

## **Scitech Activities: The Chemistry of Cosmetics**

**Time:** 4 hours (broken down into 4-1 hour classes)

### **Standards:**

#### **4<sup>th</sup> Grade Science Content Standards:**

**I&E 6a:** Differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.

#### **5<sup>th</sup> Grade Science Content Standards:**

**I&E 6h:** Draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion.

**I&E 6i:** Write a report of an investigation that includes conducting tests, collecting data or examining evidence, and drawing conclusions.

### **Topical Objectives:**

- Students will investigate the compounds used as ingredients in a variety of cosmetics with the goal of understanding the function of the compound and possible toxicity.
- Students will conduct various experiments to determine pH and viscosity and will test and rate each product for a variety of characteristics; i.e. Smell, bubble-ability, cleanliness, smoothness. Students will also calculate for a fair selling price for each product.
- Students will mix ingredients to make their own lip balm.
- Students will develop an understanding of the significant role of chemistry in the creation of various cosmetic products.

### **Safety Rules:**

Make sure students are aware of location and temperature of hot plates or heated water in the classroom and exercise appropriate precautions.

No product should be tested by tasting and all precautions should be taken to avoid eye contact.

Proper laboratory behavior is required for each day of testing.

### **Materials:**

- Lip balm tubes one for each student
- 'Lip solutions' 1tsp for each student
- Popsicle sticks
- teaspoon measuring spoon, 1/8 teaspoon measuring spoon
- Small beakers with lids, one for each student
- Containers for hot water bath
- Paper towels
- Essential oil and flavoring, peppermint, raspberry, rootbeer and tangerine
- Mini pipettes
- Litmus paper,
- paper cups,
- tweezers,
- pH charts
- test tubes with stoppers

- test tube holders
- stop watches
- small plastic bead
- a variety of cosmetic products of different brands: shampoo, conditioner, hair gel or styling product, lotion, body wash, toothpaste, deodorant, etc.
- Barbies with lots of hair, as test subjects.
- Photocopies of periodic charts
- Small plastic cups
- permanent markers
- computers with internet access

### **Day One: Cosmetic and chemistry introduction**

**Preparation:** Choose 5 products to test for properties. Wrap each bottle to keep the actual product a secret until after the experiment. Fill cups #1-5 with each product and fill an extra cup with water to test products reaction with water.

#### **Procedure:**

1. Administer chemistry of cosmetics questionnaire.
2. Introduce Chemistry as a study of matter, review the three states of matter, what is matter, what is matter made up of and what is in charge of giving matter it's properties, look to periodic charts, review elements and compounds.
3. Brainstorm examples of cosmetics. Define what a cosmetic is. Cosmetics are any product used to enhance or protect the appearance or odor of the human body.
4. Read and discuss how chemistry is related to cosmetics. Read sections of the Cosmetic Chemist article together. Explain that cosmetics are mixtures of lots of chemicals.
5. Introduce appropriate lab behavior, no tasting or exposure to eyes. We will be investigating the properties ( may need to briefly review what properties are) of 5 different cosmetics, recording observations and descriptions, testing with water and hypothesizing the purpose of each product and how the properties led to their conclusion.
6. Demonstrate how the students will dip their finger into each product, rub their fingers together to describe properties, smell, then using the same finger, dip into the water and rub again, noting any changes that occur when water is added.
7. When finished, we will share with the class, what we thought each product was and why.
8. Reveal the answers and see if they were correct.
9. Clean up

#### **Science Notebook Ideas:**

As part of the introduction to chemistry note taking may be needed. Terminology can include: matter, periodic table, element, atoms, compounds.

### **Day two: Researching Ingredients and Compounds**

**Preparation:** Set up computers with internet access, minimum of 6 per class.

#### **Procedure:**

1. Divide the students into groups of 2 or 3.
2. Have each group choose 3 products they will research the ingredients/ compounds of. Briefly review what a compound is. Remind them we are not opening any of the containers, only looking at ingredients.
3. Record the first three ingredients/compounds of each product in your data sheet
4. Use the computer (Wikipedia) to research each ingredient, what is the purpose? What is it? And what is its compound or chemical sentence.
5. Are any of the ingredients toxic or skin irritants? How do the ingredients differ in another brand of the same product?
6. Have each group come up and present one of their products, the three ingredients they researched, show the chemical compound for one of its ingredients, and share if any of the ingredients were toxic and why.

**Science Notebook ideas:**

Record data and research as it is collected. Any questions they might have after reviewing ingredients. Short list of any toxic compounds they encountered.

**Day 3: pH tests**

**Preparation:** Make sure there are enough supplies for each group.

**Procedure:**

1. Introduce pH, pH scale and that it is measuring in intensity, for alkalinity or acidity. Explain that they will be testing two products pH levels twice.
2. Have the students divide into groups and choose 2 products.
3. They will label one product A and the other product B, then they will label two paper cups A and two paper cups B.
4. Pour about a tablespoon of product A in A cups and Product B in B cups.
5. Pass out litmus paper, tweezers and litmus scale charts.
6. Using the tweezers, have the students dip their litmus paper into the product A cups, compare and identify the color and number to the pH indicator chart and record. Do this twice for each product.
7. Repeat with product B.
8. Compare the results from each group with the class, and review results for commonalities or patterns. Which products are more acidic? Or more base? Are they all neutral? Why would a product need to be acidic?

**Science Notebook ideas:**

Recording data and developing conclusions

**Day 4: Viscosity**

**Preparation:** Choose a variety of cosmetics that will have high or low viscosity and are easy to clean up, or clear enough that the bead can be located as it falls. Each group should have beads, test tubes, test tube holders and “liquid” products

**Procedure:**

- 1) Introduce viscosity: Viscosity is the resistance to flow that a liquid has. Some liquids flow faster or slower, are thick or thin, if a fluid is thick it is said to have a higher viscosity, low viscosity if it is thin and flows easy.
- 2) Explain the procedure of using the bead and timing how long it takes to fall through the liquid. Make sure test tube is filled to the top with liquid and all beads are roughly the same shape and size.
- 3) A standardized test with water will be conducted first, make sure each team tests and times the viscosity of water, record and compare results. Did each group get the same result? What would explain differences? Do this test twice so the students get the hang of using the timer.
- 4) Create a chart in their notebooks for collecting the data from each test.
- 5) Have each group select 2 products to test and write a hypothesis of which product will have a higher viscosity. Using one test tube, test one product at a time, making sure that they wash their test tube out before moving to the next product. Record product details, observations and time.
- 6) Share results and compare all the different products tested to see which products had the highest and lowest viscosity.
- 7) If time allows, decide on what qualities we are looking for when we test products at our next meeting. How do we decide what makes a good shampoo? Conditioner? Lotion? Eyeliner? Etc.

**Science Notebook ideas:** Write some hypothesis for each of the tests. Collect and record data from other groups that tested different products.

**Day 5: Product Testing**

**Preparation:** Barbie's will be needed for testing hair products, smooth white paper for testing eyeliner, eye shadow and lipsticks or foundation products.

**Procedure:**

- 1) First review what characteristics or qualities we are looking for in each product. Make a chart for each product on the board with qualities the groups might be testing for in order to decide if a product is good or not. Lotions might be soft, greasy, too smelly, nice smelling, sticky, slimy, and smooth.
- 2) Explain that we will be testing any hair products on the Barbie hair and any facial products on the paper, they are allowed to test the lotion on a smart part of their hands, but must immediately wash it off after making observations.
- 3) Have each group test 3-4 products and rate each one giving reasons why they liked or didn't like the products and which would they purchase. Present this information to the class and collect data from other groups.
- 4) If time allows have each group test out other "approved" products from other groups.
- 5) If time allows give out post test for cosmetic chemistry.

Test 1: Researching Ingredients / Coumpounds

1. Complete a list of the top 3 compounds found in each consumer product you will test.
2. Research each ingredient and record the function, compound equation, and toxicity.

Product A

Product name:

Product Manufacturer:

Ingredient/Compound

Type of Function

1.

2.

3.

Are any of the ingredients toxic or skin irritants?

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Product B

Product name:

Product Manufacturer:

Ingredient/Compound

Type of Function

1.

2.

3.

Are any of the ingredients toxic or skin irritants?

Product C

Product name:

Product Manufacturer:

Ingredient/Compound

Type of Function

1.

2.

3.

Are any of the ingredients toxic or skin irritants?

Chemistry of Cosmetics

Test 2: pH Factor

pH or the potential for hydrogen will reveal if something is acidic or alkaline (acid or base). The pH scale goes from 0-14, 7 being neutral or non acidic and non base, 0-7 being acidic and 7-14 being basic or alkaline. Knowing the pH of different ingredients is important when mixing ingredients to make solutions and almost all cosmetics are solutions with of chemicals ingredients.

- 1) Choose 3 products to test the pH, label them product A,B,C.
- 2) 6 cups, 2 labeled product A, 2 labeled product B, 2 labeled product C.
- 3) Fill the cups with their products, we will be conducting each pH for each product twice.
- 4) Using the tweezers remove one pH strip and place it into the product being tested.
- 5) Note the color change and match it with the color and number scale.
- 6) Record the number that correlates with the color of the pH strip and if it is acid or base.

Test #1

Product A

Product A

Color:

Color:

Acid/Base:

Acid/Base:

pH number:

pH number:

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Test #2

Product B

Product B

Color:

Color:

Acid/Base:

Acid/Base:

pH number:

pH number:

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Test #3

Product C

Product C

Color:

Color:

Acid/Base:

Acid/Base:

pH number:

pH number

