About the American Physical Society (APS)
The American Physical Society is the premier professional society for physicists in the United States. APS shares the knowledge of physics by publishing journals, hosting scientific meetings, reaching out to the public, and promoting physics education.

PhysicsQuest is brought to you by APS Public Engagement, an APS program that communicates the excitement and importance of physics to people of all ages.

APS PhysicsQuest Publication Staff
The American Physical Society (APS) would like to thank the following people:

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Both activities were developed by the STEP UP Physics team

For Teachers
There is a guide available online for teachers and/or parents with videos, additional resources, and supporting materials for the content presented in this guide. You can find it online at aps.org/programs/outreach/physicsquest).

Learn How Your World Works
Ask a physicist your toughest science questions with the Physicists To-Go program. aps.org/programs/outreach/physiciststogo.cfm.

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PUBLICATION DATE: NOVEMBER 2022

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This material is based upon work supported by the National Science Foundation under Grant Nos. 1720810, 1720869, 1720917, and 1721021. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.
Welcome to PhysicsQuest 2022!

What do physicists do? Who can become a physicist? These are common student questions. Hopefully you will see the answers can be: EVERYTHING and ANYONE, including YOU. Physics is a branch of science that studies matter, its components, its motion, as well as how it interacts with energy and forces. There are many branches of physics including mechanics, electricity, astronomy, motion, waves, sound, and light. Physics studies the smallest elementary particles and atoms as well as the largest stars and the universe. Come and learn all YOU can do with physics by discovering the work of amazing physicists working across many disciplines in science, media, technology, and beyond.

For instance, the six cover physicists:

**Caprice Phillips:** Caprice has a bachelor's degree in physics and math and is working on her PhD at Ohio State University. Her research includes characterizing and detecting atmospheric gasses around brown dwarfs and exoplanets, for habitability studies. She is the vice president of Black in Astro, a movement which aims to celebrate and amplify the Black experience in space related fields. She enjoys outreach in science; mentoring at UT Austin and assisting with science activities and demos for the UT Girls in STEM day.

**Dr. Jocelyn Bell Burnell:** Dr. Burnell has her undergraduate degree in physics and received her PhD in radio astronomy from the University of Cambridge. She discovered the first pulsar, a cosmic source of specific radio waves, that had before been uncharacterized. The 1974 Nobel Prize was awarded to some of her supervisors for this discovery. Due to her student status, she was not named in the award. However, 50 years later, she won $3 million from the The Breakthrough Prize, funded by Silicon Valley leaders including Mark Zuckerberg. This is the largest monetary science prize in the world.

**Dr. Lynett Rock:** Lynett is a Cherokee nation citizen and an award winning educator. She earned an undergraduate and masters degree in physics and a PhD in education. She is a physics and math professor at Connors Community College in her hometown. She uses her position to encourage Native American students to pursue higher education in science.

**Katherine “Kate” McAlpine:** Kate double majored in physics and writing and has turned these passions into a career. She is a science journalist who has worked for national labs and universities communicating their science initiatives to the public. She has also created many raps to teach about science concepts. Check them out on YouTube.

**Dr. Deborah Bierebicz:** Debbie does it all. She is the first Mexican woman to have received a PhD in physics from Stanford University. She is an award winning speaker, TV host, communicator, volunteer, and analyst. She formerly worked as risk analyst for Morgan Stanley and other Wall Street firms and now is the Chief Data Scientist at Metis, a leading data science training company. She uses her many talents and interests to make physics come alive and interesting to diverse audiences with varying degrees of scientific knowledge.

**Dr. Sylvester James “Jim” Gates Jr.:** Dr. Gates is an award winning physicist that made many contributions to the field of theoretical physics; specifically supersymmetry, supergravity, and superstring theory. He received his bachelor's degree and PhD in physics from MIT. He was a professor at the University of Maryland for almost 40 years. He became the first African American to become an endowed professor at a major American research university. In 2013, he was elected to the National Academy of Sciences, as the first African American theoretical physicist recognized in its 150-year history. In the same year, President Obama awarded Jim the National Medal of Science.

The goal of the PhysicsQuest 2022 kits is to introduce students to these physicists as well as many others as a way for them to see themselves represented in the physics community, and begin to identify with physics as a possible degree and career path by teaming up with the STEP UP program. STEP UP is a national community of physics teachers, researchers, and professional societies. We design high school physics lessons to empower teachers, create cultural change, and inspire young women to pursue physics in college.

In this edition of PhysicsQuest you will find teacher's guides with extensive implementation notes and fillable PDFs for the student guides for two lessons: Careers in Physics and Women in Physics. Both can stand alone or be taught in tandem.
Women in Physics

STUDENT GUIDE
THE MIDDLE SCHOOL EDITION
ACTIVITY GOALS

The following activity will help you to **examine the conditions for women in physics** and **discuss gender issues** with respect to famous physicists, gendered professions, and personal experience to **neutralize the effect of stereotypes and bias**. You will participate in an interactive presentation by the teacher, in which data about women in physics around the world are discussed. The role of culture and society are considered.

1. Complete a pre-assignment including an internet search for physicists, reading 2 biographies of historical & modern physicists, and completing a reflection.

2. **CRITICAL COMPONENT:** Understand the Guidelines for Classroom Discussion.

3. Participate in an interactive presentation, during which the teacher shares data on women in physics around the world and the class discusses the role of unconscious bias, society & culture.

4. **CRITICAL COMPONENT:** Voluntarily share your own experiences with gender bias and synthesize conclusions in a discussion with the entire class.

5. Come up with strategies to support diversity in physics and enact the best strategies proposed.

6. Complete a reflection on their views after the class discussion.
Pre-Assignment:
1. Before getting started, write the names of any physicists you can think of below.

Google search:
2. Google “famous physicist.” Write down the names of the first five physicists you found.

3. How many years ago did the earliest physicist on the list live?

4. How many women appear on the list?
Read TWO of the biographies shown below. Choose one (1) person from A and one (1) person from B:

A. Either an article on Lise Meitner, Jocelyn Bell Burnell, or Chien-Shiung Wu

B. One of the following scientist profiles: Claudia Alexander, Deborah Berebichez, Mae Jemison, Shirley Ann Jackson, Ellen Ochoa, or another woman scientist of your choice:

- **Claudia Alexander**, NASA-scientist who says, “I feel like a modern-day explorer; the last frontier is space.” 2003 Emerald Honor for Women of Color in Research & Engineering
- **Deborah Berebichez**, first Mexican woman to graduate from Stanford University with a physics PhD. Now has her own website called Science with Debbie.
- **Mae Jemison**, the first African American woman to go to space, aboard the shuttle Endeavor.
- **Shirley Ann Jackson**, the first African American woman to get a doctorate in nuclear physics.
- **Ellen Ochoa**, accomplished inventor and astronaut.

Respond to the following questions on the women from the two biographies:

What are the contributions made by these women? Summarize your response in your own words in a few sentences. Look up anything you don’t understand!

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What obstacles did the women overcome in their career paths?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

In your view, is the opportunity to excel in physics any easier for women now than it was in the 20th century? Explain how, including what is easier and what is unchanged.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Respond to the following questions by crafting at least one paragraph for each section:

Based on the class discussion, do you believe society discourages women from becoming interested in physics careers? Why or why not?

*Make sure you use evidence from lessons and/or articles to support your claim.*

If you responded “yes” above, what do you think could be done to reduce the effect of discouragement?
Do you think that societal beliefs have influenced your potential career interests?

If yes, in what ways?
If no, explain.

Does this influence bother you? Why or why not?