

**Big Concept:** To engage students in the engineering design process, encourage interest in space exploration and the pursuit of engineering careers through activities incorporating real world engineering problems.

### **Science Standards:**

- MS-ETS1**    **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.**  
-4.
- MS-ETS1**    **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 the criteria for success.**  
-3.
- MS-ETS1**    **Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**  
-2.
- MS-ETS1**    **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.**  
-1.
- MS-PS3-**    **Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.**  
5.
- MS-PS3-**    **Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.**  
4.
- MS-PS3-**    **Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.\***  
3.
- MS-PS3-**    **Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.**  
2.
- MS-PS3-**    **Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object**  
1.
- MS-ESS1**    **Analyze and interpret data to determine scale properties of objects in the solar system**  
-3.

**MS-ESS1 -1.** Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

**MS-ESS1 -2.** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system

### **ELA Standards:**

**RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3)

**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). (MS-ETS1-3)

**RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2),(MS-ETS1-3)

**WHST.6-8.7** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ETS1-2)

**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. (MS-ETS1-1)

**WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2)

**SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ETS1-4)

### **Mathematics Standards:**

**MP.2** Reason abstractly and quantitatively. (MS-ETS1-4)

**7.SP** Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. (MS-ETS1-4)

**MP.4** Model with mathematics. (MS-ESS1-1)

**6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1)

**7.RP.A.2** Recognize and represent proportional relationships between quantities.

**Problem solving and declarative/procedural knowledge:**

The problems involved in these activities will most likely be engineering focused problems as that is part of the big idea of the *NASA On the Moon* guide. The students will engage in design problems as well as troubleshooting problems. While completing the activities, the students will need to know several pieces of declarative knowledge like vocabulary, concepts of flight, force, energy transfer, etc. They will also need to know procedural knowledge such as how to make something stay in flight longer using the flight concepts they have learned or how to make something warmer or stay cold using their knowledge of energy transfer. Their ability to transfer their knowledge from memorized factual knowledge into application is the true test of comprehension and will be aided by their successful completion of the activities.

**Objectives and ancillary concepts and content covered:**

In addition to science and engineering standards covered, there will also be many ELA standards covered. The students will be engaged in research and writing throughout several of the activities. Students will also need good teamwork and communication skills in order to complete these activities. Working with others, being able to listen, and communicate ideas respectfully is an essential 21st Century skill that is necessary for future career success. Those skills are just as important as mastering any type of content knowledge.

**Identify possible activities.**

Launch It  
Touchdown  
Roving on the Moon  
Heavy Lifting  
On Target  
Feel the Heat

**Select the best activity for your classroom.**

Launch It