Planning for the Future:
Revising the Past

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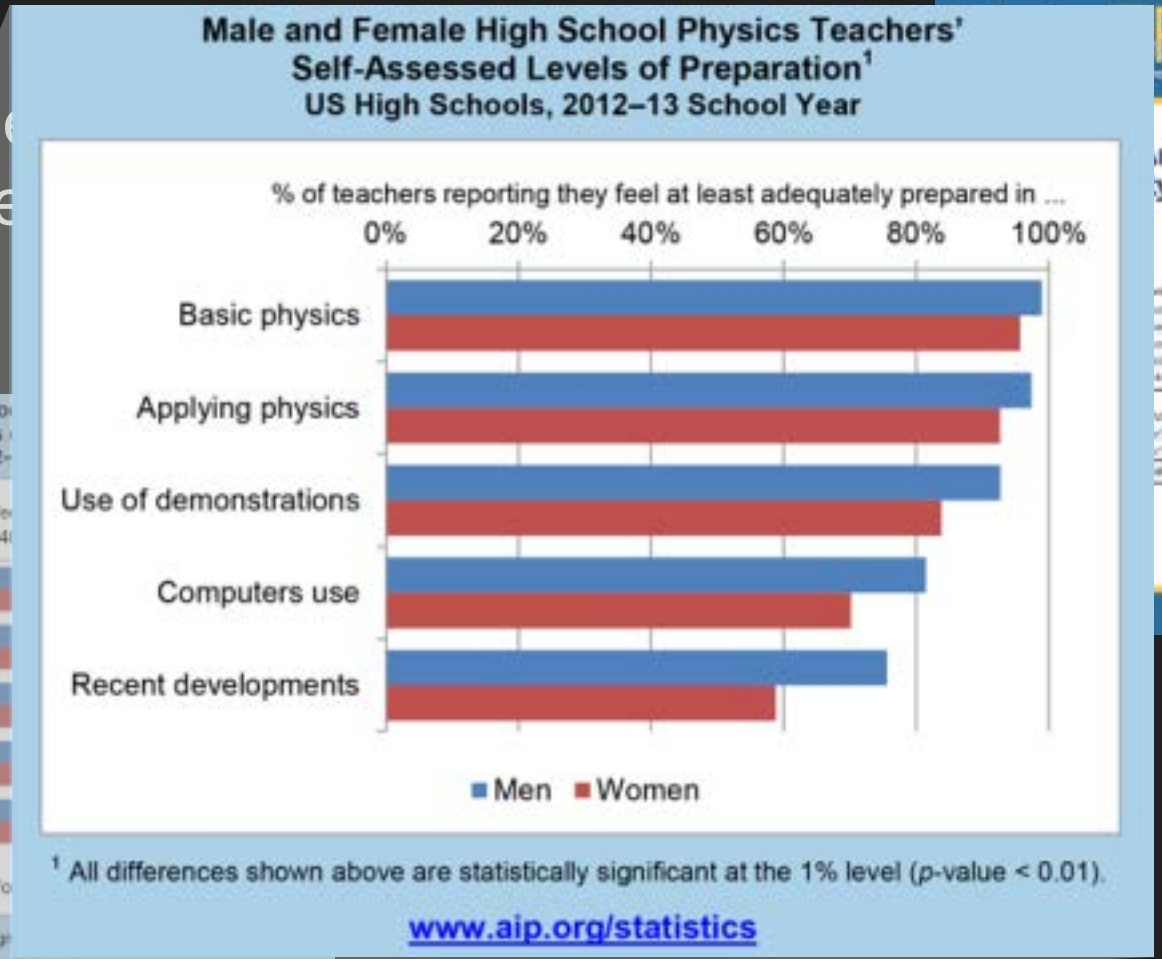
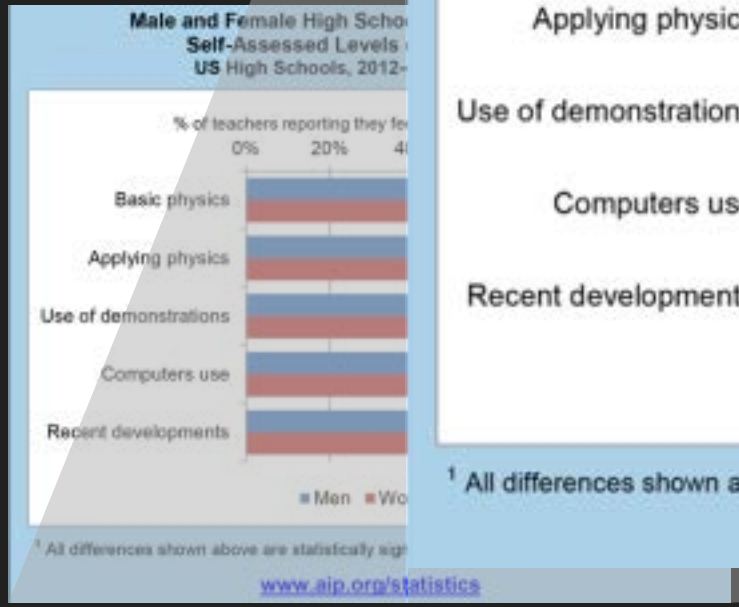
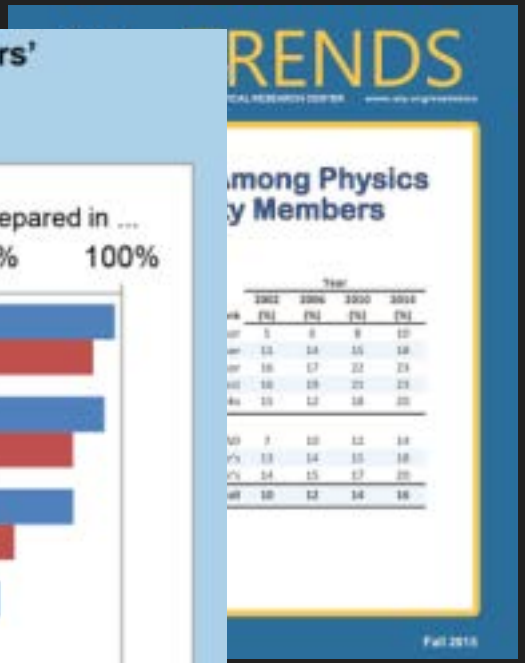
Mentor: Dr. Greg Good

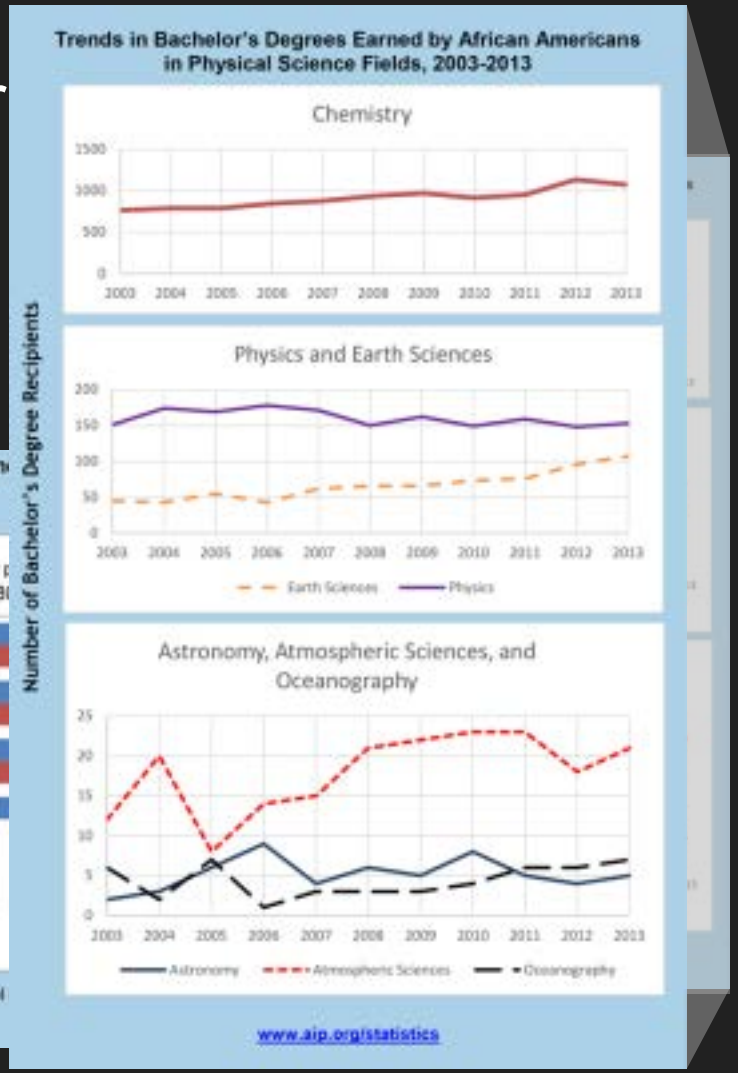
Women and Underrepresented in Physical Science



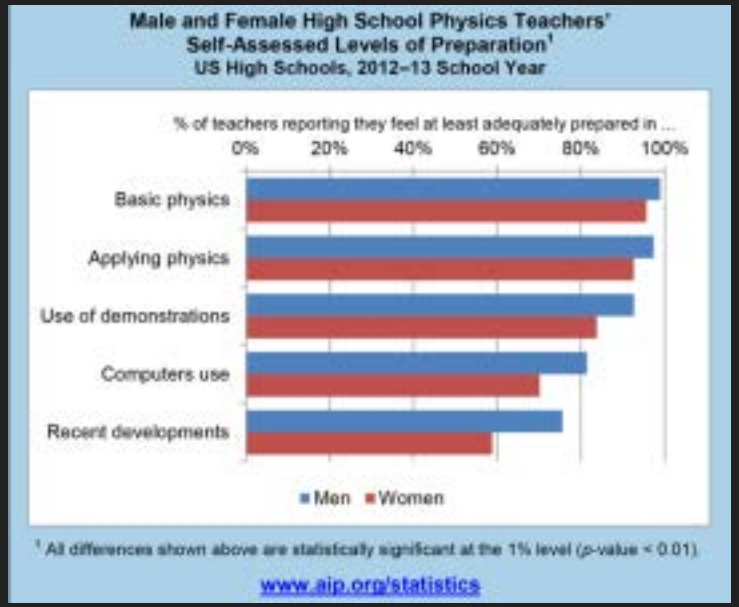


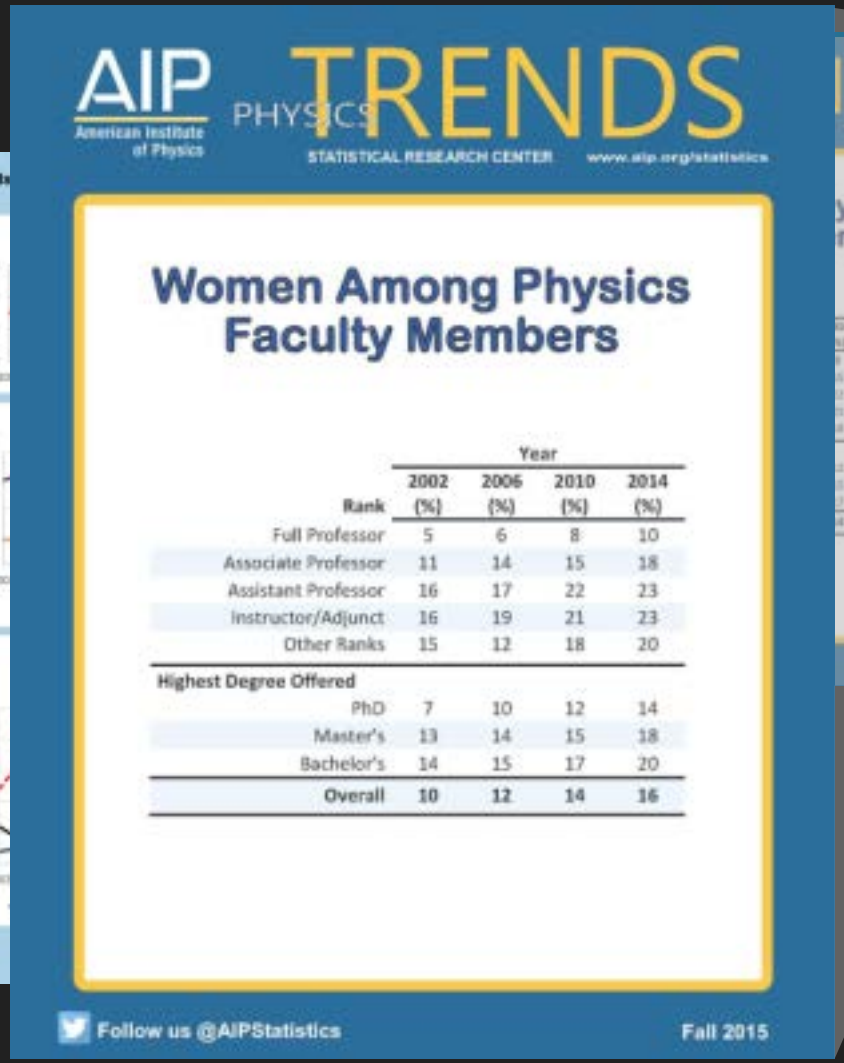


Women and Minor
Underrepresented
Physical Sciences



Women and Minorities are Underrepresented in the Physical Sciences





AIP American Institute of Physics PHYSICS TRENDS

STATISTICAL RESEARCH CENTER www.aip.org/statistics

Women Among Physics Faculty Members

Rank	Year 2002 (%)	2006 (%)	2010 (%)	2014 (%)
Full Professor	5	6	8	10
Associate Professor	11	14	15	18
Assistant Professor	16	17	22	23
Instructor/Adjunct	16	19	21	23
Other Ranks	15	12	18	20
Highest Degree Offered				
PhD	7	10	12	14
Master's	13	14	15	18
Bachelor's	14	15	17	20
Overall	**10**	**12**	**14**	**16**

Follow us @AIPStatistics

Fall 2015

Goals of the Project

Produce **teaching guides**

- Lesson plans
- Worksheets
- PowerPoints
- Readings

about the history of women and **minorities**

- African Americans
- Native Americans
- Disabled Americans

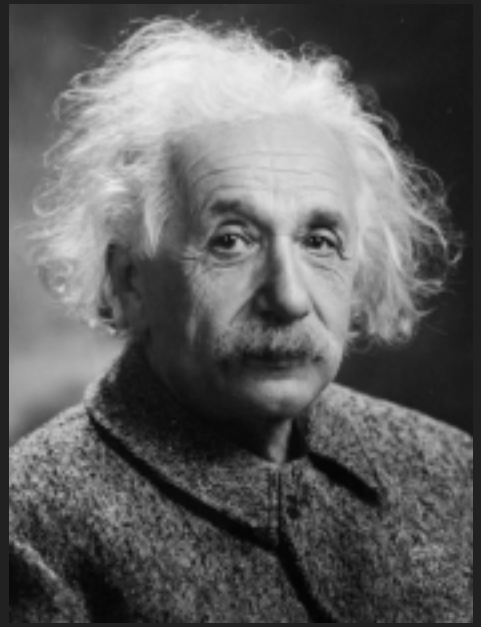
in the **physical sciences**

- Physics
- Astronomy
- Earth Science
- Chemistry

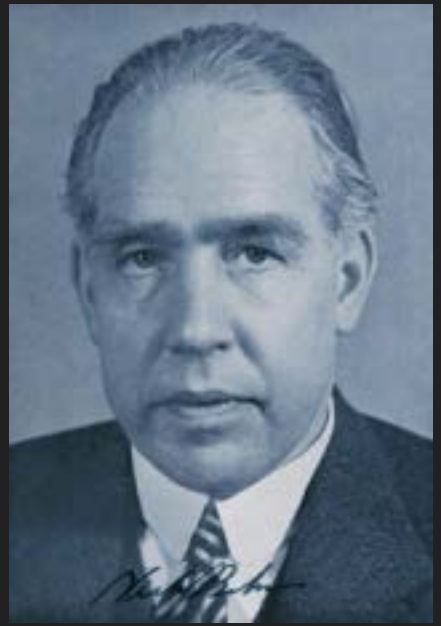
Goals of the Project

Provide students with a diverse set of role models

Isaac Newton



Albert Einstein



Niels Bohr

Goals of the Project

Provide students with a diverse set of role models

Solvay Conference in Brussels, 1927

Goals of the Project

Provide students with a diverse set of role models

Katherine Johnson

Lise Meitner

Chien-Shiung Wu

Herman Branson

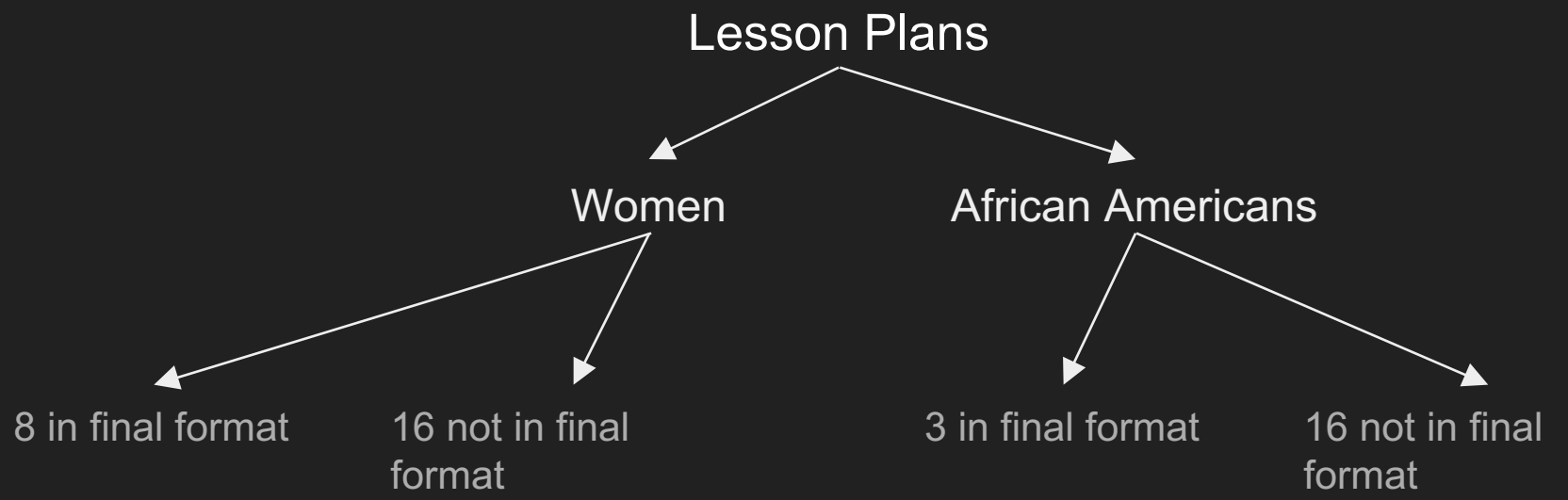
Photos from the AIP Emilio Segre Visual Archives

Goals of the Project

Raise awareness of ongoing diversity issues in the physical sciences

Building on Three Years of Work

Previously:
Teaching Guides on Women and African Americans in Physics, Astronomy and Related Disciplines



Complete Standardization of Lesson Plan Format

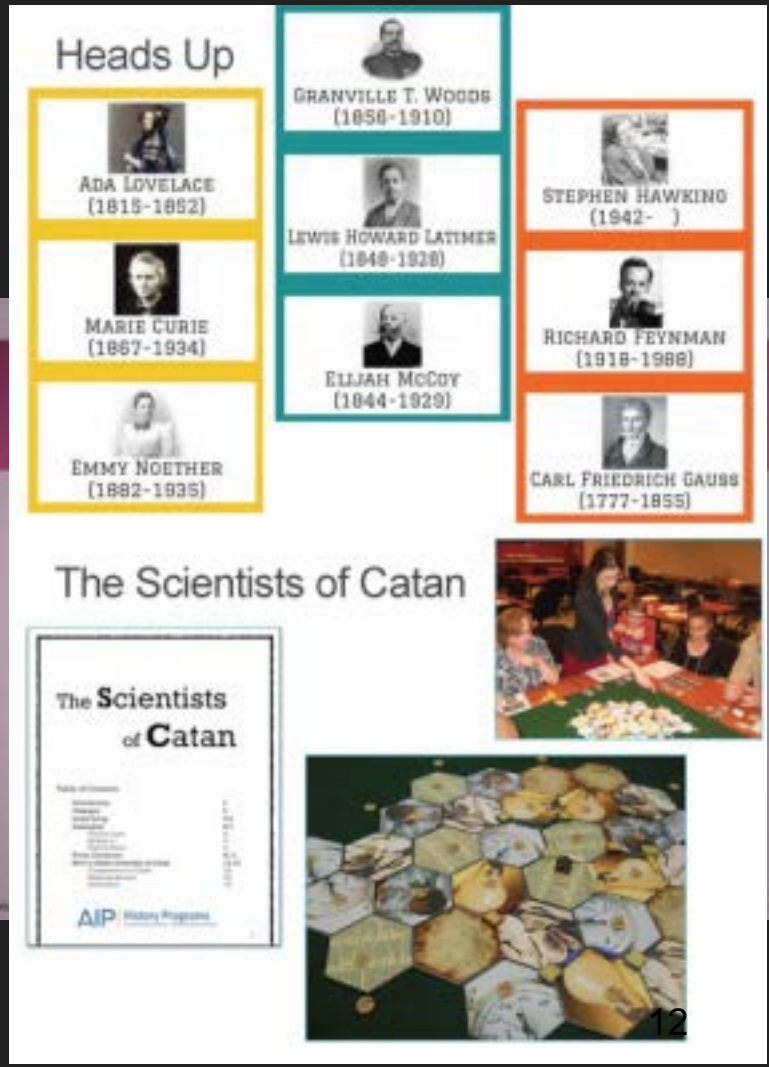
The 5 E's

Instructions	
Engage: _ Minutes	
What is the teacher doing?	What are the students doing?
Explore: _ Minutes	
What is the teacher doing?	What are the students doing?
Explain: _ Minutes	
What is the teacher doing?	What are the students doing?
Elaborate: _ Minutes	
What is the teacher doing?	What are the students doing?
Evaluate:	

Building on Four Years of Work

More than just lesson plans

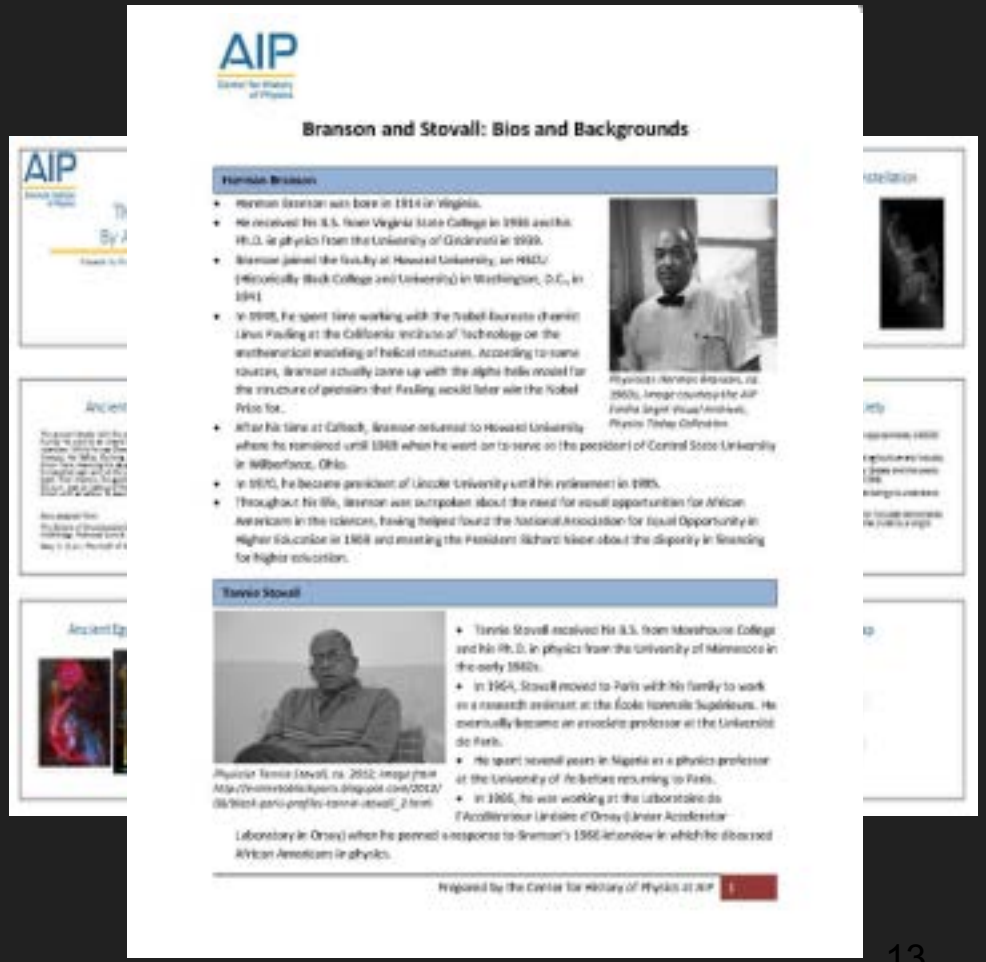
- Slideshows
- Annotated bibliographies
- Timelines
- Informational handouts
- Guides to online, AIP, archival resources
- Lists of oral histories and video interviews
- Historiographies
- Puzzles and games



Supplemental Materials

What we included

- Discussion questions/answers
- PowerPoints
- Worksheets
- Informational handouts
- Readings



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Branson and Stovall: Bios and Backgrounds

Harrison Branson

- Harrison Branson was born in 1914 in Virginia.
- He received his B.S. from Virginia State College in 1936 and his Ph.D. in physics from the University of Cincinnati in 1939.
- Branson joined the faculty at Howard University, an HBCU (Historically Black College and University) in Washington, D.C., in 1941.
- In 1949, he spent time working with the Nobel laureate chemist Linus Pauling at the California Institute of Technology on the mathematical modeling of helical structures. According to some sources, Branson actually came up with the alpha helix model for the structure of proteins that Pauling would later win the Nobel Prize for.
- After his time at Caltech, Branson returned to Howard University where he remained until 1968 when he went on to serve as the president of Central State University in Wilberforce, Ohio.
- In 1970, he became president of Lincoln University until his retirement in 1985.
- Throughout his life, Branson was outspoken about the need for equal opportunities for African Americans in the sciences, having helped found the National Association for Equal Opportunity in Higher Education in 1968 and meeting the President Richard Nixon about the disparity in financing for higher education.

Physicist Harrison Branson, ca. 1960s. Image courtesy the AIP Emilio Segrè Visual Archives, Physics Today Collection

Tennie Stovall

- Tennie Stovall received his B.S. from Morehouse College and his Ph.D. in physics from the University of Minnesota in the early 1960s.
- In 1964, Stovall moved to Paris with his family to work as a research assistant at the École Normale Supérieure. He eventually became an associate professor at the Université de Paris.
- He spent several years in Nigeria as a physics professor at the University of Ife before returning to Paris.
- In 1966, he was working at the Laboratoire de l'Accélérateur Linéaire d'Orsay (Linear Accelerator Laboratory in Orsay) when he penned a response to Branson's 1966 interview in which he discussed African Americans in physics.

Physicist Tennie Stovall, ca. 2012. Image from http://mimmobilio.blogspot.com/2012/08/black-paris-profiles-tennie-stovall_2.html

Prepared by the Center for History of Physics at AIP 1

Revising Previously Existing Lesson Plans

African American Physicists in the 1960s

Herman Branson

Tannie Stovall

Revising Previously Existing Lesson Plans

African American Physicists in the 1960s

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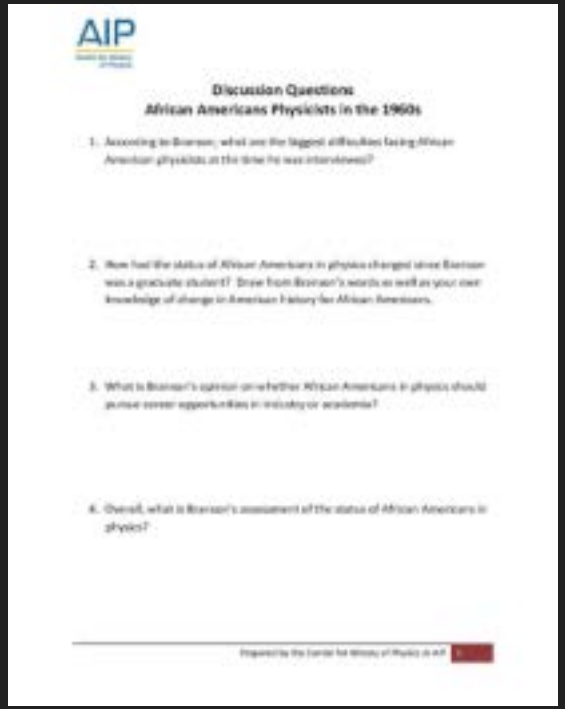
Branson and Stovall: Bios and Backgrounds



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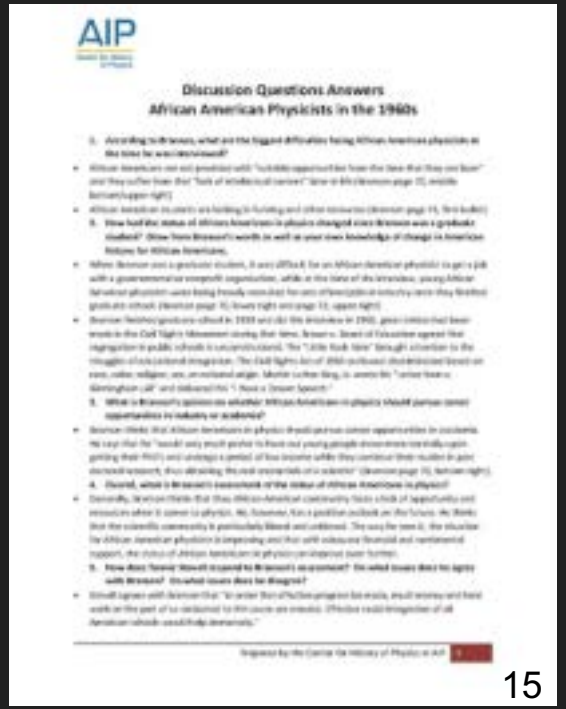
Discussion Questions
African Americans Physicists in the 1960s

1. According to Branson, what are the biggest difficulties facing African American physicists at the time he was interviewed?
2. How had the status of African Americans in physics changed since Branson was a graduate student? Draw from Branson's words as well as your own knowledge of change in American history for African Americans.
3. What is Branson's opinion on whether African Americans in physics should pursue career opportunities in industry or academia?
4. Overall, what is Branson's assessment of the status of African Americans in physics?



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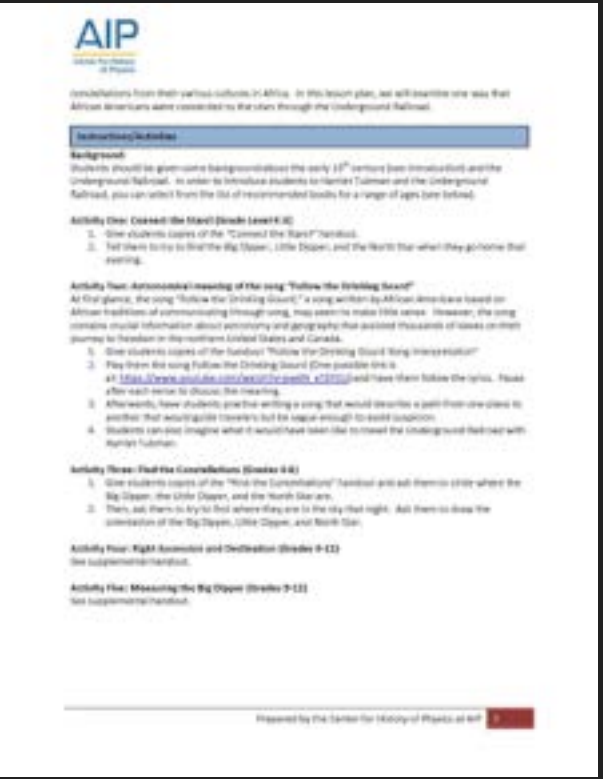
Discussion Questions Answers
African American Physicists in the 1960s

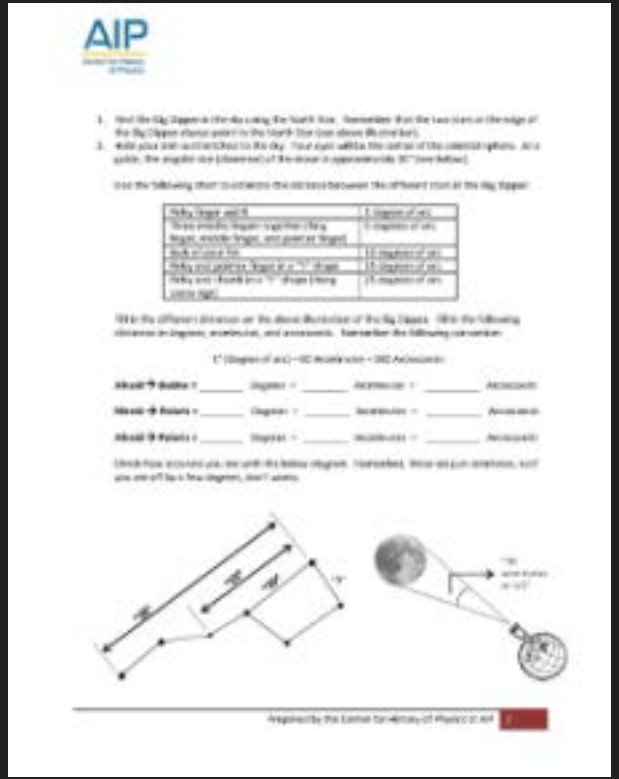
1. According to Branson, what are the biggest difficulties facing African American physicists at the time he was interviewed?
2. How had the status of African Americans in physics changed since Branson was a graduate student? Draw from Branson's words as well as your own knowledge of change in American history for African Americans.
3. What is Branson's opinion on whether African Americans in physics should pursue career opportunities in industry or academia?
4. Overall, what is Branson's assessment of the status of African Americans in physics?
5. How does Tonia Stovall respond to Branson's assessment? On what issues does he agree with Stovall? On what issues does he disagree?

https://www.youtube.com/watch?v=pw6N_eTZP2U

Revised Lesson Plans

Follow the Drinking Gourd - Before





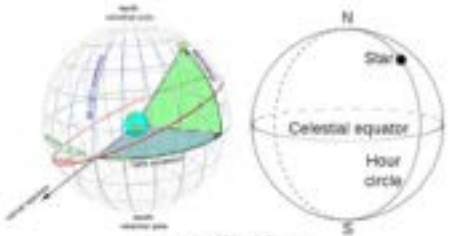
http://astro.unl.edu/naap/motion2/animations/ce_hc.html

Revised Lesson Plans

Follow the Drinking Gourd - After

AIP

Right Ascension and Declination



Rotating Sky Explorer Activity

Student Instructions

1. In your groups, go to the University of Nebraska-Lincoln Rotating Sky Explorer at http://astro.unl.edu/naap/motion2/animations/ce_hc.html.
2. In the Star Controls section, select "Big Dipper" in the Star Patterns drop-down menu.
3. In the Star Controls section, click "Add a Star Randomly."
4. Click on the star that was added.
5. In the "Celestial Sphere View", set right ascension = 2.5 h and declination to 89.2°. This star is Polaris, the North Star.
6. In the Appearance Settings section, select "show labels".
7. Click "Start Animation."
8. Play with the different options in the simulation.
9. Think about how the sky looks from different locations and how the sky changes over time.

Many Thanks to

Dr. Greg Good

Samantha Spytek, Stephen Neal, Lance Burch

The Niels Bohr Library and Archive staff

Dr. Brad Conrad, Courtney Lemon

The Society of Physics Students

The American Institute of Physics

Planning for the Future:
Educating the Present

Samantha Spytek
Virginia Polytechnic Institute and State University, Honors College
Victoria DiTomasso, CUNY Macaulay Honors College

Mentor: Dr. Greg Good

We Have Standards Here

Common Core Standards

- Reading: Literature
- Reading: Informational Text
- Speaking and Listening
- Language
- History/Social Studies
- Science & Technical Subjects
- Subject Writing

Speaking & Listening	
CCSS.ELA-LITERACY.SL.9-10.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
CCSS.ELA-LITERACY.SL.9-10.2	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
CCSS.ELA-LITERACY.SL.9-10.4	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
CCSS.ELA-LITERACY.SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11-12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
CCSS.ELA-LITERACY.SL.11-12.2	Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
CCSS.ELA-LITERACY.SL.11-12.4	Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
History/Social Studies	
CCSS.ELA-LITERACY.RH.9-10.4	Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.
CCSS.ELA-LITERACY.RH.9-10.2	Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.
CCSS.ELA-LITERACY.WHST.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow
CCSS.ELA-LITERACY.WHST.11-12.9	Draw evidence from informational texts to support analysis, reflection, and research.

We Have Standards Here

Next Generation Science Standards

Dimension One: Practices	1. Asking Questions and Defining Problems 3. Planning and Carrying Out Investigations (Extension) 4. Analyzing and Interpreting data (Extension) 8. Obtaining, Evaluating and Communicating Information
Dimension Two: Crosscutting Concepts	1. Patterns 2. Cause and effect 4. Systems and system models 7. Stability and change
Dimension Three: Disciplinary Core Ideas	PS2.A: Forces and Motion PS2.C: Stability and Instability in Physical Systems ESS2.A: Earth Materials and Systems ESS2.C: The Roles of Water in Earth's Surface Processes ETS2.A: Interdependence of Science, Engineering, and Technology

Creating New Lesson Plans

- Women Astronomers, Mathematicians and Physicists of History
  - Aglaonike
    - Hertha Marks Ayrton
      - 1854 - 1923
      - #19thcentury
      - #British
      - #physicist
    - Mileva Einstein-maric
      - 1875 - 1948
      - #19thcentury
      - #Serbian #Swiss
      - #physicist
    - Margaret Eliza Maltby
      - 1860 - 1944
      - #19thcentury
      - #American
      - #physicist
    - Mary Somerville
      - 1780 - 1872
      - #19thcentury
      - #British
      - #physicist and polymath

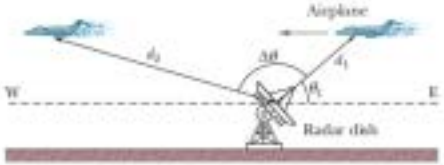
Creating New Lesson Plans

Scientifi

Learn by

85 You are kidnapped by political-science majors (who are upset because you told them political science is not a real science). Although blindfolded, you can tell the speed of their car (by the whine of the engine), the time of travel (by mentally counting off seconds), and the direction of travel (by turns along the rectangular street system). From these clues, you know that you are taken along the following course: 50 km/h for 2.0 min, turn 90° to the right, 20 km/h for 4.0 min, turn 90° to the right, 20 km/h for 60 s, turn 90° to the left, 50 km/h for 60 s, turn 90° to the right, 20 km/h for 2.0 min, turn 90° to the left, 50 km/h for 30 s. At that point, (a) how far are you from your starting point, and (b) in what direction relative to your initial direction of travel are you?

86 In Fig. 4-49, a radar station detects an airplane approaching directly from the east. At first observation, the airplane is at distance $d_1 = 360$ m from the station and at angle $\theta_1 = 40°$ above the horizon. The airplane is tracked through an angular change $\Delta\theta = 123°$ in the vertical east–west plane; its distance is then $d_2 = 790$ m. Find the (a) magnitude and (b) direction of the airplane's displacement during this period.



$(4.0\hat{i} + 2.0\hat{j})$ m/s². When the particle's x coordinate is 29 m, what are its (a) y coordinate and (b) speed?

90 At what initial speed must the basketball player in Fig. 4-50 throw the ball, at angle $\theta_0 = 55°$ above the horizontal, to make the foul shot? The horizontal distances are $d_1 = 1.0$ ft and $d_2 = 14$ ft, and the heights are $h_1 = 7.0$ ft and $h_2 = 10$ ft.

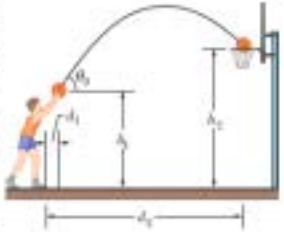


Fig. 4-50 Problem 90.

91 During volcanic eruptions, chunks of solid rock can be blasted out of the volcano; these projectiles are called *volcanic bombs*. Figure 4-51 shows a cross section of Mt. Fuji, in Japan. (a) At what initial speed would a bomb have to be ejected, at angle $\theta_0 = 35°$ to the horizontal, from the vent at A in order to fall at the foot of the volcano at B, at vertical distance $h = 3.30$ km and horizontal distance $d = 9.40$ km? Ignore, for the moment, the effects of air on the bomb's travel. (b) What would be the time of flight? (c) Would the effect of the air increase or decrease your answer in (a)?

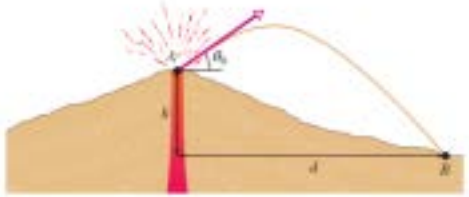
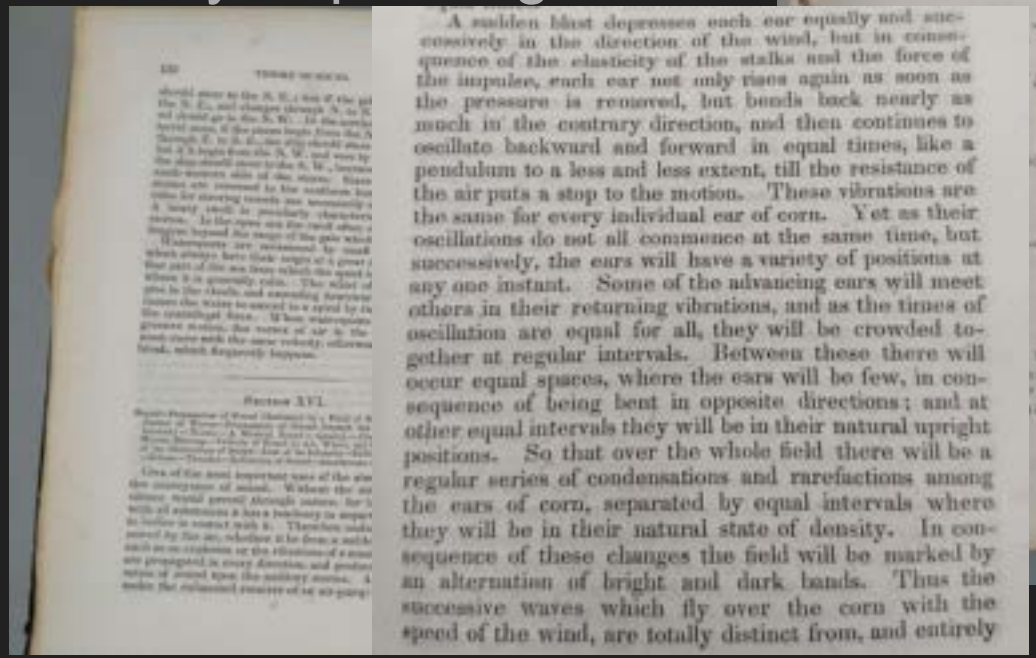


Fig. 4-51 Problem 91.

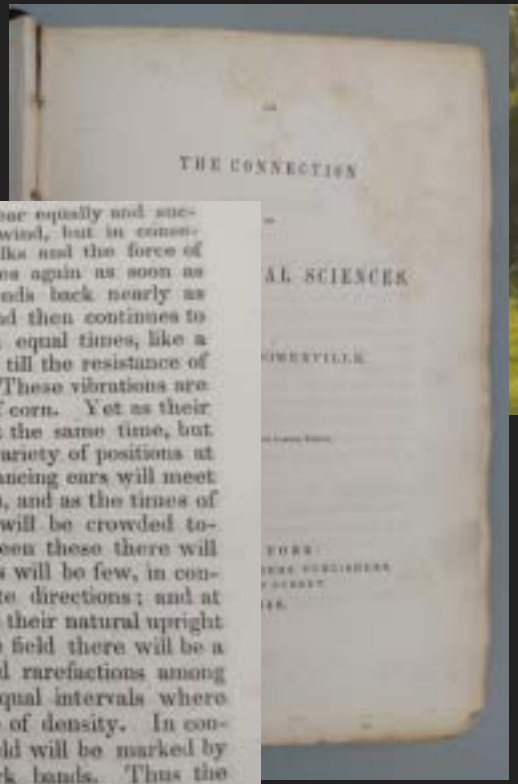
Halliday, David, Robert Resnick and Jearl Walker. 2010. *Fundamentals of Physics* (Ninth Edition). Wiley (p. 84)

Creating New Lesson Plans

Scientific Writing
Learn by Explaining

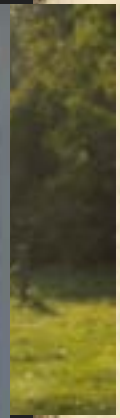


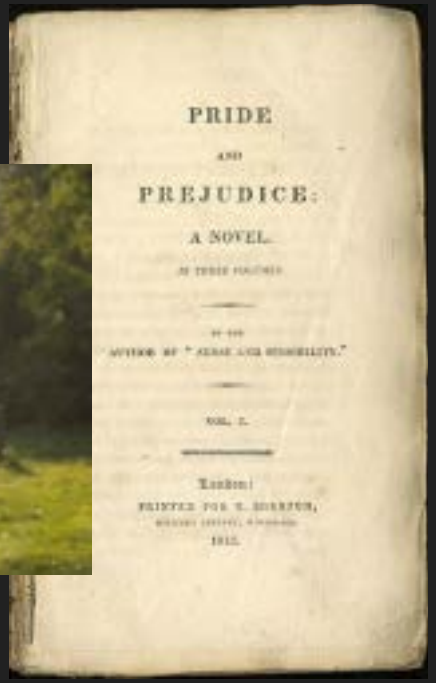
A sudden blast depresses each ear equally and successively in the direction of the wind, but in consequence of the elasticity of the stalks and the force of the impulse, each ear not only rises again as soon as the pressure is removed, but bends back nearly as much in the contrary direction, and then continues to oscillate backward and forward in equal times, like a pendulum to a less and less extent, till the resistance of the air puts a stop to the motion. These vibrations are the same for every individual ear of corn. Yet as their oscillations do not all commence at the same time, but successively, the ears will have a variety of positions at any one instant. Some of the advancing ears will meet others in their returning vibrations, and as the times of oscillation are equal for all, they will be crowded together at regular intervals. Between these there will occur equal spaces, where the ears will be few, in consequence of being bent in opposite directions; and at other equal intervals they will be in their natural upright positions. So that over the whole field there will be a regular series of condensations and rarefactions among the ears of corn, separated by equal intervals where they will be in their natural state of density. In consequence of these changes the field will be marked by an alternation of bright and dark bands. Thus the successive waves which fly over the corn with the speed of the wind, are totally distinct from, and entirely



THE CONNECTION

AL SCIENCES





PRIDE

AND

PREJUDICE:

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VOL. I.

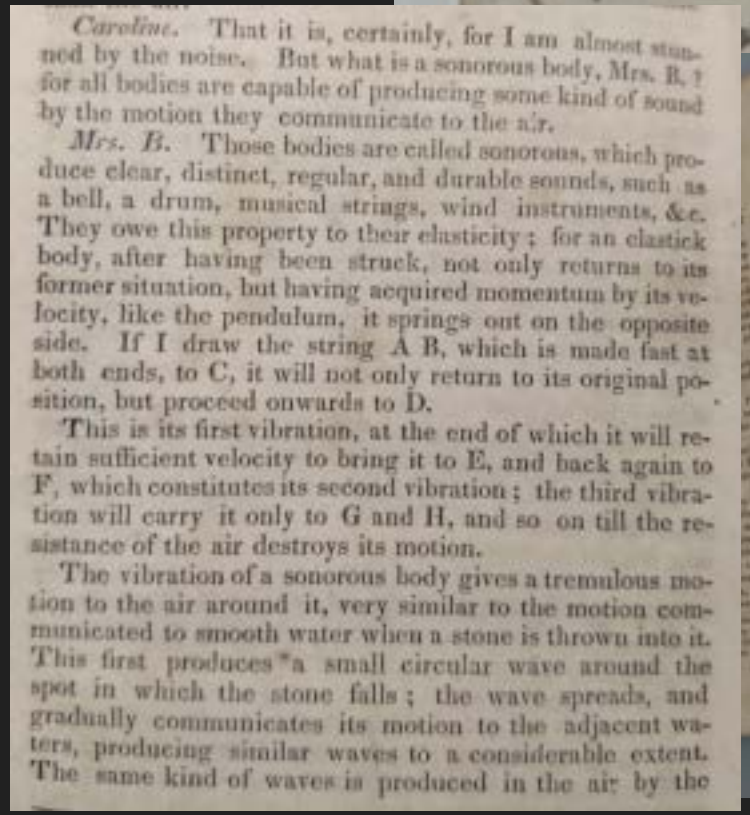
LONDON:

PRINTED FOR T. EGERTON,

1813.

Creating New Lesson Plans

Scientific Writing
Learn by Explaining

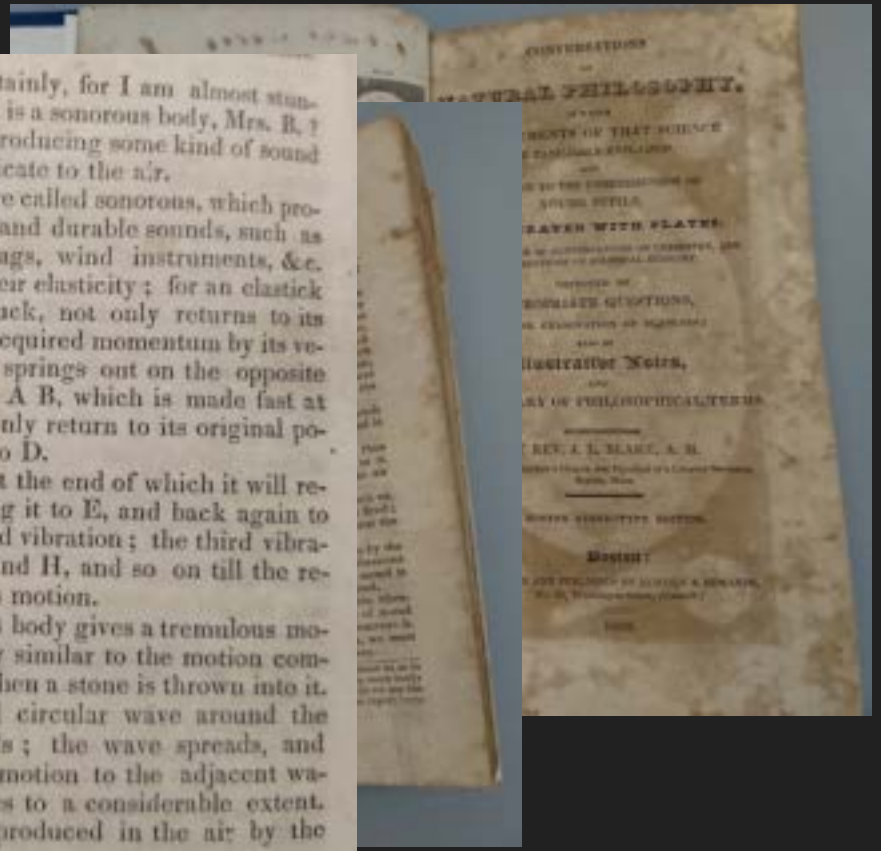


Caroline. That it is, certainly, for I am almost stunned by the noise. But what is a sonorous body, Mrs. B.? for all bodies are capable of producing some kind of sound by the motion they communicate to the air.

Mrs. B. Those bodies are called sonorous, which produce clear, distinct, regular, and durable sounds, such as a bell, a drum, musical strings, wind instruments, &c. They owe this property to their elasticity; for an elastick body, after having been struck, not only returns to its former situation, but having acquired momentum by its velocity, like the pendulum, it springs out on the opposite side. If I draw the string A B, which is made fast at both ends, to C, it will not only return to its original position, but proceed onwards to D.

This is its first vibration, at the end of which it will retain sufficient velocity to bring it to E, and back again to F, which constitutes its second vibration; the third vibration will carry it only to G and H, and so on till the resistance of the air destroys its motion.

The vibration of a sonorous body gives a tremulous motion to the air around it, very similar to the motion communicated to smooth water when a stone is thrown into it. This first produces a small circular wave around the spot in which the stone falls; the wave spreads, and gradually communicates its motion to the adjacent waters, producing similar waves to a considerable extent. The same kind of waves is produced in the air by the



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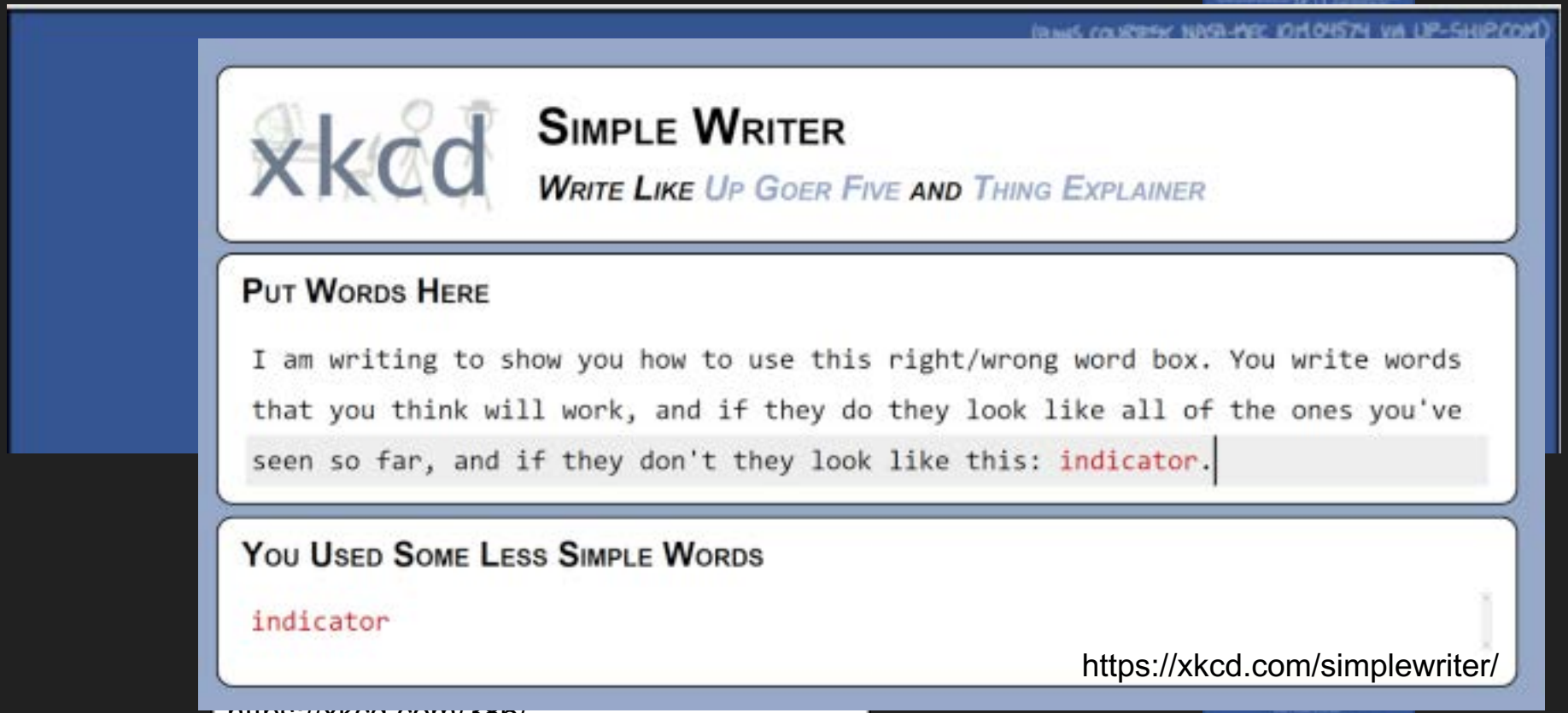


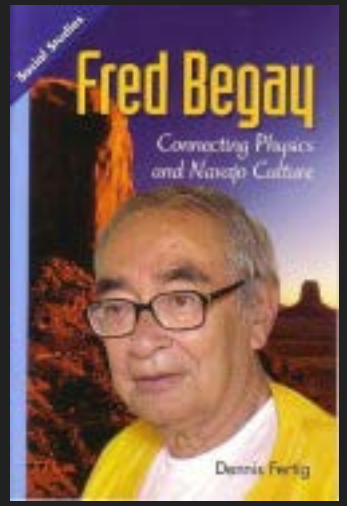
https://xkcd.com/simplewriter/

https://xkcd.com/386/

We have all of this content… Now what?

https://www.aip.org/history-programs/physics-history/teaching-guides-women-minorities/landing-page-

With a New Website Comes New Content



It Takes a Village

We'd like to thank…

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Questions?