

# Instructional Teacher Guide - Rocket Launcher Activity



Figure 1: Rocket launch

## Disclaimer

This activity guide is a general guideline of the engineering design process, intended to serve as a reference for teachers. The teacher is responsible to incorporate and comply with the New Generation Science Standards of design for 3rd to 8th grade students in their lesson plans.

### **Teacher preparation**

For additional information about engineering concepts to aid the understanding of this activity visit the link below. In addition, It is recommended to watch the instructional teacher guide videos provided in the same link:

<http://research.engr.oregonstate.edu/pigroup/engineering-design-toolkit>

### **Materials**

- One Engineering Design Toolkit containing all materials needed for this activity.



*Figure 2: Engineering Design Toolkit*

### **Constraints**

The students are expected to finish activity within a 45-50 minute time frame. (Note: Every engineering design step has a recommended time limit shown in the engineering design process section of this document.)

### **Learning outcomes - The student must...**

1. Show an understanding of the problem.
2. Show an understanding of the solution and the purpose of the solution.
3. Be able to plan/design the solution.
4. Be able to implement their plan to the solution with the materials provided.
5. Be able to test the solution.
6. Be able to understand why the solution does not work.

7. Show an understanding of the engineering design process steps.

**Note:** The learning outcomes are general guidelines of the engineering design process, intended to serve as a reference for teachers. The teacher is responsible to incorporate and comply with the New Generation Science Standards of design for 3rd to 8th grade students in their lesson plans.

**Source:** <http://www.nextgenscience.org/sites/ngss/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf>

### ***Introducing the activity***

To introduce the activity follow the following procedure:

**Note:** This procedure was only created with the intent to serve as a reference on how to structure and teach this activity. Teachers have the full flexibility of teaching this activity based on their teaching style.

1. **Setup the materials for students before session starts as shown in Figure 3.**



*Figure 2: Engineering Design Toolkit materials setup for the Rocket Launcher activity*

2. **Introduce the Engineering design process to students.**

○ ***Definition - Engineering design process:***

The engineering design process is a series of steps that engineering teams use to guide them as they solve problems. The design process requires that

engineers repeat the steps as many times as needed, making improvements along the way.

Sources: <https://www.teachengineering.org/engrdesignprocess.php>



Figure 4: Engineering Design Process

Source: <http://shop.dowlingmagnets.com/p/engineering-design-process-magnets>

### 3. Introduce the activity's problem description to the students.

#### ***Problem Description***

NASA needs to launch a rocket to reach the moon to discover if life exists there. But before NASA launches their rocket to the moon they need to test the rocket launcher on earth. Help NASA build and test a rocket launcher that travels a 10ft distance and knocks down a wall of plastic cups.

#### 4. Instruct the students to follow the Engineering design process steps.

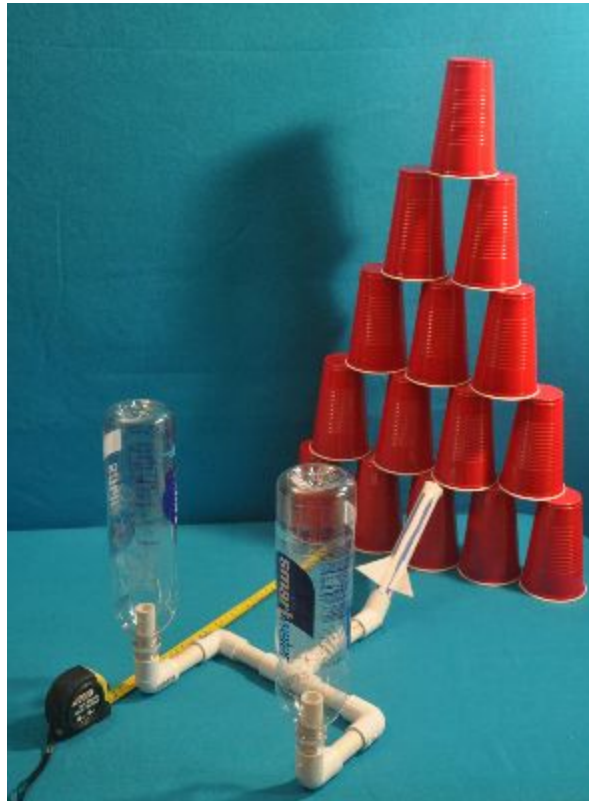
- **Step 1: Ask** ( Duration = 5 minutes )
  - What is the problem that NASA is facing? (**Learning outcome 1**)
  
- **Step 2: Imagine and plan** (Duration = 10 minutes)
  - Questions
    - What does NASA need to be able to get to the moon? Why does NASA need a rocket launcher? (**Learning outcome 2**)
    - How can we make/build a rocket launcher? (**Learning outcome 3**)
  - Mission
    - Have the students draw out their designs of the rocket launcher on the whiteboard provided.
  
- **Step 3: Create** (Duration = 20 minutes )
  - Questions
    - Using the materials provided at hand, how will you make the rocket launcher? (**Learning outcome 4**)
  - Mission
    - Show the students the possible designs diagram then let them create the rocket launcher.
  
- **Step 4: Test** (Duration = 5 minutes )
  - Question
    - To check if the rocket launcher works, we should test that it will be launched at a distance of 3ft ,How can we test if the rocket launcher works? (**Learning outcome 5**)
  - Mission
    - Have the students test their rocket launcher designs by launching the rocket through squeezing the bottle to release the air inside. If the rocket reaches the 10ft then it is a success.
  
- **Step 5: Improve** (Duration = 5 minutes)
  - Debriefing through the following questions
    - For the rocket launcher that failed to launch, Why did the fail to launch? How can we re-make the rocket launcher to improve it? (**Learning outcome 6**)
    - What have you learned ? (**Learning outcome 7**)



**Adjusting difficulty (Optional)**

***New problem descriptions***

Re-define problem statement so that the students build the rocket launcher with two bottles to increase the pressure, to make the rocket travel a further distance of 15ft as shown in figure 5.



*Figure 5: One variation of the two water bottle rocket.*