STEM 7 - Curriculum Map 2023-24

Why Mars, is it realistic and can we colonize it? Research and Exploration into the Red Planet

Unit	Standard(s)	Overview	Vocabulary	Timeline
1	ELA Literacy RI 5.1,2,3,7,8,9 ELA Literacy RST 6-8.1,2,4,6,7,9 ESS -1	**Part 1: Why Pioneer Mars (Science and technology)** **Students will explore the different targets of the celestial world such as near earth orbit, the international space station, our moon and mars. Students will analyze the purpose for these targeted areas, and how they are significant to space exploration.** Students will research the benefits of space exploration using a variety of sources. Students will identify benefits to space exploration to society and culture.	Cis-Lunar Space NASA Destination Area Space Exploration Mars Moon Earth Misson SpaceX Cryogenic boil off regolith In-situ NEA (Near Earth Asteroid) LEO (Low Earth Orbit) Lagrange points Rational (reasoning)	2-3 Classes
2	ELA Literacy RI 5.2,7,9 ELA Literacy RST 6-8.1,2,4,6,7,9 MS-PS 1-4,2,5 S-PS3-1 S-LS 1-1 S-LS 2-1 S-LS 2-2 Ag/ Science Standards:	**Part 2: What is Mars Like? (Ag Science)** **Engineering:** Students will explore and compare the similarities and differences in Earth and Mars' atmospheres. They will use these comparisons to better understand why life, such as microorganisms, haven't been able to survive on mars. Students will research, conduct and perform and experiment, discovering how plants create oxygen from carbon dioxide which is 96% of Mars' atmosphere. Then, they will rationalize that microorganisms such as cyanobacteria are more practical means of plant life to use due to their ability to survive in harsh climates with minimal necessary resources. Students will explore their habitat and survival in Antarctica, and compare these conditions to Mars. Students will learn about the process of photosynthesis and create a project-story for the germination of plant life. - Student will depict the process of photosynthesis in google drawing - Students will learn about temperature and state of matter and how they are related to the atmospheric pressure necessary for liquid water to exist. They will tie this back to the fact that liquid water is necessary for planet life to exist. - Students will conclude with evidence that organisms may be viable to Martian conditions. (cyanobacteria).	**By-Product** **Atmospheric Pressure** **Oxygen** \Water Vapor **Carbon Dioxide** Hydrogen Sulfide Hydrochloric Acid State of Matter - Liquid water in relation to atmospheric pressure. **Aquatic Plant** **Photosynthesis** **Cyanobacteria** **Multicellular** **Single Cell** Sustainability	3-5 Classes

3	*(Math)* 5.G.1 and 2 *(Science)* MS-LS 1,4,5 *(Engineering)* MS-ETS 1,2,3,4	**<u>Part 3: Can We Pioneer Mars?</u>** **Students will** - Investigate the scientific method - Identify the central question of the pioneering Mars Project - Construct hypothesis based on background evidence - Differentiate between independent and dependent variables, and experimental constants - Identify experimental and control groups in an experiment - Evaluate experimental design based on principles of the scientific method - Design and construct an experiment to test hypotheses - Analyze and interpret data	Scientific Method Hypothesis Independent and Dependent Variables Control Groups Experiment Test Analyze Interpret Data Data Table	2-3 Classes
What Our Mission Team Needs to Know Before They Go				

Unit	St(*Engineering*) ETS2 (*Engineering*) ETS1.A ETS1.B**andard(s)**		Vocabulary	Timeline
4	**St***(Engineering)* ETS2 *(Engineering)* ETS1.A ETS1.B**andard(s)**	**<u>Earth, Earth's Moon and Mars - Balloons</u>** - Students will make sense and gain an understanding of Earth's place in the universe and have an idea of its relevance to its Moon, Mars and other planets in our Solar Systems. - Students will construct a Balloon Scale Model to understand the relative size of the Earth, Earth's moon and Mars in relation to each other and their relative distance to each other at this scale. - Students will use this model to predict distances and reflect on how scientists use models to construct explanations through the scientific process .- Students understand why the mission to Mars is a 6 month exploration, compared to the mission to the Moon which only takes 3 days. **<u>Solar System Scale and Size</u>** - Students create a scale model of the solar system using craft items and string to compare planetary sizes using commo types of fruits and seeds. - Following the previous exercise, it reinforces understanding of why space exploration is challenging in terms of distance, time and resources. - Students will identify environmental constraints and cultural and other requirements **<u>Ag/ Science</u>**: - **Food Production and Food Science Unit** - The production of food safely, effectively and efficiently. - The distribution and harvesting in agriculture - The science behind quality fertilizers	Universe Solar System Perspective Metric System Model Prediction/Predict Investigation Models Predict Reasoning Safety Solutions Technology FeasibilityScientific Process	1 Class

5	*(Engineering)* ETS2	**<u>Discovering a Strange New Planet</u>** Students will use remote-sensing techniques to demonstrate how planetary features are discovered. They will experience different phases in planetary exploration, including telescope observations, fly by missions, orbiters, landers, rovers and their own ideas about human exploration. - Students will observe play-doh planets through self made telescopes to identify various objects and features of the different planets. - Using technology tools, they will learn how to take observations and measurements of what they are investigating. - Students will write first person articles about their discoveries and share with peers. **<u>Ag/ Science</u>**: Students will learn to make observations about geographic features and soil samples. Students will be able to look at new plants, using the same techniques they observed the new planets, and make inferences about the type of plant, its characteristics.	Discover Atmospheric Pressure Atmosphere Elevation Gravity Hydrogen Magnetic Field Radiation Elaborate Evaluate Analyze	2-3 classes
6	*(Engineering)* ETS1.A ETS1.B	**<u>Sustainable Community:</u>** Students develop potential solutions and technologies to meet the identified community requirements. Students create draft designs that address these requirements and evaluate them. Based on criteria, students determine which design elements are the best. This provides a synthesis and summative experience for students, allowing them to share their newly developed problem solving skills and their design-based solutions with others.	Analyze Constraints Design Criteria Empirical Evidence Explanations Evaluate Hypothesis Imagine	

		- Students will identify environmental constraints and cultural and other requirements
		
		<u>Ag/ Science</u>:
		- **Food Production and Food Science Unit**
		  - The production of food safely, effectively and efficiently.
		  - The distribution and harvesting in agriculture
		  - The science behind quality fertilizers
		  - The science of growing planets and sustaining them
			Investigation
			Models
			Predict
			Reasoning
			Safety
			Solutions
			Technology Feasibility	

7	*(Engineering)* ETS1.	**<u>Planning the Mission to Mars</u>** Students experience the fundamentals of the engineering design process, with a hands-on, critical-thinking, authentic approach. Using collaboration and problem-solving skills, they develop a mission that meets constraints (budget, mass, power) and criteria (significant science return). ● Students learn if life ever arose on Mars ● Characterize the Climate on Mars ● Differentiate between a scientific Question and Technological Design/ Solution ● Design a Technology Solution ● Analyze constraints within a technological design ● Apply technological design skills to a novel problem ● Evaluate change in ability to solve engineering problems.	Engineering Constraints Models Predict Relative Distance Relative Size Relationship Scale Constraints Spacecraft Design Log Objectives Climate Geology Human Exploration Multi-planetary	2-3 classes

8	*(Engineering)* ETS1.A ETS1.B ETS1. D	**Community and Building a Scale Model of a community** Students work together to build a representational model of their community (no-tech and high-tech options). This provides students with the chance to make their designs come to life in a scale model, drawings, or other concrete representations. - Students will build an initial model of a sustainable community that meets criteria and constraints - Students will modify a model of a sustainable community to meet a challenge - Students will evaluate a model based on criteria, constraints	Community Constraints Design Criteria Explanations Evaluate Investigation Models Reasoning	3-4 classes

Acting out the Mission to Mars				
Unit	**Standard(s)**	**Overview**	**Vocabulary**	**Timeline**

9 10		**<u>The Departure</u>** Rocketry (engineering) - Students will learn about the anatomy of rocketry - Students will explore the various Space X rocketry, engines and space pods. - Students will learn about model rockets and simulate their own launches - Students will engineer and construct model rockets in groups and launch - Students will learn about the science and physics that goes into launch a true rocket **<u>Transportation/ Locomotion Engineering</u>** Students explore alternative means of transportation with the lack of fuel or means to create gas powered vehicles on Mars. **<u>CO2 cars</u>**: Students will engineer their own CO2 powered car and test its efficiency in a competitive format by racing them versus their classmates. **<u>Magnetic Levitation Cars</u>**: Students will learn about magnetic polarity and Mass's correlation that will push a foam based vehicle down a magnetic path, propelled. Students will get an introduction to **<u>Solar Powered</u>** vehicles as well and how NASA and SpaceX have used them on the Mars Rovers. Students will see what it entails to build a Solar Powered Rover that can function on Mars, and what that entails. (video based)	Rocketry Nose Cone Neck Fins Fuel Lodge Fuel Cells Shock Cords Parachute Launch Pad Recovery Aerodynamics Friction Launch lug CO2 Aerodynamics Resistance Friction Wheel bearings distance/rate/time Axel Gravity Magnetic Polarity	

11		**LunarLanding-DraganPod(SpaceX):** Students will be given a mission with specific parameters and limited material to construct a lunar landing pod with parachute that can land Safely to earth and also keep the crew (the uncooked large egg) safe. - Students will learn about the engineering of the parachute and how it used to reduce speed - Students will learn about what factors add to creating reduced speed. - Students will witness the live streamed video of SpaceX Dragon pods entering earth's atmosphere and the retrieval process of the crew.		