

## Resources for students and educators of grades K-12

NASA Home Page  
[www.nasa.gov](http://www.nasa.gov)

NASA Johnson Space Center  
[www.nasa.gov/johnson](http://www.nasa.gov/johnson)

NASA Orion Spacecraft  
[www.nasa.gov/orion](http://www.nasa.gov/orion)

"What is Orion?" Education Page  
<http://www.nasa.gov/audience/forstudents>

NASA Space Launch System  
[www.nasa.gov/sls](http://www.nasa.gov/sls)

NASA Ground Systems  
<http://www.nasa.gov/exploration/systems/ground>

NASA's "Beyond Earth"  
[www.nasa.gov/exploration/home](http://www.nasa.gov/exploration/home)

NASA's Education Home Page  
<http://www.nasa.gov/offices/education/about>

NASA Educator Resource Network  
<http://www.nasa.gov/offices/education/programs>

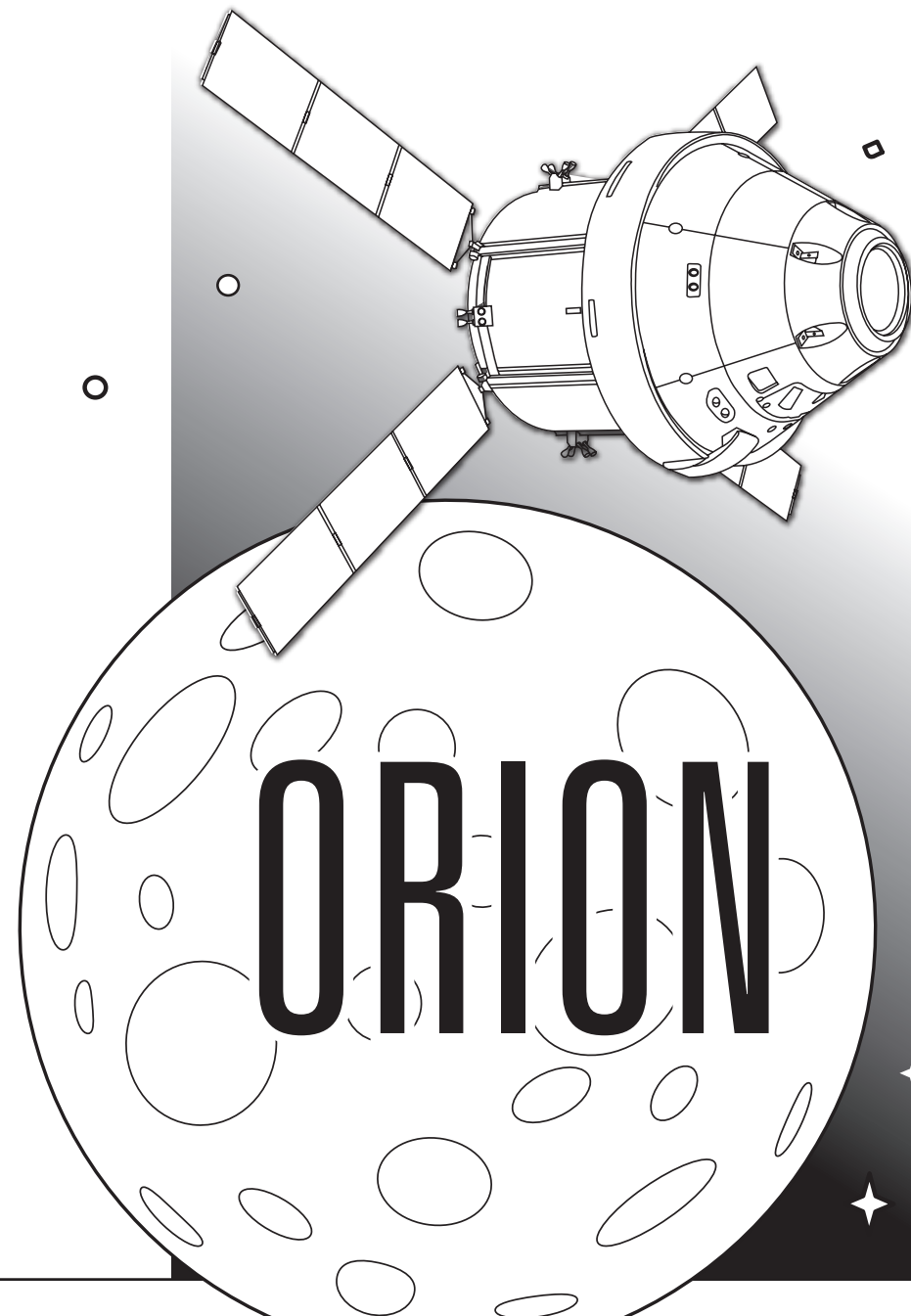
Mars Funzone:  
<http://mars.jpl.nasa.gov/participate/funzone>

Space Place:  
<http://spaceplace.nasa.gov>

National Aeronautics and  
Space Administration



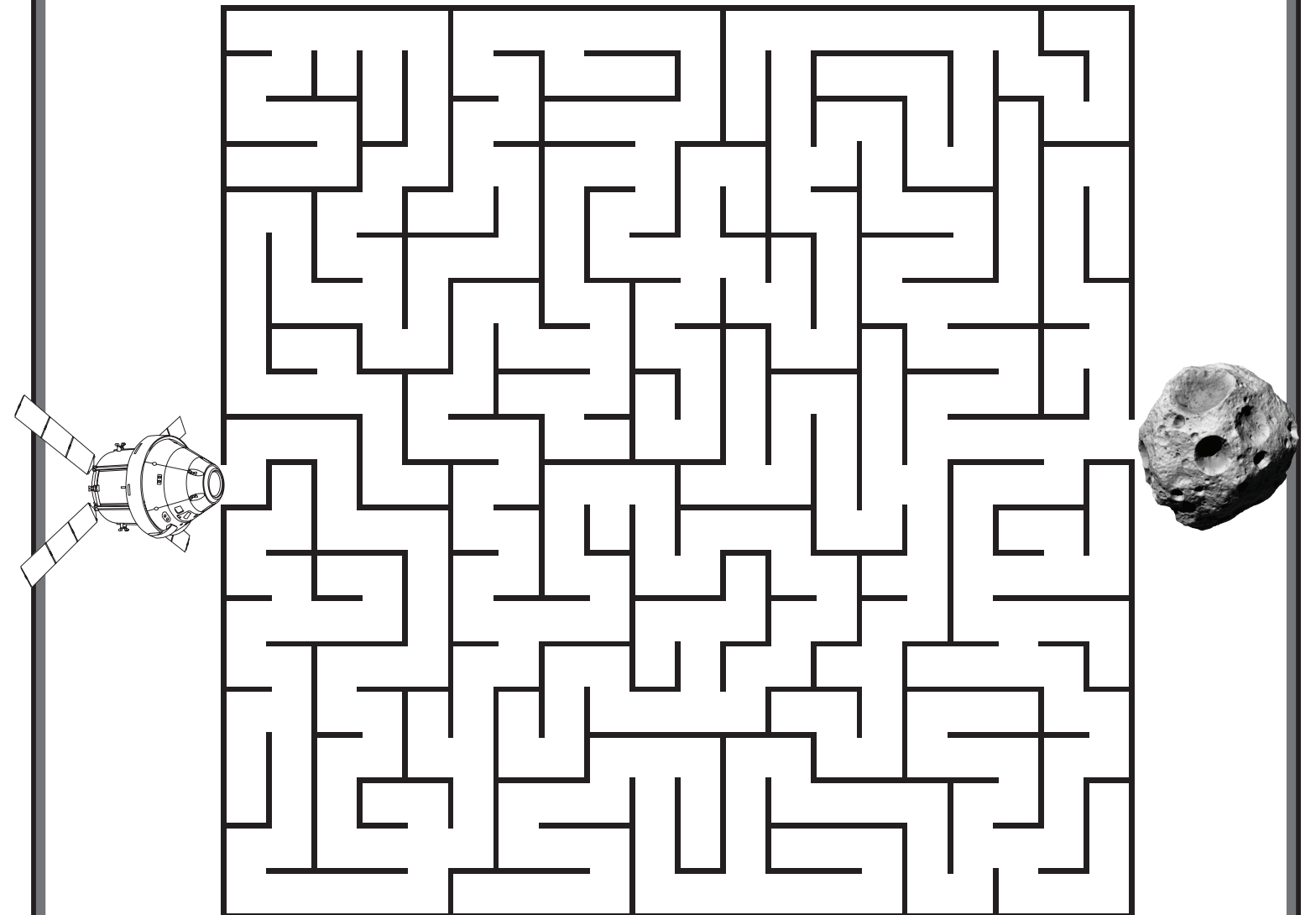
# Let's Explore With



## Deep Space Destination: Asteroids

### Help Orion reach the near-Earth asteroid and begin the Asteroid Redirect Mission

Asteroids are more than just floating rocks in space, they are leftover building blocks from the formation of our solar system and hold clues to the chemical makeup of nearby planets. NASA's Asteroid Initiative wants to learn the secrets of our solar system's history and has created a three-part plan called the Asteroid Redirect Mission (ARM). ARM will allow astronauts to take samples of a nearby asteroid and bring them back to Earth for analysis. Scientists are currently working to find the best asteroid candidate for this mission. Once selected, a robotic mission will redirect the asteroid into a stable orbit above the moon. Astronauts will then climb aboard the Orion spacecraft and be launched into space where they will perform two spacewalks to collect asteroid samples. ARM's early use of the Orion spacecraft will help lay the foundation for its crewed mission to Mars.



\*Answers on back page.

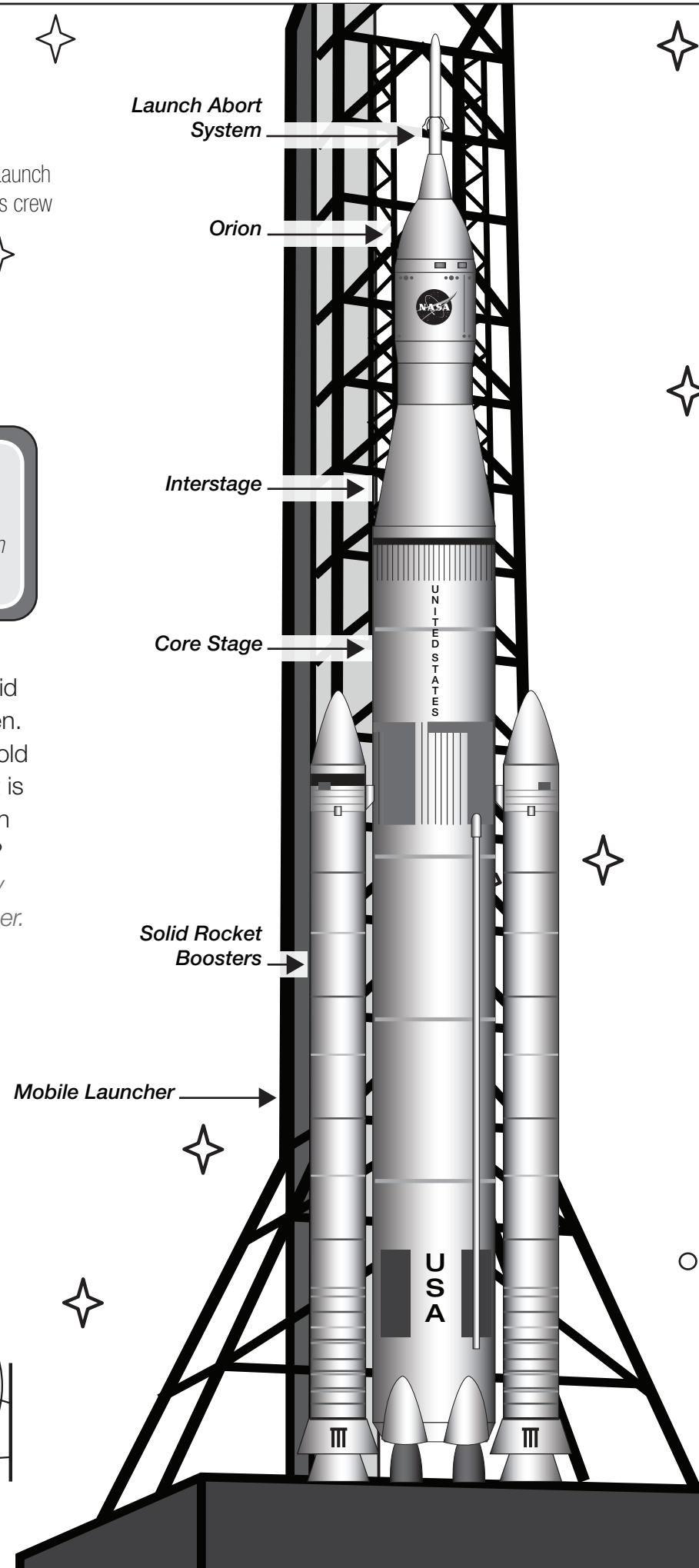
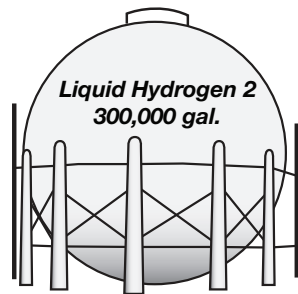
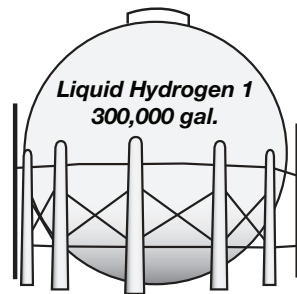
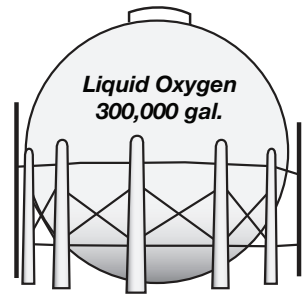
# Fuel Up and Fly!

At Kennedy Space Center's launch site, Orion and the Space Launch System (SLS) are ready to blast off. Help the ground operations crew fill up for launch.

**Fuel Fact:** Hydrogen can be found in large amounts in gas giant planets and stars.

**Fuel Fact:** Although oxygen gas is colorless, the liquid and solid forms of oxygen are blue.

The SLS rocket holds 520,456 gallons of liquid hydrogen and 194,443 gallons of liquid oxygen. There are three tanks at the launch pad that hold 300,000 gallons of fuel each. Once the rocket is completely fueled, how much liquid hydrogen and oxygen will be left in each ground tank? Fill in the blanks. *Hint: You will need to totally empty one hydrogen tank before using the other.*

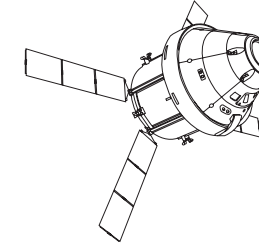


## Learn about Orion and the Space Launch System (SLS)

Fill in the blanks to learn about the Orion Spacecraft.

### Word Bank

- Earth
- Exploration Mission-1
- four
- 321
- 69,000
- 4,000°F
- moon
- constellations
- 2,000°F
- 20,000 mph
- 154,000
- low-Earth orbit
- Mars
- Asteroid



1. This new spacecraft will allow us to go farther than we've gone before, including to \_\_\_\_\_.
2. Orion is named after one of the largest \_\_\_\_\_ in the night sky.
3. Orion is being rigorously tested as engineers prepare it for a journey beyond \_\_\_\_\_.
4. The first SLS mission is called \_\_\_\_\_.
5. Orion's heat shield can withstand temperatures of approximately \_\_\_\_\_.
6. The SLS will stand \_\_\_\_\_ feet tall and will carry \_\_\_\_\_ pounds of payload.



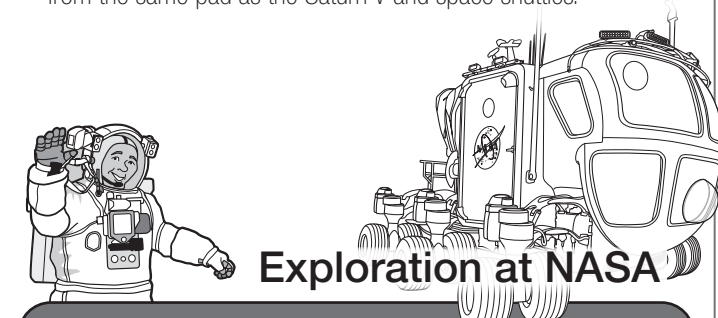
**Learn About Orion/SLS answer key**

1. Mars  
 2. constellations  
 3. low-Earth orbit  
 4. Exploration Mission-1  
 Liquid Oxygen Tank: 105,557  
 Liquid Hydrogen Tank 1: 0  
 Liquid Hydrogen Tank 2: 79,544  
 5. 4,000°F  
 6. 321 and 154,000

**\* Answers**

## Orion and SLS Fun Facts...

- The heat shield will have to withstand temperatures of approximately 4,000°F during the Earth re-entry phase of Orion's first spaceflight, Exploration Flight Test-1. Just how hot is 4,000°F?
  - About twice the temperature of Hawaiian basaltic lava, which reaches 2,120°F
  - About the same as the Earth's molten core or a nuclear reactor meltdown, which are both about 4,000°F
- Orion will make use of advances in propulsion, communications, life support, structural design, navigation and power, drawing from the extensive spaceflight experience of NASA and its industry partners.
- The first Orion test flight will occur this year. The spacecraft will launch 3,600 miles into space in order to reach speeds of more than 20,000 mph.
  - 3,600 miles is also more than 15 times farther than the International Space Station's orbital position. The United States is approximately 3,000 miles wide, so Orion will travel farther up than the distance across the entire country!
- Orion will have the capability to carry humans to multiple destinations beyond low-Earth orbit, including, Mars!
- The SLS height is 321 feet, which is taller than the Statue of Liberty.
- The SLS will use proven hardware and cutting-edge tools and manufacturing technology from the Space Shuttle Program.
- The SLS will stand atop a modified mobile launcher and will launch from the same pad as the Saturn V and space shuttles.



**Exploration at NASA**

This is the beginning of a new era in space exploration. We are building the capabilities to send humans beyond low-Earth orbit and to destinations such as Mars. Orion and SLS are at the core of NASA's human exploration plans. Other technologies include new spacesuits, advanced communications systems, advanced propulsion methods and more! The road ahead is challenging but this approach to space exploration puts us in a position to go where no human has gone before. To learn more about NASA's exploration missions, please visit: [www.nasa.gov/exploration](http://www.nasa.gov/exploration).