**Exploration of Mars**

**STEM Topics -** Science equipment used for exploration on Mars, Deep space travel concepts (colonization, life support systems), Designing and building principles for making spacecraft

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**Grade Level:** 6-8 Grade

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**Goals**: Know the purpose for performing exploration missions on Mars and learn about the challenges of landing on Mars.

**Learning Objectives:**

1. SWBAT know what processes and equipment are necessary for the colonization of Mars.
2. SWBAT learn the specific equipment contained on the orbiters and rovers that allow for the search of life on Mars.
3. SWBAT design a model of a spacecraft that can land effectively taking into consideration principles of drag, balance and cushioning.

**Materials:**

Videos :

1.Next Mars Rover in Action : –

<https://www.youtube.com/watch?v=PuH1b2NgMpY> - 4 min 20 s

2.NASA’s Curiosity Finds Climate Clues on a Martian Mountain : -

<https://www.youtube.com/watch?v=T1SL0NnXRW0> - 1 min 38 s

3. Mission Overview : NASA’s Perseverance Mars Rover : -

<https://www.youtube.com/watch?v=5qqsMjy8Rx0> - 2 min 58 s

1. Crazy Engineering: Making Oxygen on Mars with MOXIE : -

<https://www.youtube.com/watch?v=7rzu7TTkIMA> - 3 min 11 s

Power points:

Exploration Missions to Mars.pptx

Process for Finding Life on Mars.pptx

Instructions for Life on Mars Powerpoint.pptx

Design Principles for Mars Lander.pptx

Documents:

Instructions for Mars Life Exploration Mission Presentation.docx

Experimental Materials (for each student):

4 plastic straws

2-3 – 3” x 5” blank sided notecards

1 4” x 5” piece of cardboard

8 mini marshmellows

1 500 mL plastic water bottle

3 medium rubber bands

Scotch tape roll

Scissors

Website Resources:

Jet Propulsion Laboratory (JPL) – Classroom Activity TOUCHDOWN

<https://www.jpl.nasa.gov/edu/teach/activity/touchdown/> -

**Vocabulary:**

**Reactor:** A container or apparatus in which substances are made to react chemically, especially one in an industrial plant.

**Mars Exploration Science Goals:** 1) Determine whether life ever arose on Mars, 2) Characterize the climate of Mars, 3) Characterize the Geology of Mars, 4) Prepare for Human Exploration

**Rover**:  A vehicle for driving over rough terrain, especially one driven by remote control over extraterrestrial terrain.

**Drag:** The longitudinal retarding force exerted by air or other fluid surrounding a moving object.

**Oxides:** Chemical compounds that contain at least one oxygen atom and one other element in its chemical formula.

**Chemical Energy:**  Energy stored in the bonds of chemical compounds, like atoms and molecules. This energy is released when a chemical reaction takes place.

**Setup:**

1.Take a look at the power point lesson **Exploration Missions to Mars.pptx** and note the different topic areas to discuss such as exploring mars, colonization of Mars, Life support systems for deep space travel, Mars Exploration Program and the specific Exploration Missions. On the last slide is where you will show the videos in the pictures where you discuss the rovers. Review the videos under the Materials section.

2.Open up the power point file **Process for Finding Life on Mars.pptx** and review the slides within it. It introduces the project the students will do and the approach they will take. It demonstrates the materials or energy that certain instrumentation can find on Mars to show that Life existed or exists on the planet. Next review the document **Instructions for Mars Life Exploration Mission Presentation.docx and Instructions for Life on Mars Powerpoint.pptx** to see how the students will design their own power point presentation.

3.The next activity will be the students building their Mars Landers from recycled materials. Review the website <https://www.jpl.nasa.gov/edu/teach/activity/touchdown/> - for instructions and material related towards building the Mars Lander. The activity is modified slightly from the instructions they give on the website. For the changes review the power point lesson **Design Principles for Mars Lander.pptx** that is used to give the students guidance on building their Mars Landers. Next gather the materials the students need to build the Mars Landers and perhaps have extra to practice in building a lander yourself before doing the activity so that you can guide the students on how to build them.

**Lesson Plan Procedure:**

1.Start the lesson by teaching the material in the power point lesson **Exploration Mission to Mars.pptx.** You can choose to use the animation sequences already setup for the presentation or just refer to the images to the right of the text. When you get to the last slide you will be showing a sequence of four videos. They will mainly be introduced on the last set of three images on that slide. [25 minutes].

2. Next introduce the Finding Life on Mars power point project that they will perform. Introduce the subject material, equipment, materials they will find on Mars through the power point lesson

**Process for Finding Life on Mars.pptx.** Concentrate mainly on the equipment they will use from the missions on Mars and the type of materials they will be exploring for such as rock formations, minerals, ice, water and carbon. Next use the documents **Instructions for Mars Life Exploration Mission Presentation.docx** and **Instructions for Life on Mars Powerpoint.pptx** to guide the students on making their own power point presentations. Give them adequate time to make their own slides. Afterwards have one or two students show their power point presentations and have the class discuss them. [45 minutes]

3.The final part of the lesson is having the students construct their Mars Landers. Get all the materials together for the Mars Lander as listed under the Experimental Materials listed in the Materials section. Distribute them to all of the students. Then show the power point presentation **Design Principles for Mars Lander.pptx** in order to give students ideas on how to build their Mars Landers. Give them hints and suggestions on how they can use certain materials to fulfill the design principles laid out. For example they could cut up the index cards and use them for air drag resistance. The marshmellows could be used as cushioning materials. The straws and cardboard could be used for stabilization materials. Give them some time to construct their Mars Landers. After they are done have a few of them show their landers and have them tell you how they constructed them. [45 minutes]