



Engineering Design Process

Educator Notes

Learning Objectives

- Students define engineering and the engineering design process.
- Students apply the engineering design process to material challenges on the International Space Station.
- Students use the engineering design process to develop technology found at home, in the classroom, and in space.

Safety

- Students should be careful when cutting materials during the engineering design process extension activities.

Think-Pair-Share

Ask

- Ask students to have ready a blank piece of paper for all tasks during the think-pair-share portion of this lesson.
- Give students 1 minute to quickly draw a picture of an engineer on their blank piece of paper.
- Ask each student to compare their drawing of an engineer with how they view themselves. Students write down similarities and differences between their drawings and their appearance.

Share

- Place students in groups of two or three.
- Ask students to compare their drawings with the other student drawings in their group. Each group lists similarities and differences among the drawings.
- Choose a few groups to describe their observations to the class.
- Ask student groups to work together to list characteristics of an engineer and describe what makes a person an engineer.
- Choose a few groups to describe their observations to the class.
- Guide students to help them understand that anyone can become an engineer. Engineers use science, math, technology, and ingenuity to create solutions to technical problems. Engineers can be of any age, gender, race, and ethnicity.

Grades 6 to 12

Suggested Pacing

60 minutes total

- Think-Pair-Share – 20 min
- Guided Inquiry – 35 min
- Conclusion – 5 min

Materials

- Engineering Design Process Student Worksheet
- Blank piece of paper
- Writing utensil

National STEM Standards

- MS-ETS1-1
- HS-ETS1-3

Engineering Design Process

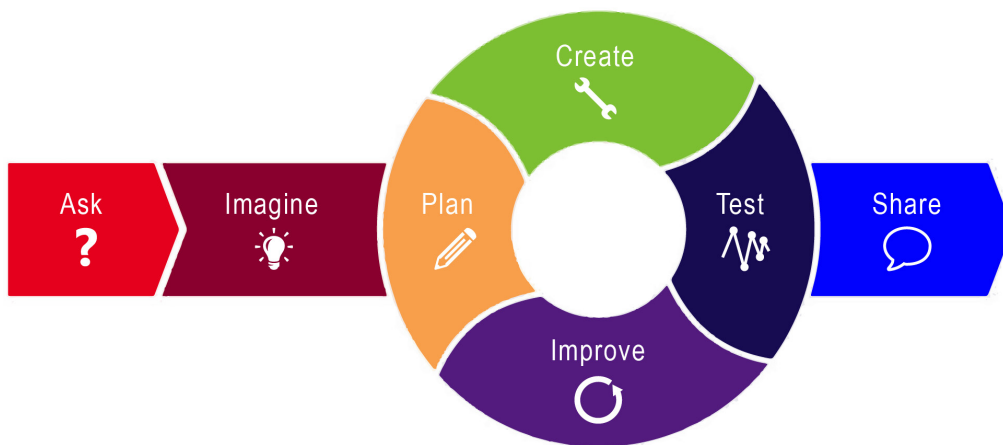
Guided Inquiry

STEMonstration Video

- Ask students to brainstorm a list of tasks they believe engineers complete during a typical workday. Provide an opportunity for students to share their ideas. Highlight common threads across student suggestions and introduce the engineering design process.
- Watch the Engineering Design Process STEMonstration video found at <https://www.nasa.gov/stemonstrations>.
- Distribute one Engineering Design Process Worksheet per student.
- As a class, use the “STEMonstration Video Questions” to facilitate a discussion on the information shared in the video.

Classroom Activity

- Divide students into small groups of three to four. Allow students to use the “Classroom Activity” section of the worksheet to apply the engineering design process through a guided inquiry. Note: Technology examples students choose for this activity can be “low-tech,” like a pencil, mechanical pencil sharpener, window, window shade, carpet, or ceiling tile. Examples can also be “high-tech,” like an electric pencil sharpener, smoke detector, television, or computer.



Conclusion

- Ask a few groups to share their activity results with the class. Reinforce how each technology example was engineered numerous times and will continue to evolve many more times using the engineering design process.

Extensions

- Students complete the same activity individually at home and share their results with the class.
- Students participate in the following Spacecraft Safety Engineering Design Challenge: <https://www.nasa.gov/centers/glenn/stem/glenn-engineering-design-challenges/spacecraft-safety>
- Students participate in the following engineering design activity: <https://www.nasa.gov/stemonstrations-eng-design-trusses.html>
- Students participate in the four activities from the Landing Humans on the Moon Educator Guide: <https://www.nasa.gov/stem-ed-resources/landing-humans-on-the-moon.html>

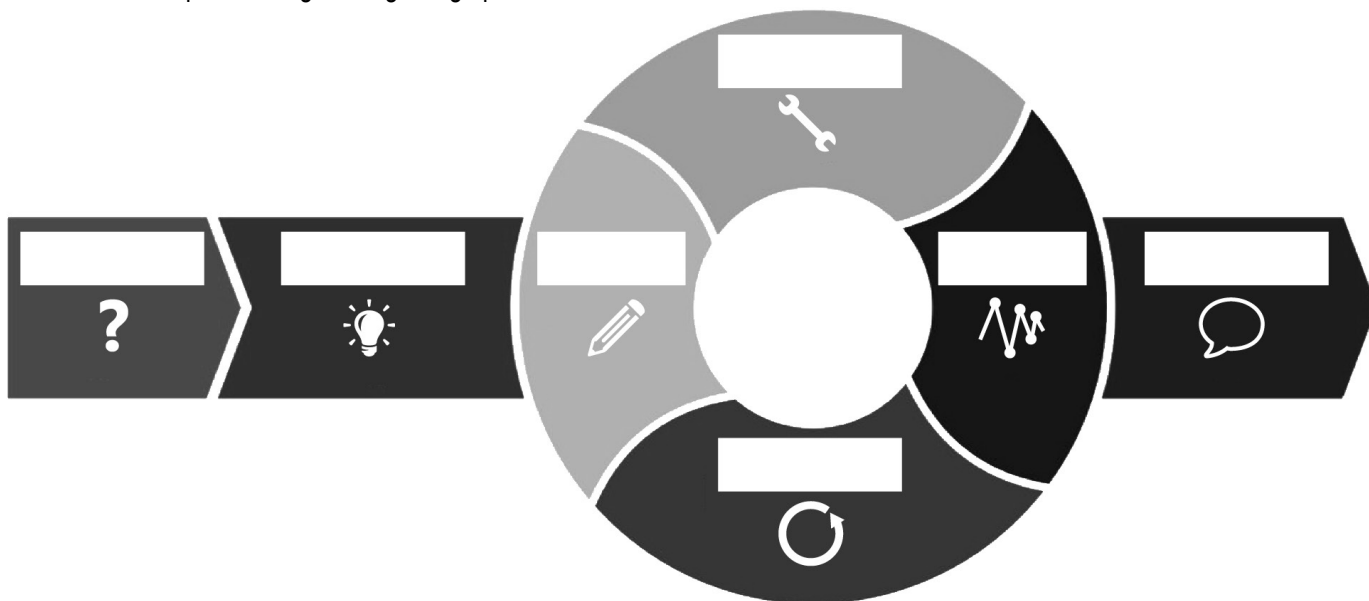
Engineering Design Process Student Worksheet

STEMonstration Video Questions

Use the word bank along with the STEMonstration video to respond to each of the following writing prompts and to help you correctly complete the engineering design process visual below.

Word Bank		
create	technology	imagine
test	math	improve
plan	ingenuity	share
ask	technical	science

- Describe how engineers create solutions to problems using at least five words from the word bank above.
- List three examples of technical problems.
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- What skills or attributes help engineers determine the best solution to a technical problem?
- Name each step of the engineering design process:



Engineering Design Process

- Using your own knowledge and the STEMonstrator video, list five things engineered for the International Space Station.
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Classroom Activity

- Choose one example of technology found in your classroom. Try to be unique and choose something no other group is likely to choose.

- Create a 2-minute oral presentation describing how this technology evolved using the engineering design process. Use the following questions to help guide your presentation.

STEP 1: Why was your technology invented? What purpose does it serve? Does the technology meet a need or want?

STEP 2: Do multiple solutions exist to meet the need or want? What do these solutions look like?

STEP 3: What kind of research would engineers do as they create this technology? What resources would engineers use to create this technology (money, time, materials)? What limitations does this technology have (budget, materials, lifespan, needs alternating-current (AC) electricity, needs direct-current (DC) electricity)?

STEP 4: Do you think models and prototypes of this technology existed before engineers developed the actual working technology? What could you use to make a model of this technology?

STEP 5: How do engineers test and evaluate models and prototypes? How could your chosen technology be tested?

STEP 6: What improvements have been made over time to improve this technology?

STEP 7: Who would be interested in this technology? Who would benefit from this technology? Who would purchase this technology?