

**Objective:**

Students will create, test, and modify their own spool racers by competing against one another in racing trials.

**Arkansas State Standards Addressed:**

Science

**NS.1.4.8**

Develop a *hypothesis* based on prior knowledge and observations

**NS.1.4.11**

Generate conclusions based on evidence

**4-PS3-4** Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Speaking and Listening

**SL.4.1; SL.5.1:** Engage effectively in a range of *collaborative conversations/discussions*

**Learning Goals:**

**Students will...**

<b>Understand that</b> energy can exist in two forms, kinetic and potential energy.	
<b>Know</b> that potential energy is energy that is stored and can do work at some future time, while kinetic energy is the energy of a moving object.	<b>Do/Make</b> a spool racer to test in racing trials against their classmates, modifying variables to make the spool race faster, go farther, and travel in a straight line.

**Materials Needed:**

- Wooden spools
- flat toothpicks
- rubber bands
- tape
- large metal washer
- small metal washer
- small pencils

**Procedures:**

1. Explain to students that energy is the ability to make things happen. Ask them to brainstorm about sources of energy (the sun, gasoline, etc.) Introduce them to the concept of potential energy (energy that is stored and can do work at a future time) and kinetic energy (movement). How can it be converted from one form to another?
2. Many tools for space exploration, such as rockets and planet surface rovers, are designed using this basic energy principle. This equipment is also tested and re-designed by engineers

to make them more energy efficient. In this challenge, students will build and test a spool roller, collect data, and modify its design to make it run faster, farther, and in a straight line.

Further details, including a data sheet and a step-by-step spool racer guide, can be found at the following links:

[https://www.teachengineering.org/activities/view/ucd\\_energy\\_lesson01\\_activity1](https://www.teachengineering.org/activities/view/ucd_energy_lesson01_activity1)

<http://www-tc.pbskids.org/zoom/printables/activities/pdfs/spoolracer.pdf>

### **Additional Resources at Bentonville Public Library**

The following are a selection of resources about space travel and exploration available at Bentonville Public Library. All items are available for checkout at Bentonville Public Library; call numbers are included in brackets. Online resources are available through BPL's Student Portal:

<http://www.bentonvillelibrary.org/student-portal/>

#### **Books**

- *The Amazing Story of Space Travel* by Agneiszka Biskup. [JGR 629.4 BIS]
- *Astronaut: Life as a Scientist and Engineer in Space* by Ruth Owen. [JNF 629.45 OWE]
- *Astronauts* by David West. [JGR 629.45 WES]
- *Incredible Space Missions* by Gary Jeffrey. [JGR 629.45 JEF]
- *The Mighty Mars Rovers: The Incredible Adventures of Spirit and Opportunity* by Elizabeth Rusch. [JNF 523.43 RUS]
- *Space Exploration: Primary Sources* by Peggy Saari. [JNF 629.4 SAA]
- *The Space Race* by Peter Benoit. [JNF 629.4 BEN]
- *T-Minus: The Race to the Moon* by Jim Ottaviani. [JGR.4502 OTT]

#### **Online Resources**

##### **(K-4) PebbleGo:**

Biographies—

“John ‘Danny’ Olivas.” *PebbleGo*. [www.pebblego.com](http://www.pebblego.com). December 29, 2016.

##### **(K-4) World Book Online for Kids:**

“Space exploration.” *World Book Kids*. World Book, 2016. Web. 29 Dec. 2016.

“Space race.” *World Book Kids*. World Book, 2016. Web. 29 Dec. 2016.

##### **Learn More:**

NASA Design Challenges: <https://www.nasa.gov/feature/space-poop-challenge>

NASA Education: Women in STEM: <https://www.nasa.gov/education/womenstem>

NASA International Space Station: [https://www.nasa.gov/mission\\_pages/station/main/index.html](https://www.nasa.gov/mission_pages/station/main/index.html)

NASA Kennedy Space Center: <https://www.nasa.gov/centers/kennedy/home/index.html>

NASA Spinoff: NASA Technologies Benefit Our Lives:

[https://spinoff.nasa.gov/Spinoff2008/tech\\_benefits.html](https://spinoff.nasa.gov/Spinoff2008/tech_benefits.html)

Smithsonian National Air and Space Museum: <https://airandspace.si.edu/>

##### **Explore Space Exhibit Information:**

Explore Space: A Cosmic Journey, a traveling exhibition for libraries, is part of the STAR Library Education Network (STAR\_Net) led by the National Center for Interactive Learning at the Space Science Institute. Exhibit partners include the American Library Association, the Lunar and Planetary Institute, and Afterschool Alliance. Explore Space is supported through a grant from the National Science Foundation.

