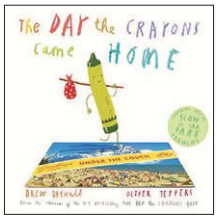
The Science of Art

By Emily Morgan and Karen Ansberry

It's easy to see the connections between science, technology, engineering, art, and mathematics (STEAM) in daily life, but they may not be so obvious in the classroom. This month's lessons allow students to explore the components of STEAM through a favorite art supply, the crayon, and a beloved American tradition, the Macy's Thanksgiving Day Parade.

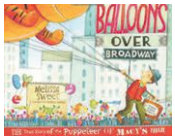
This Month's Trade Books



The Day the Crayons Came Home
By Drew Daywalt
Illustrated by Oliver Jeffers
ISBN: 978-0-399-17275-5
Philomel Books
48 pages
Grades K–2

Synopsis

This clever book tells the story of Duncan's crayons, a colorful bunch who have survived a series of misadventures.



Balloons Over Broadway: The True Story of the Puppeteer of Macy's Parade
By Melissa Sweet
Illustrated by Melissa Sweet
ISBN: 978-0-547-19945-0
Houghton Mifflin Books for Children,
40 pages
Grades 3–5

Synopsis

Caldecott Honor artist Melissa Sweet's mixed-media illustrations and charming text tell the true story of Tony Sarg, who designed the first helium-filled balloons for the Macy's Thanksgiving Day Parade.

Curricular Connections

This month's lessons demonstrate that science and engineering are essential components in art. In the lesson for grades K–2, students are inspired to think about all of the ways in which crayons can be changed. Then, they explore the properties of crayons and learn that by adding heat, crayons can be changed from solid to liquid. Students also learn how crayons are manufactured in a factory, and they design a process for creating crayons of mixed colors and different shapes out of pieces of crayon. Finally, students write about the changes their crayons experienced.

The lesson for grades 3–5 also addresses physical science in the context of art and engineering. Students learn about Tony Sarg, who created the Macy's Thanksgiving Day Parade, and how he used the science of gases to solve some of the problems in the first versions of the parade. Students use balloons in the classroom to learn more about the Macy's parade balloons. Students also identify how science, technology, engineering, art, and mathematics all came together as Tony Sarg designed and refined this annual parade. In the Elaborate phase of the lesson, students are challenged to design their own parade to celebrate a school event. Finally, students identify how they used all of the components of STEAM when designing their parade. ■

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Grades K–2: Crayon Science

Purpose

Students will learn what crayons are made of, how they can be changed, and how they are manufactured.

Materials

- crayons to be observed, broken, and melted (1 per student)
- silicone baking molds or ice cube trays in interesting shapes
- oven (for teacher use only)
- 64-count box of crayons

Engage

Ahead of time, hide a crayon in a mystery bag (a paper bag with a question mark on it). Tell students that you have a mystery item in the bag and give them some clues about it (e.g., it is red, you can draw with it), allowing them to guess after each clue. When they have guessed correctly, pull out the crayon and show them. Say, "You may think this crayon is ordinary, but by the end of this lesson you will think that crayons are extraordinary!"

Show students the cover of *The Day the Crayons Came Home*. Introduce the author and illustrator. Students may be familiar with Daywalt and Jeffers's previous book, *The Day the Crayons Quit*. Tell students that as you read the book, they should notice all of the different things that happen to the crayons and the ways in which the crayons in the book are changed (CC ELA Connection: Reading – Literature, Key Ideas and Details). After reading, together make a list of all the ways the crayons were changed in the book: broken, melted by the Sun, chewed by a dog, sharpened, melted in the dryer, and so on. Tell students that they are going to learn more about these common art tools—where they come from, what they are made of, and how they can be changed.

Explore

Give each student a crayon and a Crayon Observation Sheet (see NSTA Connection). On the sheet, students draw a picture of their crayon, record observations, and list some ways that the crayon can be changed. Ask, "Is your crayon a solid, a liquid, or a gas?" (solid). Have students peel the wrappers off their crayons and break them into smaller pieces. Ask students how the crayon is different (e.g., more pieces, different shape) and how it is the same (e.g., still draws, same color).

Explain

Next, show students a 64-count box of crayons. Ask them what they are wondering about the crayons and to record some of their wonderings. Then add these questions to their list (if they are not already on it):

- Where did this box of crayons come from?
- How did it get to the store?
- Where were the crayons made?
- What are they made of?
- How did they become this shape?
- How did the wrappers get on them?
- How did all of these colors end up in one box?

Discuss each question with your students and allow them to share their ideas (responses will vary). Then, tell students that you have a video that will give them the answers to many of these questions. Show the video in which Fred Rogers explains how crayons are made (see Internet Resources). You may also want to show students "Life of an American Crayon" and "How It's Made: Crayons" to show different perspectives (see Internet Resources). While watching the videos, have students listen for the answers to the questions on the board (CC ELA Connection: Reading – Informational Text, Key Ideas and Details). After students have watched the videos, revisit the questions above. With the box of crayons in hand, review how each component is made and assembled. Explain that every step of this process, from transporting the wax to the factory to designing the machinery that sorts and packages the crayons, was designed by engineers. Students learn from the Mr. Rogers video that crayons are made of wax and pigments. Ask students if wax is a solid or a liquid (it is a solid at room temperature and becomes liquid when heated). Ask students why they think crayons are shaped the way they are (it makes it easy to write and color with them). Then ask, "Do you think it is possible to make crayons into different shapes? How?" (have students share their ideas).

Elaborate

Reread pages 27 and 28 in *The Day the Crayons Came Home*, where the turquoise crayon is melted in the dryer, and ask students the following questions:

- Why would a crayon melt in a dryer? (It is hot in the dryer.)
- How did the turquoise crayon get in the dryer? (Duncan left it in his pocket.)
- Why it is a bad thing if a crayon gets in the dryer? (It melts and gets stuck in the clothes.)

Next, revisit pages 13 and 14, where the orange and red crayons are melted together, and ask, "Why did the red and orange crayons melt?" (they were left in the heat of the Sun) (CC ELA Connection: Reading – Literature, Key Ideas and Details).

Students should realize that because crayons are made of wax, they will turn to liquid when heated and become solid again when they cool. Tell students that you would like them to design a process that turns their crayons (from the Explore phase) into multicolored crayons of different shapes. Show them the silicone baking tray and tell them that you will also be using an oven. Together, brainstorm a step-by-step process, such as having students exchange crayon pieces to mix up the colors and then having them place their broken pieces into the silicone tray. Tell them that you are going to go home and heat the tray in the oven to melt the pieces together (detailed instructions for melting the crayons in the silicone tray can be found at the Making Melted Crayon Art website; see Internet Resources). The following day, give students their new crayons and have them draw with them and compare them to the original crayon. How are they the same? How are they different?

Evaluate

Give each student a postcard template copied onto cardstock (see NSTA Connection). Tell them that they are going to be writing a postcard to themselves from the crayon they were given at the beginning of this lesson. On their postcard, they will explain all of the things that happened to it, just like the postcards in *The Day the Crayons Came Home*. You may want to reread a few examples from the book to remind students how the cards are formatted and written. In their postcard, they must start from the crayon being whole, then broken, then melted, then turned back to a solid. Encourage them to use temporal words such as "first" and "next" to signal event order. They must also use the words "solid," "liquid," and "heat" in their writing. On the other side of the postcard, they can draw a scene showing at least one thing that happened to the crayon (CC ELA Connection: Writing – Text Types and Purposes).

NSTA Connection

Download the Crayon Observation Sheet and postcard template at *www.nsta.org/SC1602*.

Connecting to the *Common Core*

This section provides the *Common Core for English Language Arts and/or Mathematics* standards addressed in this column to allow for crosscurricular planning and integration. The Standards state that students should be able to do the following at each grade level:

English/Language Arts

Reading Standards for Literature K–2 – Key Ideas and Details

- Grade 2: Ask and answer such questions as *who, what, where, when, why,* and *how* to demonstrate understanding of key details in a text.

Reading Standards for Informational Text K–2 – Key Ideas and Details

- Grade 2: Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.

Writing Standards for K–2 – Text Types and Purposes

- Grade 2: Write narratives in which they recount a well-elaborated event or short sequence of events, include details to describe actions, thoughts, and feelings, use temporal words to signal event order, and provide a sense of closure.

Reading Standards for Informational Text 3–5 – Key Ideas and Details

- Grade 5: Quote accurately from a text when explaining what they text says explicitly and when drawing inferences from the text.

Reading Standards for Informational Text 3–5 – Craft and Structure

- Grade 5: Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent.

Writing Standards for 3–5 – Production and Distribution of Writing

- Grade 5: Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

Furthermore, the *Common Core State Standards*, ELA, provide a standard related to the Range of Text Types for K–5 where it indicates that students in K–5 should apply the Reading standards to a wide range of texts to include informational science books.

Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013):

2-PS1 Matter and Its Interactions

www.nextgenscience.org/2ps1-matter-interactions

K-2-ETS1 Engineering Design

www.nextgenscience.org/k-2ets1-engineering-design

The chart below makes one set of connections between the instruction outlined in this article and the NGSS. Other valid connections are likely, however space restrictions prevent us from listing all possibilities. The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectations listed below.

Performance Expectations	**Connections to Classroom Activity** *Students:*
2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.	• describe crayons by their observable properties on the Crayon Observation Sheet.
K-2 ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	• develop a process to create crayons in different shapes.
Science and Engineering Practice	
Obtaining, Evaluating, and Communicating Information	• learn how crayons are manufactured and what they are made of.
Disciplinary Core Ideas	
PS1.B: Structure and Properties of Matter • Different kinds of matter exist and many of them can either be solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.	• observe crayons in both their solid and liquid states through classroom experiences and watching videos.
ETS1.A: Defining and Delimiting the Problem • A situation that people want to change or create can be approached as a problem to be solved through engineering.	• develop a process to create crayons in different shapes.
Crosscutting Concept	
Cause and Effect	• recognize that heat causes crayons to turn to liquid and that they become solid again at room temperature.

Internet Resources

History Channel: Thanksgiving Day Parade Tech
www.history.com/topics/thanksgiving/history-of-thanksgiving/videos/thanksgiving-day-parade-tech

Life of An American Crayon
www.crayola.com/videos/video-category/the-life-of-an-american-crayon.aspx

Making Melted Crayon Art
www.pbs.org/parents/crafts-for-kids/arts-and-crayons

PBS Kids: Mr. Rogers's Neighborhood: How Crayons are Made
http://pbskids.org/rogers/video_crayons.html

Science Channel: How It's Made: Crayons
www.sciencechannel.com/tv-shows/how-its-made/videos/how-its-made-how-crayons-are-made