High School History — Women in Science

What does it mean to be a woman in science?

Standards and Content	**D2.His.1.9-12.** Evaluate how historical events and developments were shaped by unique circumstances of time and place as well as broader historical contexts. **D2.His.3.9-12.** Use questions generated about individuals and groups to assess how the significance of their actions change over time and is shaped by the historical context.
Staging the Compelling Question	Have students come up with a list of ten famous scientists. Once they've completed a list, have them figure out how many on their list are women. As a class, come up with the average percentage of women in science included on the lists. Is the percentage below 50 percent?

Supporting Question 1	Supporting Question 2	Supporting Question 3	Supporting Question 4
What was it like to be a woman in science in the mid-twentieth century?	How have women in science dealt with the "two elephants in the room" of race and gender?	How have women in science balanced being partners/spouses, mothers, and scientists?	How have people addressed the gender disparity in science?
Formative Performance Task	**Formative Performance Task**	**Formative Performance Task**	**Formative Performance Task**
Use Labov's method to determine the narrative parts of Cohn's and Kwolek's stories and write one paragraph drawing conclusions about their experiences, answering the supporting question.	Write one paragraph explaining how women have dealt with race and gender in science. Compare and contrast Anderson's and King's experiences. How were they similar? How were they different?	Use a word wall from Bertozzi's and Sanchez's interviews to see what language they use related to the supporting question and write one paragraph answering the supporting question.	Develop a claim supported by evidence that answers the supporting question in 1-2 paragraphs. Draw from Nelson's and Chowdhry's experiences, as well as other information if desired.
Featured Sources	**Featured Sources**	**Featured Sources**	**Featured Sources**
Source A: Mildred Cohn, interview by Leon Gortler PDF, pgs. 15-16 **Source B:** Stephanie L. Kwolek, interview by Raymond C. Ferguson PDF, pgs. 17-18	**Source A:** Gloria L. Anderson, interview by Jeannette E. Brown PDF, pgs. 41-43 **Source B:** Reatha Clark King, interview by Jeanette E. Brown PDF, pgs. 18-20	**Source A:** Carolyn R. Bertozzi, interview by Andrea R. Maestrejuan PDF, pgs. 100-102 **Source B:** Yolanda Sanchez, interview by David J. Caruso PDF, pgs. 70-72	**Source A:** Donna J. Nelson, interview by Hilary Domush and Leah Webb-Halpern PDF, pgs. 37-48 **Source B:** Uma Chowdhry, interview by Hilary Domush PDF, pgs. 43-45

Summative Performance Task	**ARGUMENT:** *What does it mean to be a woman in science?* Construct an argument (detailed outline, poster, speech, essay) using specific claims and relevant evidence and information from historical and contemporary sources.
	EXTENSION: Conduct a thirty- to sixty-minute oral history interview of a local woman in science. Consider asking questions about race, gender, and class.

Taking Informed Action	**UNDERSTAND:** Research other women in science through oral history interviews, historical biographies, images, newspaper articles, etc. **ASSESS:** Compare and contrast the experience of the women researched to the women featured in the oral history interview excerpts. **ACT:** There are several ways a student could use this information, including several suggestions below: • Create a crowdsourcing campaign on social media to identify unknown women in science. See an example here. Remember that crowdsourcing can be challenging and isn't guaranteed to produce any additional information. • Reach out to a local newspaper or news station and ask them to feature one (or more!) of the women students discovered in their research in an upcoming article or broadcast. Help spread the word about women in science. • Develop an online exhibit examining the lives and experiences of women in science. Knight Lab and Sutori are two examples of open-source tools students can use to develop a variety of online exhibits from timelines to story maps.

**Featured sources are suggested. It may be that these resources are no longer available, and we apologize in advance for the inconvenience.*

What does it mean to be a woman in science?

Overview

Inquiry Description

This inquiry encourages students to consider the experiences—both positive and negative—of women in science to get a glimpse of what it means to be a woman in science. Although there are many sources about women in science that could be considered, this inquiry focuses on eight oral history interviews available through the Science History Institute's Digital Collections. Through the inquiry, students consider social, cultural, racial, economic, and other factors that shaped the experiences of these eight women in science. This inquiry introduces students to women in science from a wide variety of backgrounds to expose them to different experiences women in science have had.

To apply to a broad audience of educators, this inquiry uses national history standards from the National Council for Social Studies, College, Career, and Civic Life (C3) Framework for Social Studies State Standards: Guidance for Enhancing the Rigor of K-12 Civics, Economics, Geography, and History, "Change, Continuity, and Context," page 46. Teachers may also use standards and content specific to their states and localities.

Structure of the Inquiry

In addressing the compelling question, "What does it mean to be a woman in science?" students will work through a series of supporting questions, formative performance tasks, and featured sources to construct an argument supported by evidence. The supporting questions help introduce students to women in science from different backgrounds and display facets of the scientific life. Students will examine how diverse women have navigated the field of science and provide an assessment of what it means to be a woman in science in the Summative Performance Task.

At the end of the inquiry, there are several ways students can take informed action. After researching other women in science, they may create a crowdsourcing campaign to identify unknown women in science, reach out to a local newspaper or news station to feature a woman (or women) in science, or develop an online exhibit to consider the lives and experiences of women in science.

It is important to remember that this inquiry does not present a comprehensive picture of the experiences of all women in science, and teachers may choose to adapt the question to look at a more focused subset of women in science, such as Black women in science or Hispanic women in science. Teachers may even want to connect the lesson to an important historical event like the gas crisis of the 1970s and how that inspired Stephanie Kwolek's discovery of the fibers that led to the development of Kevlar.

Staging the Compelling Question

To introduce the inquiry, the teacher may guide students in thinking about scientists they know or know of and how many scientists they can think of that are women. The teacher may encourage the class to make predictions about the percentage of women in science included on their lists before the class comes up with the average percentage.

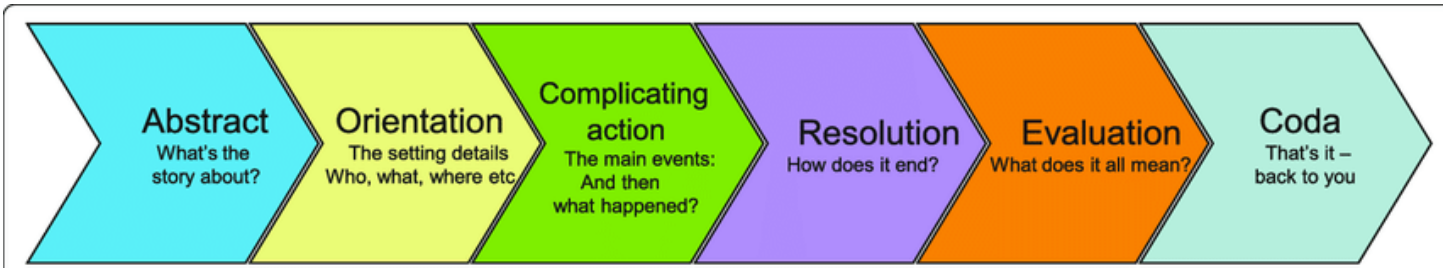
As introductory material, the teacher may choose to show all or parts of the *Women in Chemistry* TV show that highlights the contributions of women in science. Separate segments of roughly fifteen minutes for each woman

featured in the show are also available. Three of these segments highlight women who will be discussed in the featured sources of this inquiry: Mildred Cohn, Stephanie Kwolek, and Uma Chowdhry.

Supporting Question 1

The first supporting question "What was it like to be a woman in science in the mid-twentieth century?" introduces students to women pioneers in the scientific field. Students will examine two sections of oral history interviews that include anecdotes from women in science before the 1980s. For the Formative Performance Task, students will use Labov's method to find the narrative parts of Cohn's and Kwolek's stories and then write one paragraph answering the supporting question based on those stories. Students may work together to use Labov's method.

The teacher should introduce students to the Labov's method prior to reading/listening to the Cohn and Kwolek interviews. See the graphic below. As a reminder, remember that not all parts are in every story, and they may be located in a non-chronological order. The **abstract** is the setup, the **orientation** is the context, the **complicating action** is what event caused a chain of events, the **resolution** is how the situation was put into order for better or for worse, the **evaluation** is the takeaway or moral of the story, and the **coda** is what has happened since then/brings the reader/listener up to date.



Supporting Question 2

The second supporting question "How have women in science dealt with the 'two elephants in the room' of race and gender?" encourages students to consider the experiences of so-called double minorities: scientists who are women and minorities. Students will read/listen to the experiences of two Black women and how their race and gender played a role in their experiences as scientists. Teachers may supplement these sources with oral history interviews or other primary sources of other minorities. Carolyn R. Bertozzi, Yolanda Sanchez, Uma Chowdhry, and Donna J. Nelson's oral history interviews are the featured sources for the third and fourth supporting questions, but their interviews could also be used here. The Formative Performance Task encourages students to compare and contrast Anderson's and King's experiences. How were they similar? How were they different?

Supporting Question 3

The third supporting question "How have women in science balanced being partners/spouses, mothers, and scientists?" turns students' attention to work-life balance. The Featured Sources include excerpts from two oral history interviews, including one that describes the experience of a lesbian woman in science. For the Formative Performance Task,

students will first create a word wall—individually or in groups—to see what language Bertozzi and Sanchez use to describe their experiences as a scientist, partner/spouse, and/or mother. Then they will write one paragraph answering the supporting question, paying special attention to the language and terminology used and how it may differ between the two women.

Supporting Question 4

The fourth supporting question "How have people addressed the gender disparity in science?" turns students' attention to how individuals have responded to the challenges women in science have faced. The teacher may wish to discuss other contemporary examples like the response of a local university to women in STEM or work taking place in the federal government to support women in science. The Formative Performance Task asks students to develop a claim supported by evidence that answers the supporting question in a paragraph or two. In addition to the sources listed on the blueprint, the teacher may also wish to show students Nelson's diversity report available here. Focus particularly on the executive summary and pages 1-9.

Summative Performance Task

At this point in the inquiry, students have examined different experiences of women in science and considered ways in which those experiences are similar and different as well as their change (if any) over time as more women have become scientists. Students should be expected to demonstrate the breadth of their understandings and their abilities to use evidence from multiple sources to support their claims. In this task, students construct an evidence-based argument using multiple sources to answer the compelling question "What does it mean to be a woman in science?" Students can present their arguments in oral, written, or visual form depending on the preference of the student.

Students' arguments will likely vary, but could include any of the following:

- Being a woman in science is exciting. They get to make fascinating discoveries and impact the world around them.
- Being a woman in science is challenging. They face a lot of discrimination, unequal pay, and questioning of their scientific ability.
- Being a woman in science has changed over time. It used to be that it was very unusual for a woman to be a scientist. Now there are more women in science, and the field is equalizing though there is still work to be done.

As an extension task, students can conduct an interview a woman in science. Interviewing a woman in science themselves would allow students to ask questions that may have arisen during this inquiry relating to race, gender, class, etc. Conducting an oral history interview would also give the students the opportunity to practice a skill that they have discussed throughout this inquiry. For a quick introduction to oral history interviewing, look at this article.

Students have several ways to take informed action, starting first with researching other women in science and comparing and contrasting the experience of the women researched and/or interviewed to the women featured in the oral history excerpts. Based on this information, students could create a crowdsourcing campaign to identify unknown women in science, reach out to a local newspaper or news station and ask them to feature the story of one (or more) women in science, or develop an online exhibit examining the lives and experiences of women in science.

Supporting Question 1: Featured Sources

Source A: Mildred Cohn, interview by Leon Gortler at University of Pennsylvania, Philadelphia, Pennsylvania, 15 December 1987 and 6 January 1988. Format: digital transcript (Philadelphia: Chemical Heritage Foundation, Oral History #0080). Available at: https://digital.sciencehistory.org/works/z029p571v (accessed on 11 August 2022).

Source B: Stephanie L. Kwolek, interview by Raymond C. Ferguson at Sharpley, Delaware, 4 May 1986. Format: digital transcript (Philadelphia: Chemical Heritage Foundation, Oral History #0028). Available at: https://digital.sciencehistory.org/works/d217qq72t (accessed on 11 August 2022).

Supporting Question 2: Featured Sources

Source A: Gloria L. Anderson, interview by Jeannette E. Brown at Morris Brown College, Atlanta, Georgia, 21 August 2009. Format: digital transcript (Philadelphia: Chemical Heritage Foundation, Oral History #0673). Available at: https://digital.sciencehistory.org/works/pmx6mgs (accessed on 11 August 2022).

Source B: Reatha Clark King, interview by Jeannette E. Brown at Minneapolis, Minnesota, 1 May 2005. Format: digital transcript (Philadelphia: Chemical Heritage Foundation, Oral History #0663). Available at: https://digital.sciencehistory.org/works/kgwes25 (accessed on 11 August 2022).

Supporting Question 3: Featured Sources

Source A: Carolyn R. Bertozzi, interview by Andrea R. Maestrejuan at the University of California, Berkeley, Berkeley, California, 17 and 18 August 2003. Format: digital transcript (Philadelphia: Chemical Heritage Foundation, Oral History #0529). Available at: https://digital.sciencehistory.org/works/3xomins (accessed on 11 August 2022).

Source B: Yolanda Sanchez, interview by David J. Caruso at Dartmouth College, Hanover, New Hampshire, 29 and 31 July 2008. Format: digital transcript (Philadelphia: Chemical Heritage Foundation, Oral History #0803). Available at: https://digital.sciencehistory.org/works/4i9xaau (accessed on 11 August 2022).

Supporting Question 4: Featured Sources

Source A: Donna J. Nelson, interview by Hilary Domush and Leah Webb-Halpern at the University of Oklahoma, Norman, Oklahoma, 21 and 22 July 2008. Format: digital transcript (Philadelphia: Chemical Heritage Foundation, Oral History #0482). Available at: https://digital.sciencehistory.org/works/et0zejr (accessed on 11 August 2022).

Source B: Uma Chowdhry, interview by Hilary Domush at Experimental Station, Wilmington, Delaware, 24 and 25 August 2011. Format: digital transcript (Philadelphia: Science History Institute, Oral History #0715). Available at: https://digital.sciencehistory.org/works/nt2ydj8 (accessed on 11 August 2022).