

# Educating Space Age Environmentalists: A Kindergarten-High School Standards-Based Curricular Approach

(Aligned to the Next Generation Science Standards for Earth and Space Science)

## GRADE 1



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## Grade 1

Outer space is a valuable natural resource, serving as home to the International Space Station – where many different experiments are conducted that are beneficial to living beings on Earth. If spacecraft such as this are to continue operating, answers to the problem of space debris must be found.

Students gain an appreciation for the importance of spacecraft and outer space through learning about the Moon in alignment with **1-ESS1-1 (Earth’s Place in the Universe)**. In conjunction with this standard, students match pictures of the Moon on cards with matching pictures on a banner that shows the Moon phase cycle. They note patterns, ask questions, make observations, and share past experiences of looking at the Moon. A video that aligns well with this lesson helps students understand why the Moon changes shape throughout the month as it is viewed on Earth. A recommended nonfiction book entitled, *The Moon Seems to Change*, by Franklyn Branley (from the highly-regarded *Let’s-Read-and-Find-Out Science* book series) also serves as an excellent resource for this lesson.

Extension 1 materials include a picture book entitled, *Mousetronaut*, by retired NASA astronaut Mark Kelly – one of the acclaimed *Story Time from Space* books. Four NASA photographs of the moon taken from the International Space Station, as well as two moon photos taken from Earth, are helpful in showing students how views of the moon from space look different from how we see it on Earth – particularly in the level of detail seen from space. These resources help show students that space is not only beautiful and fascinating, but also that it is “home” to astronauts who are living and working in space to make life better for people on Earth.

Extension 2 features a space debris graphic and an article entitled, “Collision in Space,” which serve as the basis for class discussion. Students subsequently write their own opinion pieces about space debris, in alignment with the Grade 1 *Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects*. (Grade 1 – CCSS.ELA – Literacy.W.1.1) Students state why this issue is important, backing up their opinion with facts from the article. Students also discuss what a “space junk” cleanup solution might look like. As a culminating activity, students create and share their own “Keep Outer Space Clean” T-shirts.

<b>Next Generation Science Standards Alignment</b>	<b>Spacecraft Featured:</b> <i>International Space Station</i>	<b>NASA Main Page for Featured Spacecraft:</b> <a href="#">Click here</a> for International Space Station.
<p><b>Disciplinary Core Idea/Sub-Idea:</b>  <b>ESS1. Earth's Place in the Universe</b>  <b>The Universe and Its Stars (ESS1.A)</b></p> <p>Grade 1: Earth and Space Sciences</p> <p><b>ESS1. Earth's Place in the Universe</b></p> <p>1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.</p>	 <p style="text-align: center;">Credit: NASA</p>	<p><i>This is a really big space station. We do a lot of various kinds of work here, different kinds of science experiments; we have over 400 different experiments going on at any one time in different areas, from basic science research to medical technology, that hopefully will benefit more people on Earth. –</i></p> <p style="text-align: right;"><i>-Astronaut Scott Kelly</i></p>

**NSTA-Vetted Lesson Plan – NGSS@NSTA**

Lesson: "Moon Phases Matching"

Goals (from the lesson plan):

- Students begin to understand that the Moon appears to change shape, or have different phases.
- Students begin to understand that there is a pattern to how the shape of the Moon's appearance changes over time.
- Students practice using scientific terms for lunar phases, such as *crescent*, *quarter*, *gibbous*, and *full*.

Lesson description: (from NSTA website) Using a *Match the Moon Phases Poster*, students match pictures of the moon with matching pictures on a poster that shows the moon phase cycle. The teacher guides students as they make observations, ask questions, and share past experiences of looking at the moon through open-ended questioning techniques. A printable pdf. Of the *Moon Phases Poster* and *Moon Phases Cards* are provided.

[Click here](#) for the lesson description, a full listing of alignment to NGSS, and suggested modifications to more fully align with the NGSS.

[Click here](#) for the lesson plan, the materials needed, and accompanying resources.

Additional Resources recommended by protectouterspace.com include:

- **Video: (4 min.) – Why Does the Moon Change?** – SciShow Kids

This brief but informative video helps students understand why the moon changes shape throughout the month as we view it here on Earth. [Click here](#) for the video.



• **Book: Branley, Franklyn M. and Barbara & Ed Emberley. *The Moon Seems to Change*.** New York: HarperCollins, 2015. Print. ISBN: 978-0062382061. (Let's-Read-and-Find-Out Science 2 Series. Age Range: 4-8 years/Grade Level: Pre-K-3) This book belongs to the highly regarded *Let's-Read-and-Find-Out Science Books* series, designed to educate preschoolers and young elementary school students about basic science concepts. It is an excellent resource for teaching young children about the phases of the moon, and includes a simple experiment using an orange, a pencil, and a flashlight, designed to help students understand why the moon looks different at different times of the month. It also features content-specific vocabulary and simple diagrams.

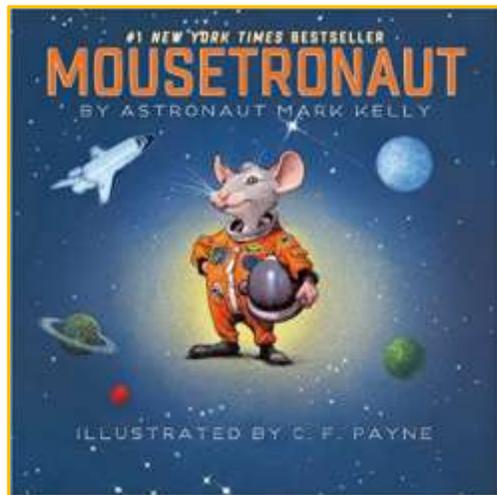


Clipart Credit: Clipartpanda.com

### Extension 1: Outer space is a valuable natural resource, serving as home to spacecraft that provide essential information and perspective for understanding Earth's Place in the Universe, Earth's Systems, and Earth and Human Activity.

**Instructional Focus:** *The International Space Station provides astronauts with views of the moon that are similar to – but also different from how we see it from Earth, especially with respect to the level of detail.*

Extension 1 resources consist of a picture book, four NASA moon photographs from space, and two moon photographs taken from Earth – all helpful in teaching students that space is not only beautiful and fascinating in and of itself, but also that it is “home” to astronauts who are living and working up in space to make life better for living beings on Earth.



• **Book: Kelly, Mark and C.F. Payne. *Mousetronaut*.** New York: Paula Wiseman Books, 2012. Print. ISBN: 978-1442458246. (Age Range: 4-8 years/Grade Level: Preschool-3/Lexile Measure: 670L) This book, by bestselling author and retired NASA astronaut Commander Mark Kelly (recommended for grades Pre-K-3). Quoting from the back of the book: *A heartwarming picture book tale of the power of the small, from bestselling author and retired NASA astronaut Commander Mark Kelly. Astronaut Mark Kelly flew with “mice-tronauts” on his first spaceflight aboard space shuttle Endeavour in 2001. Mousetronaut tells the story of a small mouse that wants nothing more than to travel to outer space. The little mouse works as hard as the bigger mice to show readiness for the mission . . . and is chosen for the flight! While in space, the astronauts are busy with their mission when disaster strikes—and only the smallest member of the crew can save the day. With lively illustrations by award-winning artist C. F. Payne, Mousetronaut is a charming tale of perseverance, courage, and the importance of the small!* This book is due to be read shortly from the International Space Station. **Once the video is posted, students will be able to listen to an astronaut reading the book aloud from space.** [Click here](#) for the *Story Time from Space* website.

[Click here](#) for a brief (4 min.) video that provides additional background on *Story Time from Space*.

- **Four NASA photographs** – two of the moon taken from the International Space Station, and two moon photos taken from Earth - help students see that pictures of the moon taken from space look similar to pictures of the Moon taken from Earth, but the pictures taken from space provide much more detail.



*"Moon Rise from the Space Station"*

-(Left) [Click here](#) for "Moon Rise from the Space Station" – NASA astronaut Randy Bresnik took this picture of the moon rising from his vantage point in low Earth orbit aboard the International Space Station on August 3, 2017. He wrote, "Gorgeous moon rise! Such great detail when seen from space."

-(Right) [Click here](#) for "Space Station View of the Full Moon" – NASA Expedition 48 Commander Jeff Williams took this picture from the International Space Station on June 21, 2016, writing, "A spectacular rise of the full moon just before sunset while flying over western China."



*"Space Station View of the Full Moon"*



*"Goodnight, Moon"*

-(Left) [Click here](#) for "Discovery Aglow" (Slide 20)  
A nearly full moon sets as the space shuttle Discovery sits atop Launch pad 39A at the Kennedy Space Center in Cape Canaveral, Florida, in the early morning hours of March 11, 2009.



*"Full Moon Over Endeavor"*  
Photo Credits: NASA

-(Right) [Click here](#) for "Full Moon Over Endeavor" – Above Launch Pad 39A at NASA's Kennedy Space Center in Florida, the full moon hovers over space shuttle Endeavour waiting for liftoff on the STS-126 mission.

**Extension 2: The growing problem of space debris requires us to clean up the space environment – utilizing new technologies and public advocacy – before it becomes too dangerous to navigate.**

*Instructional Focus: Students write an opinion piece on the issue of space debris in alignment with the Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects (Grade 1 – CCSS.ELA – Literacy.W.1.1) after the reading and discussion of a Scholastic article about the 2009 collision of the Iridium 33 and Cosmos 2251 satellites that created over 1000 pieces of trackable debris.*

**Standards Alignment**

*Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects*

**Grade 1 Reading Standards for Informational Text [RI]**

**Key Ideas and Details**

**CCSS.ELA – Literacy.RI.1.1**

1. Ask and answer questions about key details in a text.

**CCSS.ELA – Literacy.RI.1.2**

2. Identify the main topic and retell key details of a text.

**Grade 1 Writing Standards [W]**

**Text Types and Purposes**

**CCSS.ELA – Literacy.W.1.1**

1. Write opinion pieces that introduce the topic or name the book they are writing about, state an opinion, supply a reason for the opinion, and provide some sense of closure.

**Production and Distribution of Writing**

**CCSS.ELA – Literacy.W.1.5**

5. With guidance and support from adults, focus on a topic, respond to questions and suggestions from peers, and add details to strengthen writing as needed.

**Grade 1 Speaking and Listening Standards [SL]**

**Comprehension and Collaboration**

**CCSS.ELA – Literacy.SL.1.1**

1. Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.

**CCSS.ELA – Literacy.SL.1.1A**

- a. Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion.)

**CCSS.ELA – Literacy.SL.1.1B**

- b. Build on others' talk in conversations by responding to the comments of others through multiple exchanges.

Extension 2 resources feature a space debris graphic, an article, a sharing of possible “space junk” solutions, and a writing activity. As a culminating activity, students create and share their own “Keep Outer Space Clean” T-shirts.



### 1. NASA Space Debris Graphic

Following a discussion about the Moon's place in the universe, its phases, and its position in relation to Earth, show students a NASA space debris graphic. Explain that the little dots/objects represent pieces of space debris that are orbiting continuously around the Earth, and no longer serve a useful purpose; rather, this debris (or "junk") is endangering astronauts and spacecraft due to the risk of collisions. Explain the source of this debris, and provide specific examples, such as: discarded rocket parts, obsolete satellites that no longer work, leftover fuel tanks, old rocket boosters, bolts and screws, paint flecks, and items astronauts have lost out in space – such as tools and gloves.

Emphasize that this space junk must be cleaned up to keep astronauts and spacecraft safe. Compare this to the importance of keeping our environment clean here on Earth. Remind students that they do this at home by keeping their rooms neat, cleaning up after themselves, picking up their toys, and disposing of their trash correctly. Stress with students the importance of also doing this in space. Keeping outer space clean is very important so that astronauts can continue to work safely there, and spacecraft can continue to operate – providing us with important information to keep all living beings healthy and safe. Emphasize with students that space junk can destroy a spacecraft, and that even a paint fleck – traveling at a high rate of speed – can cause damage, as it did to a window in the International Space Station. As students have been studying the moon and have gained an appreciation for its mystery and beauty, emphasize that without spacecraft, we would not have the detailed pictures of the moon that we now have. Tell the students that if we hope to travel to the moon again in the future, outer space must be clean so spacecraft can get there safely. [Click here](#) for the graphic. (Additional NASA space debris graphics are found by [clicking here](#).)

### 2. Article: "Collision in Space"

Read with the students an article entitled, "Collision in Space." (Attached) Review with the students the important things that satellites do from space, and why space debris is a threat to these satellites. Discuss the questions accompanying the article with the students.

### 3. "Space Junk" Cleanup Solutions

Encourage students to share their ideas regarding what a "space junk" cleanup solution might look like. Emphasize to students that scientists and engineers are currently considering many different ideas for space junk cleanup, and that perhaps in the future, they may want to become aerospace engineers and design space debris solutions to help solve this problem.

### 4. Writing Activity – Opinion Piece

Have students write an opinion piece on space debris, stating what their opinion is on this subject, and backing up their thoughts with information from the article as well as their suggestions for possible solutions.

## 5. Design a “Keep Outer Space Clean” T-Shirt

As a fun culminating activity, have each child design his/her own “Keep Outer Space Clean” T-shirt with a message about the importance of cleaning up space junk. Materials needed for this project: a T-shirt template for each student (see appendix), pencils, crayons, markers, scissors, and rulers. Prior to designing their T-shirts, it would be beneficial for students to have time – either as a class or working in small groups – to brainstorm ideas for their T-shirt.

### **Directions:**

1. Have students trace the T-shirt template onto card stock, and then cut out the T-shirt shape. If desired, students could cut out two shapes so they could design both the front and the back of their shirt.
2. Prior to designing their T-shirts, have students work in small groups to brainstorm ideas for an important idea or slogan they would like to use to illustrate their T-shirt. (Examples might be: “Keep Outer Space Clean,” “Clean Up Space Junk Now,” “No More Space Junk,” etc.) If desired, distribute the space debris cutout page (attached) for the students to use in creating their T-shirt design. Encourage the students to incorporate into their design their idea of what a “space junk” cleanup solution might look like.
3. Have them draw their design in pencil, and then color it with markers or crayons.
4. Have students present their T-shirt designs to the class, explaining why they chose their slogan and design. Display the T-shirts hung on a clothesline for an attractive classroom display! As an alternative, students could create an electronic version of their T-shirt using a computer or other electronic device.

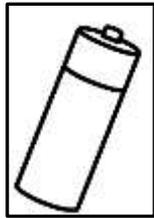


# Space Debris Cutout Page

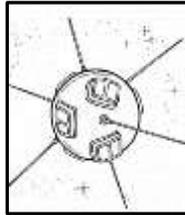
Paint Flecks



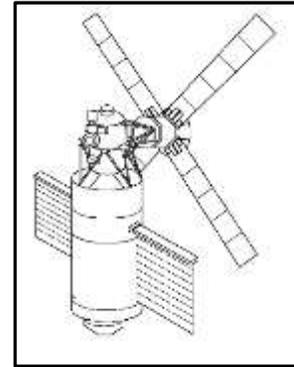
Old Battery



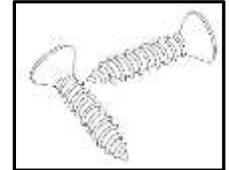
Explorer 1 Satellite  
Launched in 1958



Old Satellite



Screws

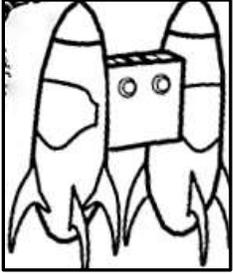


Leftover Fuel Tanks

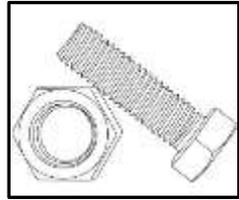


Discarded Rocket

Glove

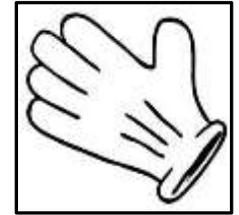
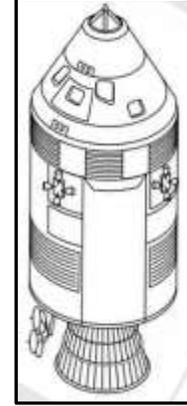
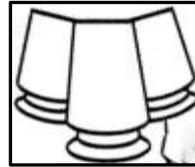


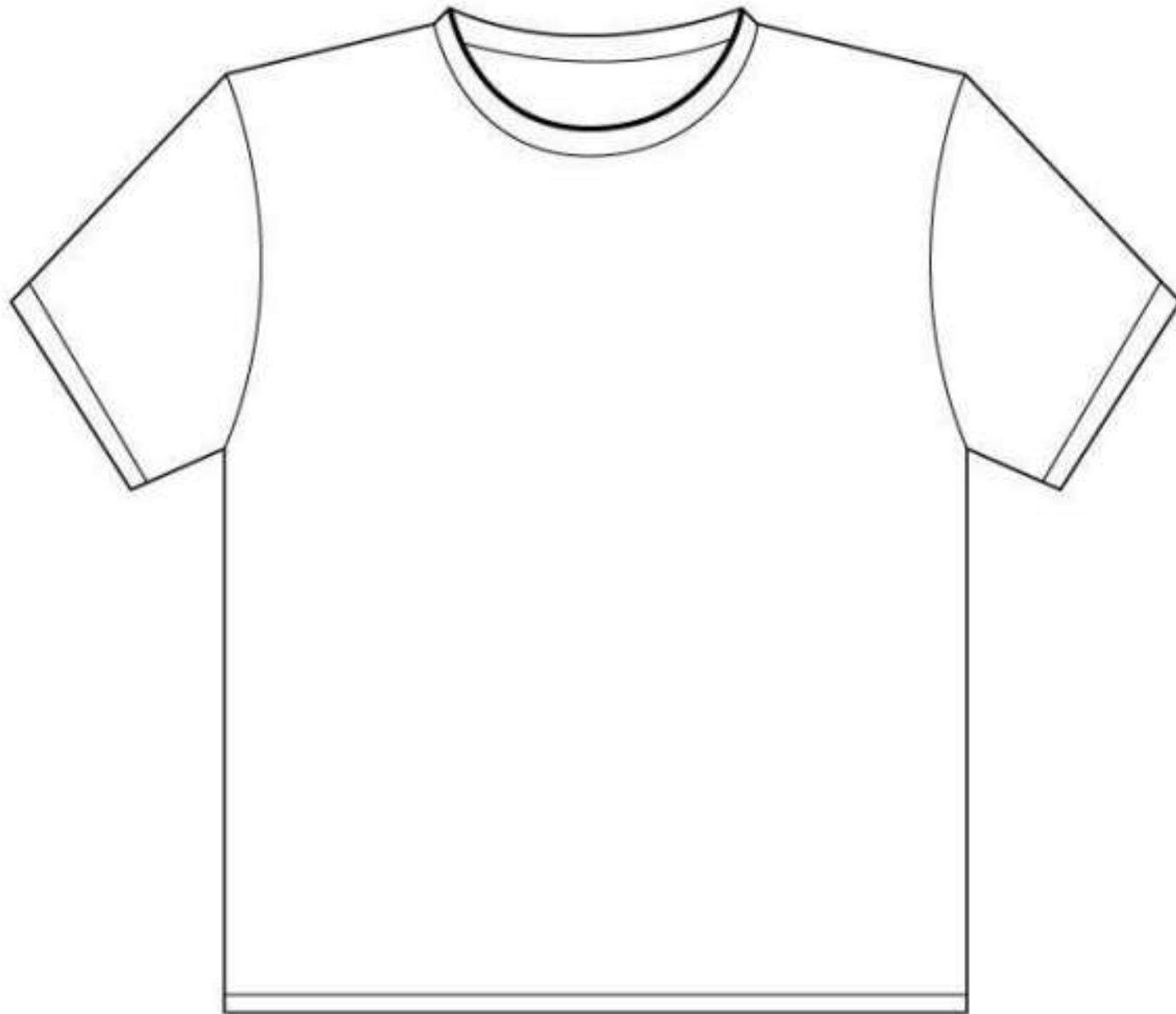
**Nuts and Bolts**



**T-Shirt Template**

**Old Rocket Booster**





# Collision in Space

*(This article, originally written by Dante A. Ciampaglia and published by Scholastic News Online in Feb. 2009, was updated and revised by protectouterspace.com editors in 2017.)*

*Earthlings take a closer look at the space junk circling the planet after two satellites crash into each other.*

The area around the Earth is a very crowded place. There are thousands of human-made satellites in Earth's orbit. Some of these objects collect scientific data about what's happening in outer space. Others research Earth's air and oceans. And some allow humans to use gadgets like cell phones and computers.



**Iridium 33**



**Cosmos 2251**

On Feb. 10, 2009, 485 miles above Earth, two of those satellites collided. The American Iridium 33 communications satellite and an old Russian satellite, Kosmos-2251, were circling Earth at a speed of 25,200 miles per hour (mph). When their paths crossed, they smashed into each other and sent a cloud of debris into Earth's orbit.

Humans have been sending satellites into orbit since 1957. This was the first time two satellites crashed into each other.

Scientists say the collision occurred in a low orbit around Earth that is especially crowded. There are a lot of satellites in this region. There are also bigger objects. The Hubble Space Telescope is about 372 miles above Earth. The International Space Station is in orbit 220 miles above Earth. Shuttle missions usually take place here too.

But it's the small stuff crowding Earth's orbit that has scientists concerned.

There are millions of pieces of space junk circling Earth. Every time a space shuttle or satellite or space station is sent into space, humans leave a little bit of garbage behind. This trash can include pieces of booster rockets and insulation, bolts, paint chips, and even bags of tools.

Some of this debris is tiny, while other pieces are bigger. Scientists at places like the National Aeronautics and Space Administration (NASA) say they are tracking at least 23,000 objects in orbit. (Tracking means that the scientists can see and follow the objects using telescopes.)

When the two satellites collided back in 2009, about 1,000 pieces of debris larger than 4 inches were added to the clutter in a low orbit around Earth.

Spacecraft continue to orbit the earth, and scientists say debris poses a growing threat. The dangers will increase as more satellites are launched into space.

Right now, scientists say they are keeping an eye on how much trash is floating above Earth, and trying to figure out what to do about it. The satellite crash made them take a closer look at how to clean up Earth's cluttered outer reaches.

Discussion Questions:

1. What is space debris?
2. Why are scientists concerned about it?
3. What are some important things that spacecraft do?
4. Why are scientists concerned about space debris?
5. What ideas do you have to clean up the space junk circling Earth?