STEMploration Engineering & Design Virtual Lessons

Unit Overview

Lesson	Overview	Student Learning Outcomes	Time
STEMploration Engineering & Design Virtual Lessons Lesson 1: Introduction to Engineering	Have you ever wondered what a career in engineering would be like? In this lesson, you will be introduced to career options in the field of engineering. We are going to start by looking at an important data point in a Mystery Data activity. Then, we'll look at some images to help you start thinking about some of the career options in engineering. Finally, you will have a chance to discuss what you have learned about the field of engineering and your thoughts about engineering career options with your classmates. As a bonus activity, you will be able to work with a family member or trusted friend to learn more about future engineering career options.	• Describe some of the careers in the engineering field. • Explain why it is important to make informed career choices. • Use digital media to learn more about a specific engineering career.	45-50 minutes
STEMploration Engineering & Design Virtual Lessons Lesson 2: Engineering and Design 101	Have you thought about what engineering is like? In this lesson, you will be introduced to engineering and the basics of the engineering and design process. We are going to begin with a video from the Crash Course YouTube channel that presents engineering as a way of thinking and solving problems. This video will also introduce you to the four main disciplines of engineering. Following the video, you will have the opportunity to try out your engineering skills with the first engineering Design Lab activity — the Paper Pillar Challenge Finally, we will conclude with a Gallery Exploration where you and your classmates can review the results of your Design Lab activity and share your feedback.	• Use available materials to create a solution to a problem. • Explain why some solutions are effective while others are not.	45-50 minutes

STEMploration Engineering & Design Virtual Lessons Lesson 3: Engineering and Design Process	In this lesson, you will learn about the engineering and design process (EDP). You will learn about the steps of the EDP and you will reflect on the EDP steps that you followed in the paper pillar problem. Then you will learn about a tool that engineers use to structure their thinking: an engineering notebook. As a Young Professional interested in engineering, you can use an engineering notebook as a way to archive your thinking and work in a single location. You will look at exemplary engineering notebooks so that you can see good examples of record keeping. You will also start your own notebook using your ideas from the paper pillar project.	• Define the steps of the engineering and design process. • Describe how people in engineering careers use the EDP to solve problems. • Evaluate a design challenge to identify key steps from the EDP. • Archive engineering work in an organized way.	45-50 minutes
STEMploration Engineering & Design Virtual Lessons Lesson 4: Water Crisis and Research	In the first part of the lesson, you will gain an understanding of the importance of water, the issues surrounding lack of access, and how these factors affect the problem that is worsened in the wake of natural disasters. You will consider a fictional scenario where a tsunami has occurred on an island. The island's freshwater supplies have been contaminated with salt water and freshwater supplies are running very low. People need to be able to build their own solar stills to have enough fresh drinking water. You will also focus on building background knowledge about sanitation and disease and the STEM design process for developing solutions to problems. Finally, you will be analyzing examples of water purification technologies against pre-determined design criteria.	• Explain the global issue of people not having access to clean water • Evaluate possible design solutions systematically and based on predetermined criteria and constraints • Discuss potential solution designs	45-50 minutes
STEMploration Engineering & Design Virtual Lessons	In this lesson, you will get in the **brainstorm** mindset by completing a **brainstorming** exercise.	• Explain how to brainstorm an idea for an engineering solution.	45-50 minutes

Lesson 5: Brainstorming a Solution	In the last lesson, you learned that salt water is purified naturally by the water cycle. You can model this process on a small scale to get fresh water using a solar still. Because people need to be able to build these for themselves, they need to be made out of recycled or **reclaimed materials**. Your job is to find materials that you can use to create an example. You will learn about the Indonesian state of emergency and **brainstorm** solutions to the water contamination crisis. Then, you will critique the solutions of your peers. You will select the best of your own ideas and record your process in your Engineering Notebook. You will also: Discuss the elements that go into a good **sketch.** Create the **sketch** for your **prototype**. In the next lesson, you'll build and test your model.	• Create a model prototype based on background knowledge built by using the engineering and design process (EDP).	
STEMploration Engineering & Design Virtual Lessons Lesson 6: Water Purification	In a previous lesson, you learned that the water purification cycle makes access to drinkable water possible. Then, you learned about brainstorming your ideas to address a water crisis. In this lesson, you will use this combined knowledge to build and test your solar still to see how well it performs and what changes might need to be made before providing or presenting this example to the WHO. Finally, you will set goals for future Engineering Notebook entries.	• Create a water purification system modeled after the water cycle. • Analyze data to understand how solar distillation purifies water. • Formulate a hypothesis using the "If _, then _" format.	45-50 minutes

STEMploration Engineering & Design Virtual Lessons Lesson 7: Zip Line	In this lesson, you will use the engineering and design process to solve a zip-line problem. Using readily available materials, you will design a solution to carry a ping-pong ball down a string and release it to hit a target. First, you will explore the problem, design constraints, and background research. Then, you will build and test a prototype, recording the results in your Engineering Notebook. You will consider ways that you could rebuild your prototype. Finally, you will look at careers related to the mechanical engineering field, evaluating each through the lenses of self, security, and society.	• Create a solution to a problem using the engineering and design process. • Analyze careers in this field through the lenses of self, security, and society.	45-50 minutes
STEMploration Engineering & Design Virtual Lessons Lesson 8: Airdrop	Have you ever wondered how cargo is airdropped into places? In this lesson, you will use the engineering and design process to solve an airdrop/parachute problem. Using readily available materials, you will design a solution to carry a set mass to the ground as slowly as possible. First, you will be introduced to the project and explore the problem, constraints, and background research before starting to design a prototype. Then, you will build and test a prototype, recording the results in your engineering notebook. Next, you will rebuild and retest your prototype using feedback from your classmates, teacher, and families. Finally, you will present your results and look at different careers in this field, evaluating them through the lenses of self, security, and society.	• Create a solution to a problem using the engineering and design process. • Analyze careers in this field through the lenses of self, security, and society.	45-50 minutes
STEMploration Engineering & Design Virtual Lessons Lesson 9: Shelter	In this lesson, you will use the engineering and design process to solve a shelter problem. Using readily available materials, plus scavenged materials, you will design a shelter solution that can be used in the rebuilding process in the wake of the tsunami. First, you will be introduced to the project and explore the problem, constraints, and background research before starting to design a prototype. Then, you will build and test a prototype, recording the results in your engineering notebook. Next, you will rebuild and retest your prototype using feedback from others. Finally, you will look at different careers in this field, evaluating them through the lenses of self, security, and society.	• Create a solution to a problem using the engineering and design process. • Analyze the careers in this field through the lenses of self, security, and society.	45-50 minutes

STEMploration Engineering & Design Virtual Lessons Lesson 10: Towers	In this lesson, you will use the engineering and design process to solve a paper tower problem. Given minimal materials, you will design the tallest tower you can. First, you will be introduced to the project and explore the problem, constraints, and background research before starting to design a prototype. Then, you will build and test your prototype, recording the results in your engineering notebook. Next, you will rebuild and retest your prototype using feedback from others. Finally, you will present your results and look at different careers in this field, evaluating them through the lenses of self, security, and society.	• Create a solution to a problem using the engineering and design process • Compare and contrast the careers in this field	45-50 minutes
STEMploration Engineering & Design Virtual Lessons Lesson 11: Presenting Your Designs	As an engineer, you will often be asked to present your ideas to others. It is important to understand how to do this in an effective and efficient way. In this lesson, you will learn how to plan and prepare a final presentation of the work you did on one of the projects in the Engineering unit.	• Analyze a presentation for effective elements using a rubric. • Plan a quality presentation using a rubric.	45-50 minutes
STEMploration Engineering & Design Virtual Lessons Lesson 12: What Have I Learned About Engineering Sciences	This lesson begins with some questions designed to help you recall the work you've done and what you've learned throughout this engineering unit. You will engage in a reflective portfolio assignment and share your final thoughts with your classmates in Flipgrid.	• Reflect on your learning and growth over time. • Communicate your learning and growth over time.	45-50 minutes

Implementation Best Practice

Best Practice	Condensed Unit	Introduction to Engineering	
All 12 lessons in order	Lessons 1 through 6 in order &	Lessons 1 through 3 only	Lesson 1: Introduction to Engineering
			Lesson 2: Engineering and Design 101
			Lesson 3: Engineering and Design Process
			Lesson 4: Water Crisis and Research
			Lesson 5: Brainstorming a Solution
			Lesson 6: Water Purification
			Lesson 7: Zip Line
			Lesson 8: Airdrop
			Lesson 9: Shelter
			Lesson 10: Towers
	Student Presentations and/or Closure		Lesson 11: Presenting Your Designs
			Lesson 12: Engineering Sciences Closure