

University

# Volume 2

# **University Physics Volume 2**

SENIOR CONTRIBUTING AUTHORS

SAMUEL J. LING, TRUMAN STATE UNIVERSITY
JEFF SANNY, LOYOLA MARYMOUNT UNIVERSITY
WILLIAM MOEBS, PHD



## OpenStax

Rice University 6100 Main Street MS-375 Houston, Texas 77005

To learn more about OpenStax, visit https://openstax.org. Individual print copies and bulk orders can be purchased through our website.

©2017 Rice University. Textbook content produced by OpenStax is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0). Under this license, any user of this textbook or the textbook contents herein must provide proper attribution as follows:

- If you redistribute this textbook in a digital format (including but not limited to PDF and HTML), then you must retain on every page the following attribution:
  - "Download for free at https://openstax.org/details/books/university-physics-volume-2."
- If you redistribute this textbook in a print format, then you must include on every physical page the following attribution:
  - "Download for free at https://openstax.org/details/books/university-physics-volume-2."
- If you redistribute part of this textbook, then you must retain in every digital format page view (including but not limited to PDF and HTML) and on every physical printed page the following attribution: "Download for free at https://openstax.org/details/books/university-physics-volume-2."
- If you use this textbook as a bibliographic reference, please include https://openstax.org/details/books/university-physics-volume-2 in your citation.

For questions regarding this licensing, please contact support@openstax.org.

## **Trademarks**

The OpenStax name, OpenStax logo, OpenStax book covers, OpenStax CNX name, OpenStax CNX logo, OpenStax Tutor name, Openstax Tutor logo, Connexions name, Connexions logo, Rice University name, and Rice University logo are not subject to the license and may not be reproduced without the prior and express written consent of Rice University.

PRINT BOOK ISBN-10 1-938168-16-X
PRINT BOOK ISBN-13 978-1-938168-16-1
PDF VERSION ISBN-10 1-947172-21-2
PDF VERSION ISBN-13 978-1-947172-21-0
ENHANCED TEXTBOOK ISBN-10 1-947172-27-1
ENHANCED TEXTBOOK ISBN-13 978-1-947172-27-2
Revision Number UP2-2016-002(03/17)-BW
Original Publication Year 2016

## **OPENSTAX**

OpenStax provides free, peer-reviewed, openly licensed textbooks for introductory college and Advanced Placement® courses and low-cost, personalized courseware that helps students learn. A nonprofit ed tech initiative based at Rice University, we're committed to helping students access the tools they need to complete their courses and meet their educational goals.

## RICE UNIVERSITY

OpenStax, OpenStax CNX, and OpenStax Tutor are initiatives of Rice University. As a leading research university with a distinctive commitment to undergraduate education, Rice University aspires to path-breaking research, unsurpassed teaching, and contributions to the betterment of our world. It seeks to fulfill this mission by cultivating a diverse community of learning and discovery that produces leaders across the spectrum of human endeavor.



## **FOUNDATION SUPPORT**

OpenStax is grateful for the tremendous support of our sponsors. Without their strong engagement, the goal of free access to high-quality textbooks would remain just a dream.



Laura and John Arnold Foundation (LJAF) actively seeks opportunities to invest in organizations and thought leaders that have a sincere interest in implementing fundamental changes that not only yield immediate gains, but also repair broken systems for future generations. LJAF currently focuses its strategic investments on education, criminal justice, research integrity, and public accountability.



The William and Flora Hewlett Foundation has been making grants since 1967 to help solve social and environmental problems at home and around the world. The Foundation concentrates its resources on activities in education, the environment, global development and population, performing arts, and philanthropy, and makes grants to support disadvantaged communities in the San Francisco Bay Area.



Calvin K. Kazanjian was the founder and president of Peter Paul (Almond Joy), Inc. He firmly believed that the more people understood about basic economics the happier and more prosperous they would be. Accordingly, he established the Calvin K. Kazanjian Economics Foundation Inc, in 1949 as a philanthropic, nonpolitical educational organization to support efforts that enhanced economic understanding.



Guided by the belief that every life has equal value, the Bill & Melinda Gates Foundation works to help all people lead healthy, productive lives. In developing countries, it focuses on improving people's health with vaccines and other life-saving tools and giving them the chance to lift themselves out of hunger and extreme poverty. In the United States, it seeks to significantly improve education so that all young people have the opportunity to reach their full potential. Based in Seattle, Washington, the foundation is led by CEO Jeff Raikes and Co-chair William H. Gates Sr., under the direction of Bill and Melinda Gates and Warren Buffett.



The Maxfield Foundation supports projects with potential for high impact in science, education, sustainability, and other areas of social importance.



Our mission at The Michelson 20MM Foundation is to grow access and success by eliminating unnecessary hurdles to affordability. We support the creation, sharing, and proliferation of more effective, more affordable educational content by leveraging disruptive technologies, open educational resources, and new models for collaboration between for-profit, nonprofit, and public entities.



The Bill and Stephanie Sick Fund supports innovative projects in the areas of Education, Art, Science and Engineering.

## WOULDN'T THIS LOOK BETTER ON A BRAND NEW IPAD MINI?

Knowing where our textbooks are used can help us provide better services to students and receive more grant support for future projects.

If you're using an OpenStax textbook, either as required for your course or just as an extra resource, send your course syllabus to contests@openstax.org and you'll be entered to win an iPad Mini.

> If you don't win, don't worry - we'll be holding a new contest each semester.



