Pre and post-visit activities for *Mission Mars* Field Trip Package

An astronomy lesson for grades 3-8

Learning Goals (for field trip and pre/post-activities)

- Students will understand that with current technology, rockets use chemical reactions to generate the thrust needed to counteract the force of gravity.
- Students will understand that there are vast distances in space and will be able to discuss these distances using astronomical units.
- Students will be able to identify the forces that affect rockets during space flight such as gravity and thrust.
- Students will be able to state and explain Newton's laws of motion and tell how they relate to rocket propulsion.
- Students will be able to identify different parts of a rocket.
- Students will use the scientific method and change variables to improve the performance of a straw rocket.
- Students will find the mass of their rocket using a scale and use this information to design their straw rocket.
- Students will predict how far their rocket will travel. Students will record and test their prediction.
- Students will collect and record data about the distance their rocket traveled and use this information to improve their rocket design.
- Students will graph the data they collected and use this data to identify variables that improved the way their rocket traveled.

Pre-visit Activities

Before bringing students to the Science Center you may want to try some of the following activities in order to activate prior knowledge and prepare them for their field trip. (Grades 3 to 8) Lessons should be adjusted for grade level.

1. Make a paper airplane
    a. Needed materials – paper, meter sticks.
    b. Students will make paper airplanes of their own design.
    c. Discuss in class some forces that act on their airplane while in flight. Some of the forces you can discuss with 3rd through 5th graders are gravity and thrust. You can discuss how gravity pulls down on the airplane and thrust is the forward motion created by your arm throwing the plane. Students in 6th through 8th grade can explore concepts of lift and drag as forces that affect their airplane. The following websites are a good resource for information and activities for paper airplanes.

i. https://www.grc.nasa.gov/www/k-12/airplane/glidpaper.html
ii. https://www.grc.nasa.gov/www/k-12/aerosim/LessonHS97/paperairplaneac.html

d. Students can measure the distance their planes fly using meter sticks. They can then make changes to their design such as adding a paper clip to increase their plane's mass and see how the change affects the distance their planes fly. If time allows, students may try different plane designs to see how different designs compare.

2. Build and launch a virtual rocket using NASA's "Rocket Science 101."
   a. You can run this on your computer online or download the app for your tablet. Use the link below to use Rocket Science 101. http://www.nasa.gov/externalflash/RocketScience101/RocketScience101.html
   b. Students can learn about the different parts of a rocket as they add components using this program.
   c. Students will learn to choose the appropriate rocket to satisfy the mission goals outlined in Rocket Science 101.

Post-visit Activities

You can extend your visit to the Science Center back in the classroom with the following post-visit activities. (Grades 3 to 8) Lessons should be adjusted for grade level.

1. Research
   a. Have students individually or in groups research the Mercury, Gemini, Apollo or shuttle programs. The students can give a short report or PowerPoint presentation on one of these space programs. Helpful websites to aid students in their research can be found in the resource section.
2. Explore rocket science for grades K-2 with NASA Activities
   a. http://www.nasa.gov/pdf/58149main_3.2.1.Liftoff.pdf
3. Create straw paper rockets back in the classroom
   a. Have students use the NASA guide to create smaller paper rockets in the classroom. http://www.grc.nasa.gov/WWW/k-12/TRC/Rockets/paper_rocket.html. Students put their paper rockets on straws and thrust is provided by blowing through the straws. The students then measure the distances their rockets traveled.
   b. The experiment can be repeated with some variables changed in order to hopefully increase the distance the rockets will travel. For example, students can weigh their rockets to find their mass and then add tape or paper clips in order to increase the mass before retrying the experiment. They can then measure to see if the alteration changed the distance their rocket traveled.
4. Graph your rocket data
   a. Using the data from the above activity, students may create a bar or line graph showing the distance their rockets traveled on the two different attempts.
   b. The class can also create a graph comparing the distances traveled by each rocket in the class.
   c. The students can then create a PowerPoint presentation showing their graphs and presenting the data they created as a class. The class can discuss what designs seemed to travel farthest.

Standards Addressed (NGSS)

NGSS 5-PS2-1, 3-5-ETS-3, MS-ETS1-1, MS-ETS1-3

Resources

Websites

Project Mercury

- https://www.nasa.gov/mission_pages/mercury/missions/program-toc.html
- http://www-pao.ksc.nasa.gov/history/mercury/mercury.htm
- http://starchild.gsfc.nasa.gov/docs/StarChild/space_level2/mercury_astronauts.html

Gemini Program

- http://www.nasa.gov/mission_pages/gemini/index.html
- http://nssdc.gsfc.nasa.gov/planetary/gemini.html
- https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-was-gemini-program-k4.html

Apollo Program

- http://www.nasa.gov/mission_pages/apollo/missions/index.html
- http://www.nasa.gov/mission_pages/apollo/index.html
- http://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-was-apollo-program-58.html
- http://starchild.gsfc.nasa.gov/docs/StarChild/space_level1/apollo11.html

Space Shuttle Program

- http://starchild.gsfc.nasa.gov/docs/StarChild/space_level2/travel.html
- http://www.nasa.gov/mission_pages/shuttle/main/index.html
- http://www.nasa.gov/audience/foreducators/rocketry/home/shuttle-activities-index.html
- http://www.nasa.gov/audience/foreducators/rocketry/home/shuttle-commem-index.html#.VdS79flVhBd
- http://www.nasa.gov/audience/foreducators/rocketry/home/shuttle-activities-index.html

International Space Station

- http://www.nasa.gov/mission_pages/station/main/index.html

NASA Rocket Science Activities

- http://www.nasa.gov/pdf/58149main_3.2.1.Liftoff.pdf

New Horizons Mission to Pluto

- http://pluto.jhuapl.edu/