

National Aeronautics and Space Administration



Educator Guide

www.nasa.gov

rockets

The image features several line drawings of rockets and boosters, arranged diagonally from the top-left to the bottom-right. On the left, there are two large, multi-stage rockets with numerous boosters attached. In the center, there is a smaller, single-stage rocket with a pointed nose cone. To the right, there are three boosters of varying sizes, each with a distinct nozzle at the bottom. The drawings are detailed, showing structural elements like windows, panels, and nozzle shapes.

rocket

Pronunciation: \ră-keɪ\ noun (It rocchetta)

A vehicle, typically cylindrical, containing liquid or solid propellants which produce hot gases or ions that are ejected rearward through a nozzle and, in doing so, create an action force accompanied by an opposite and equal reaction force driving the vehicle forward. Because rockets are self-contained, they are able to operate in outer space.

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Space Administration



ROCKETS

Educator's Guide with Activities in
Science, Technology, Engineering, and Mathematics.

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Acknowledgments

The original Rockets Teacher Guide was published by NASA's Education Division in the early-1990s. It has found widespread use in both formal and informal educational settings because of the exciting nature of the topic and because of its dynamic classroom activities that match and support both national and state education standards for science, mathematics, and technology.

This revision of the guide updates educators on NASA's Space Launch System (SLS), an advanced rocket enabling human exploration beyond low-Earth orbit. SLS will be the most powerful rocket ever built. When completed, it will enable astronauts to begin their journey to explore destinations far into the solar system. The activities in this guide have not been changed.

Many educators and scientists have contributed ideas and content directly and indirectly to this revision. Their assistance is gratefully appreciated.

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Dear Educators:

More than 50 years have passed since the National Aeronautics and Space Administration (NASA) was created to explore the atmosphere and space. It has been an amazing time that carried humans into space and onto the Moon. Robotic spacecraft explored all of the planets and satellites gave us a new view of Earth. A giant space station was constructed, serving as a microgravity laboratory and home to astronauts from many nations. Other satellites looked out into the galaxy and beyond, almost to the beginning of time. These and other amazing events became possible because of one technology - rockets.

We stand on the edge of a new era in space exploration and rockets will take us there. Using the next generation of rockets, human presence will soon extend beyond the confines of Earth orbit. Powerful and versatile new vehicles will enable humans to return to the Moon and travel to Mars, and will open new possibilities for robotic missions to deep space destinations. The best ideas of our space exploring past are being merged with our dreams for the future. It is a wonderful time for you and your students to learn about science, technology, engineering, and mathematics. Rockets will be your vehicle for learning.

The *Rockets Educator Guide* provides you and your students many opportunities. Together, you will examine early rockets and meet thinkers and dreamers. You will learn about rocket science and mathematics and what rocket scientists do. You will see pictures of events and technologies spanning many years of space exploration - Sputnik, Apollo, and the space shuttle to name a few. You will see the future of space transportation. You will learn why rockets are the only vehicles that can “go where no one has gone before.”

Will your students be a part of this future in space? Will they be the scientists, technicians, engineers, and mathematicians that make dreams of exploring space possible? Yes! This guide will help you prepare them for the wonders that are coming.

Chapters within the guide present the history of rocketry, NASA’s Space Launch System, rocketry principles, and practical rocketry. These topics lay the foundation for what follows - a wealth of dynamic rocket science classroom activities that work. The activities focus on Sir Isaac Newton’s laws of motion and how they apply to rockets. They incorporate cooperative learning, problem solving, critical thinking, and hands-on involvement. They support national and state standards for science, mathematics, and technology across many grade levels.

All of the activities are designed with the classroom in mind. They include clear descriptions, background information for the teacher and student, detailed procedures and tips, lists of readily available materials, assessments, questions for discussion, and extensions. The activities are designed to foster excitement and a passion for learning.

The guide is versatile. It has been created as a two-to-six-week classroom unit, depending upon the grade level of the students but individual activities can be extracted and used as stand-alone classroom experiences. You will find activity objectives and principles clearly stated along with the vocabulary terms necessary for understanding the principles involved.

The goal of the *Rockets Educator Guide* is to excite young minds. Among your students are future leaders, planners, builders, explorers, settlers, and interplanetary pilots! This guide will help you lay the groundwork for their future in space.

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