# Unit 6: Engineering & Space
# 8th Grade Science

13 Class Meetings

*Revised June 2022*

## Essential Questions

- What is the purpose for a design?
- What are the criteria and constraints of a successful solution?
- What modifications to the design of a rocket will increase launch performance and distance?

## Enduring Understandings with Unit Goals

**EU 1:** Making measurements, analyzing, and evaluating data are necessary components of the Engineering Design Process.

- Evaluate the effectiveness of three or more alternative solutions to a problem.
- Determine the needs that must be met throughout the process.
- Analyze scientific issues that are relevant to the process.
- Determine potential societal and environmental impacts of the process.

**EU 2:** Many variables determine the height and distance a rocket will travel.

- Analyze how the nose cone, the frame, and the fins of a rocket affect its height and distance.
- Examine how similar designs have been constructed in the past.

## Standards

**Next Generation Science Standards:**

- **MS-ETS1-1:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-3:** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet criteria for success.
- **MS-ETS1-4:** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

**Common Core State Standards:**

- **RST.6-8.1:** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- **WHST.6-8.8:** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- **RST.6-8.7:** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- **SL.8.5:** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

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- **MP.2:** Reason abstractly and quantitatively.
- **6.RP.A.2:** Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship.
- **7.RP.A.2:** Recognize and represent proportional relationships between quantities.

## ISAAC Vision of the Graduate Competencies

**Competency 1:** Write effectively for a variety of purposes.
**Competency 2:** Speak to diverse audiences in an accountable manner.
**Competency 3:** Develop the behaviors needed to interact and contribute with others on a team.
**Competency 4:** Analyze and solve problems independently and collaboratively.
**Competency 5:** Be responsible, creative, and empathetic members of the community.

## Unit Content Overview

1. **History of Rockets and NASA**
   - Relate rockets of the past to present day models

2. **Different types of rockets**
   - Compare and contrast solid-fuel rockets, liquid-fuel rockets, ion rockets, and plasma rockets.

3. **Safety measures and environmental impacts**
   - Analyze the safety measures required to build a successful rocket
   - Investigate the impacts that rockets have on the environment

**Interdisciplinary Connection:**

- Language Arts (**RST.6-8.1)** – Cite textual evidence to support analysis of science and technical texts, attending to the precise details of explanation of description
- Math – Reason abstractly and quantitatively
- Art – Multimedia art

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## Daily Learning Objectives with *Do Now Activities*

**Students will be able to…**

- Critique rockets of the past and modify them to be more like rockets of the present.
    - How many planets have been visited up close and photographed?
- Create and illustrate a rocket that will be named after them.
    - What can we learn from being IN space compared to making observations from Earth?
- Evaluate other rocket designs for safety precautions.
    - Why are Musk's and Bazos' rockets so important right now?
- Compare and contrast the five main types of rockets.
    - Explain one type of rocket and how its fuel works. What was its mission?
- Analyze the safety measures and environmental impacts of each type of rocket.
    - What problems do you think have come up from testing rockets?
- Design a small straw rocket that can be tested for launch speed and distance traveled.
    - What design features will make your rocket fly the highest?
- Illustrate or graphically design a large-scale model rocket.
    - Draw your idea of the perfect rocket. Label important parts.
- Construct a rocket out of given materials.
    - What issues do you foresee in building your rocket?
- Demonstrate content knowledge for success on the unit exam.
    - What have you done to make sure you can master the content?
- Test the effectiveness of their rocket design.
    - Whose rocket will fly the highest? Why?

## Instructional Strategies/Differentiated Instruction

- Whole group instruction
- Guided notes
- Student-led instruction
- Independent problem-solving
- Collaborative problem-solving
- Graphic Organizer
- Cross-curricular problem solving (independent and collaborative)
- Accountable Talk
- Homework
- Word walls with visuals
- Small group instruction
- Manipulatives

## Assessments

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**FORMATIVE ASSESSMENTS:**

- Warm-ups
- Whiteboards
- Mid-class check-ins
- Exit Slips
- Accountable Talk Discussions
- Do Now
- Student-led instruction
- Homework
- NGSS Interim Assessments
- Performance Task- We Have Liftoff
    - Teamwork Rubric

**SUMMATIVE ASSESSMENTS:**

- Quiz – EU 1 & EU 2
- Performance Task- We Have Liftoff
- Unit 6 Test

## Unit Task

**Unit Task Name:** We Have Liftoff

**Description:** Students will encapsulate what they have learned about rockets and the engineering design process by constructing their own model-sized rockets. They will incorporate the essential components of a rocket (the nose cone, the frame, and the fins) in their designs. After they create their design, students will write a summary about their rocket, why it is safe, environmentally friendly, and will have a successful launch. Finally, each rocket will be assessed for launch speed and distance traveled in a launch experiment.

**Evaluation**: Summative Assessment and Teamwork Rubric

## Unit Resources

- Flipped Google Classroom Videos
- Worksheets
- Laptops
- NGSS Interim Assessments
- Teach Engineering
- PALS