass store to compare three different-priced (affordable to expensive) sunglass brands with UV claims. Find out if they have a UV meter so you can test each pair. Did the most expensive brand offer the best UV protection? Write a sunglass recommendation to share with others.

FOR MORE FUN: Want to know how high UV-ray levels are where you live? Check www.allaboutvision.com/uv.

OR

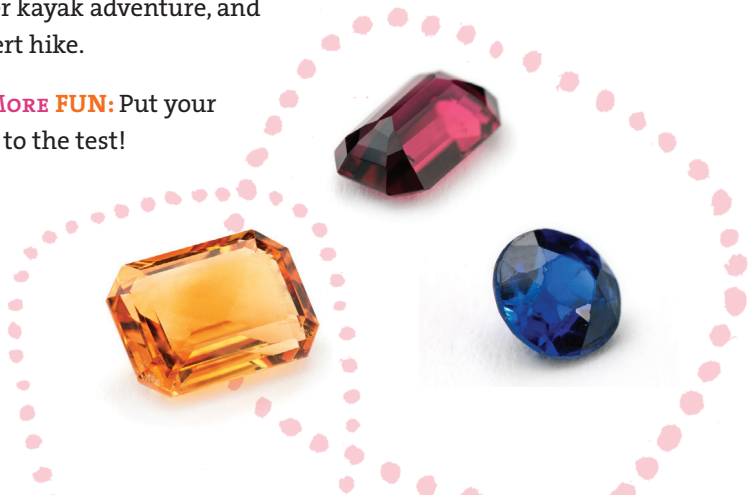
- ☐ **Grade a gem.** Visit a jewelry expert (maybe in a retail store) or talk to a gemologist about how to identify and evaluate gemstones. Find out about the four C's—color, cut, clarity, and carat—and how hue, saturation, and tone factor into a gem's quality. Then evaluate a jewel stone, either yours or a family member's.

FOR MORE FUN: Take your stone to an appraiser to find out how on target your evaluation is.

OR

- ☐ **Get into outdoor-fashion fabrics.** Go to an outdoor-clothing store or check online for information about outdoor fabrics. Find the best layering materials for cold and hot weather. What are the properties in waterproof and thermal fabrics? How are fibers designed to draw moisture to the surface of garments? Then design the perfect outfit for three outdoor scenarios—maybe a mountain climb through several climate zones, a winter kayak adventure, and a desert hike.

FOR MORE FUN: Put your outfit to the test!



Mechanical Engineering in Design

Goji Lin, one of Taiwan's top fashion designers, has a background in mechanical engineering. "I'm interested in the mechanics of clothing design. I think what makes my things unique is the construction. You can see evidence of my background in that, because my clothing is more three-dimensional."

More to Explore

Create a fashion app.

What smartphone application would make it easier to navigate the world of fashion and beauty? Perhaps an application in which you receive information about trends that look best on your body type, or what beauty items your fashion icon likes. Think through details of your application, then pitch your idea in a visual presentation to a panel of friends—or an app developer—for feedback.

STEP

3 Explore the science behind hair products and perfume

Some hair products claim to thicken hair. Others promise smoother, shinier locks. What is the scientific truth behind these claims? And do you wonder what type of scents people are attracted to and why? Get some answers in one of these activities.

More to Explore

Uncover the smelly truth.

Perfumes and fragrances can be loaded with “secret” unlisted chemicals, which can cause allergic reactions and disrupt hormones. According to the Campaign for Safe Cosmetics, 17 of the top-selling fragrances contained hidden chemicals—sometimes as many as 38. Find out about what these chemicals are and share important information with others.

CHOICES – DO ONE:

- ☐ **Compare ingredients in three different shampoos from the same brand.** Look for shampoos with different claims like “shine,” “volume,” and “color-stay.” Find the basic ingredients that shampoos share. Then compare the ingredients in those promising special effects, such as shine or volume. What compounds in the ingredients cause the effect? For instance, how do acids work on the hair cuticle to create a shine? Then try each at least twice to see what ingredients produce a result you love.

FOR MORE FUN: Explore the principles behind cold-water rinsing to make hair shinier.

OR

- ☐ **Test hair dye.** Speak to a dye expert about which chemicals are used in dyes to prevent damage to hair. How might leaving a hair dye on for too long create hair damage? At home, take a sample of five strands of hair (perhaps from your hairbrush) and submerge it in hair dye for 20 minutes. Submerge another sample for 40 minutes, and another sample for 80 minutes. Wash and dry the samples in distilled water after each process. Analyze the hair under a microscope at 100x. What are the average number of breaks for each? What can you conclude?

FOR MORE FUN: Find out how dyes vary depending on the color. What is different about permanent, semi-permanent, and wash-out dyes?

OR

- ☐ **Create a scent.** There are many ways to make your own scent. Here's one: Remove the stem from a flower you like, combine the flower with odorless oil, and let it sit for a few weeks—or find a flower's essential oil at a store. Then pour the oil only into a perfume bottle and spritz! Test your fragrance on your friends. Ask them: What does it smell like? Is it pleasing to you? What images does it conjure up?

FOR MORE FUN: Based on your results, design a print or video ad for your perfume.



SCENT OF AN EGYPTIAN QUEEN

In ancient Egypt, wearing perfume was a status symbol. So you can imagine that an Egyptian queen had access to some of the world's most precious scents. Soon, you might be able to smell one of those scents! Researchers at Bonn University's Egyptian Museum found traces of a fluid in a 3,500-year-old flacon (a small bottle) inscribed with Pharaoh Hatshepsut's name. Radiologists are using X-ray photography to examine the residue. Pharmacologists will study the results and, if possible, re-create the queen's perfume.

Careers to Explore

Chemist
Fashion forecaster
Social behaviorist
Fashion designer
Accessories designer

Hair and makeup artist
Costume designer
Pharmacologist

Dermatologist
Textile designer
Ecotoxicologist
Fashion or beauty writer
Cosmetologist
Product manager
Fashion or beauty photographer

Gemologist
Biologist
CAD designer
Fashion buyer
Physiologist

Every time you brush your teeth or wash your hair, chemicals wash down the drain. And then what happens? **Ecotoxicology** is the study of how these synthetic chemicals impact our environment.



“People need joy quite as much as clothing. Some of them need it far more.”

—Margaret Collier Graham,
American writer



STEP 4 Investigate the sociology of style

In what ways do fashion and beauty mirror our society or reflect social order? Throughout history, fashion and beauty have played significant roles in politics, psychology, and culture. Find out more.

CHOICES – DO ONE:

- ☐ **Make a timeline of fashion trends.** During World War II, Americans turned to patriotic fashion. After the Chinese Revolution, Communist leaders issued citizens dark blue uniforms. When rock and roll emerged in the 1950s, young people popularized rebellious styles, such as tight sweaters for girls and black leather jackets for boys. Put together a fashion timeline that shows how the political and social developments of the 20th century were reflected in the styles of the day. Use what you uncover to develop and sketch your vision for a future fashion trend.

OR

- ☐ **Conduct a social style experiment.** Photograph people you know in outfits that reflect how they normally dress. Then ask two separate groups to give you one-word impressions of each person, such as “sporty,” “preppy,” or “smart.” For your first survey, ask people who don’t know your subjects. For survey two, talk only to those who know the subjects. Next, ask your subjects to describe themselves. How do all three surveys stack up? Are the impressions different? What were the common descriptions? Share your opinion on whether what you wear shows who you are.

OR

- ☐ **Host a wear-a-thon.** Wear the same—or a very similar—outfit to school for one week (for instance, khaki pants and a blue sweater). You can accessorize your outfit however you want. The challenge is to learn how to make a wardrobe sustainable. Take photos of your outfits and post your findings on a blog: How did you make the same thing look different each day? Did this experiment make you more aware of reuse? Were you more creative with accessorizing and how you wore your hair or makeup? What comments did you get from classmates?

FOR MORE FUN: Ask friends to join you and get creative together.

More to Explore

Pretend you’re a Girl Scout in 1963. As Seniors did in “Project: Physical, Mental, and Social Health,” look into the history of cosmetics and the art of makeup—their origins, purposes, materials used in different eras and in different parts of the world, and how makeup and cosmetics were used.



STEP 5 Formulate future style

Where is style going to lead us? What will be some of the digital and electrical components in the future of style? Unleash your imagination and become a part of where we might be headed.

CHOICES – DO ONE:

- ☐ **Make something eco friendly.** Create a piece of jewelry or an outfit using only recycled, reused, or compostable materials.

OR

- ☐ **Create your own science-of-style project.** Check out the sidebar for inspirational projects. Find out about nanotechnology in textiles and the industries it may impact: the military, aerospace, health care, skin care, and sports. Come up with one idea of what you would develop. Draw your design and write up the idea in detail.

OR

- ☐ **Forecast fashion, beauty, or hair trends.** Fashion forecasting is big business. Experts study manufacturers, color trends, fashion shows, global influences, and consumer appetites to predict tomorrow's looks. First, research trends in one area—fashion, makeup, or hair—by talking to experts, going on trade websites, looking at global trends, reading industry news, and studying images from major runway shows. Then share what you predict for one year from now and five years from now—it might be a sketch, digital slide show, or a fashion show.

Future Fashion

Imagine shoes that vacuum up dirt. Slippers that massage feet. How about spray-on fabric? Or the Galaxy Dress, made from silk and embroidered with 24,000 color LED lights as flat as paper.

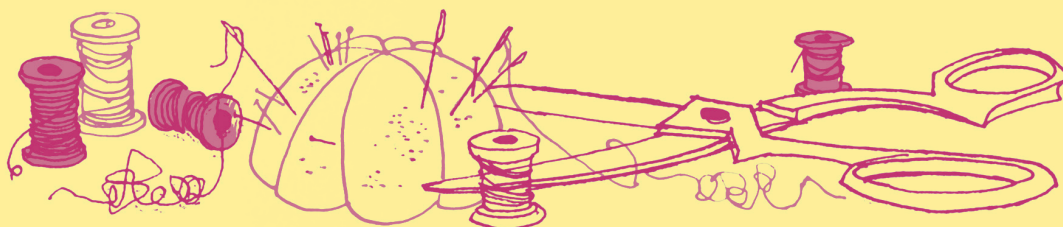
These are some examples of what already exists to serve as inspiration for what the future holds. Clothing that:

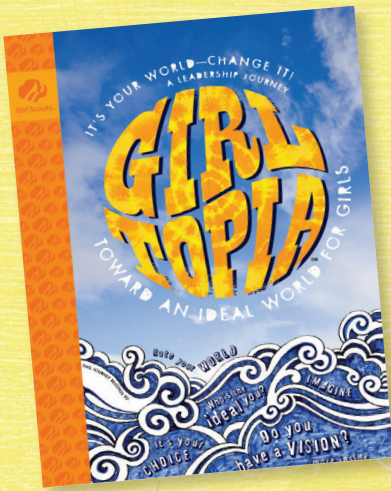
- gives off a soft, fragrant scent
- boosts energy like an energy drink
- changes color according to the temperature
- helps prevent colds and other diseases
- plays music or lets you make phone calls

Now put your brain-stimulator hat on, and think up more!

Serious Fashion Science

Japanese fashion designer Eri Matsui tends to be influenced by mathematics, physics, neuroscience, and even space. She created one of her most popular clothing lines using a computer program that combined numerical aspects of math with design aesthetics. In 2006, she created a wedding dress that would look good in zero gravity. To do this, she photographed models free-falling inside aircraft flying in parabolic trajectories. Matsui also started the Hyper Space Couture Design Contest to encourage designs for fashion-conscious space travelers.



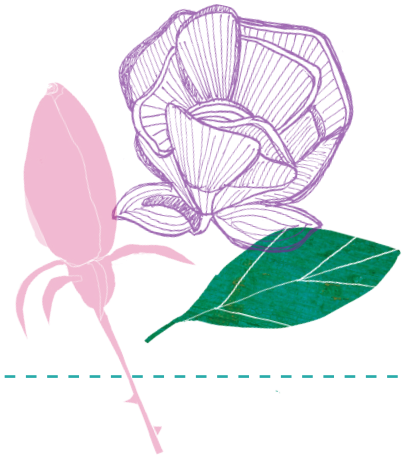


Add the Badge to Your Journey

When you do step 5, try formulating a style that matches your vision of a perfect world for girls. What's the message you would want your fashion formula to send?

Now that I've earned this badge, I can give service by:

- Helping a younger girl with a style-based science fair project
- Sharing my products with the costume and makeup departments for school or community-based plays
- Educating others about the need for sustainable materials in fashion



I'm inspired to: