

# NASA Resources for Physical Science

**For NC PSc. Obj. PSc.1.1** Understand motion in terms of speed, velocity, acceleration, and momentum.

**Lesson Plan: Where Are We?** - This writing activity can help students understand how motion depends on specific frames of reference, as they are asked to assume a specific frame of reference and describe motion in relation to multiple perspectives.

[https://dawn.jpl.nasa.gov/DawnClassrooms/2\\_ion\\_prop/development/1\\_tg\\_development.pdf](https://dawn.jpl.nasa.gov/DawnClassrooms/2_ion_prop/development/1_tg_development.pdf)

**Lesson Plan: Science in a Box** - The idea behind this guide is to bridge the gap between laboratory science research and the classroom and to expose students to the purpose and use of real space research. There is a standards matrix to help identify which activities such as investigating displacement-time graphs using the motion detector most meet your curriculum needs and interests.

[https://www.nasa.gov/pdf/143714main\\_Science.in.a.Box.pdf](https://www.nasa.gov/pdf/143714main_Science.in.a.Box.pdf)

## Articles:

- **Acceleration Measurements aboard the International Space Station**

<https://www.nasa.gov/centers/glenn/about/fs11grc.html>

**For NC PSc. Obj. 1.2** - Understand the relationship between forces and motion.

**Lesson Plan: Give Me a Boost: How Gravity Assists Aid Space Exploration** - Learners will explore how engineers minimize the use of fuel by utilizing gravity. In Activity 1, students explore the physical conservation laws by observing the behavior of balls colliding with other objects. In Activity 2, the students use an interactive online simulation tool to explore the various ways in which gravity assists can be used to aid space exploration. [http://www.messenger-education.org/teachers/Modules/Lessons/MissionDesign\\_G9-12\\_L2.pdf](http://www.messenger-education.org/teachers/Modules/Lessons/MissionDesign_G9-12_L2.pdf)

**Lesson Plan: Rocket Go Round** - Newton's Third Law of Motion states that every action is accompanied by an opposite and equal reaction. This activity demonstrates the action-reaction principle of a rocket using a balloon. [https://guides.library.uncc.edu/ld.php?content\\_id=23746995](https://guides.library.uncc.edu/ld.php?content_id=23746995)

**Lesson Plan: Do it Yourself Newton's Law Podcast** - The best place to see Newton's Laws of Motion in action is in a microgravity environment such as the International Space Station. Download video clips, audio clips and images to create your own podcast. <https://www.nasa.gov/audience/foreducators/diypodcast/newtons-laws-index.html>

**Lesson Plan: Flight Testing Newton's Laws** - These ten lessons with corresponding videos emphasize how Newton's three Laws of Motion and the four forces of flight apply to flight testing an

aircraft. Students solve problems involving kinematics and dynamics.

[https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Flight\\_Testing\\_Newtons\\_Laws.html](https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Flight_Testing_Newtons_Laws.html)

### Videos:

- **Launchpad: Newton's Laws On-Board the International Space Station** - Learn about the inverse relationship between mass and acceleration when calculating force and see what the equation  $f=ma$  has to do with rockets.

<https://nasaclips.arc.nasa.gov/video/launchpad/launchpad-newtons-laws-on-board-the-international-space-station>

- **Real World: Work, Force, Energy and Motion** - Learn how to calculate the force, energy, motion and work of an object using proper units of measurement. Find out how these properties compare with one other. Calculate gravitational potential energy.

<https://nasaclips.arc.nasa.gov/video/realworld/real-world-work-force-energy-and-motion>

### Articles:

- **Planetary Motion: The History of an Idea That Launched the Scientific Revolution**

<https://earthobservatory.nasa.gov/Features/OrbitsHistory/page2.php>

**For NC PSc. Obj. PSc.2.1** Understand types, properties, and structure of matter.

**Lesson Plan: Melting Ice: Designing an Experiment** - Students will design an experiment to determine whether ice melts faster in pure water or salt water and will understand that new technology can reveal processes that were previously unseen.

[https://cosmictimes.gsfc.nasa.gov/teachers/downloads/lessons/1993/Melting\\_Ice.pdf](https://cosmictimes.gsfc.nasa.gov/teachers/downloads/lessons/1993/Melting_Ice.pdf)

**Lesson Plan: Spacecraft Materials** - In this lab activity, students will become materials scientists for a day. Working with NASA to design a satellite or a rover means understanding the properties of metals under conditions very unlike those on Earth. <https://www.jpl.nasa.gov/edu/teach/activity/spacecraft-materials-and-the-chemistry-of-space-exploration/>

### Videos:

- **Launchpad: Cohesion and Adhesion On-Board the International Space Station** - Use a simple eyedropper to examine the strong cohesive bond of water. See how adhesion helps the astronaut on the International Space Station form a glove of water around his hand.

<https://nasaclips.arc.nasa.gov/video/launchpad/launchpad-cohesion-and-adhesion-on-board-the-international-space-station>

### Articles:

- **NASA-supported researchers have discovered a weird new phase of matter called fermionic condensates.** [https://www.nasa.gov/vision/earth/technologies/12feb\\_fermi.html](https://www.nasa.gov/vision/earth/technologies/12feb_fermi.html)

- **It's All in the Mix With Fluid Physics in Space**

[https://www.nasa.gov/mission\\_pages/station/research/news/BCAT\\_6.html](https://www.nasa.gov/mission_pages/station/research/news/BCAT_6.html)

**For NC PSc. Obj. PSc.2.3** Understand the role of the nucleus in radiation and radioactivity.

**Lesson Plan: Space Faring: The Radiation Challenge** - Even though this guide is marked for middle school students, there is an activity to test knowledge of ionizing versus non-ionizing radiation which would be appropriate for this objective. In addition, there is a nice chart of where people are exposed to radiation. [https://www.nasa.gov/pdf/284277main\\_Radiation\\_MS.pdf](https://www.nasa.gov/pdf/284277main_Radiation_MS.pdf)

#### **Videos:**

- **Launchpad: What Are Radioisotope Power Systems?** - NASA uses Radioisotope Power Systems, or RPS, to convert heat from radioactive decay to electricity. Learn how a next generation Radioisotope Stirling Engine will perform four times more efficiently and help NASA use even less of a precious resource. <https://nasaclips.arc.nasa.gov/video/launchpad/launchpad-what-are-radioisotope-power-systems>
- **Launchpad: History, Benefits, and Safety of Radioisotope Power Systems** - With safety designed from inside out and outside in, see how NASA has used Radioisotope Power Systems, or RPS, for more than 20 missions over the last 50 years. <https://nasaclips.arc.nasa.gov/video/launchpad/launchpad-history-benefits-and-safety-of-radioisotope-power-systems>

#### **Articles:**

- **Types of radiation in space** [https://www.nasa.gov/sites/default/files/np-2014-03-001-jsc-orion\\_radiation\\_handout.pdf](https://www.nasa.gov/sites/default/files/np-2014-03-001-jsc-orion_radiation_handout.pdf)

**For NC PSc. Obj. PSc.3.1** Understand types of energy, conservation of energy and energy transfer.

**Lesson Plan: Invisible Collisions** - This activity relates an elastic collision to the change in a satellite's or spacecraft's speed and direction resulting from a planetary fly-by, often called a "gravity assist" maneuver. Both hands-on and online interactive methods are used to explore these topics. [http://pluto.jhuapl.edu/common/content/activities/invisible\\_collisions\\_activity\\_final\\_accessible.pdf](http://pluto.jhuapl.edu/common/content/activities/invisible_collisions_activity_final_accessible.pdf)

**Lesson Plan: Collisions** - This activity focuses on observing colliding marbles, which demonstrate the law of conservation of momentum. [https://guides.library.uncc.edu/ld.php?content\\_id=6477245](https://guides.library.uncc.edu/ld.php?content_id=6477245)

**Lesson Plan: Pop Can "Hero Engine"** - Investigate Newton's third law of motion using thrust produced by falling water. [https://guides.library.uncc.edu/ld.php?content\\_id=6477243](https://guides.library.uncc.edu/ld.php?content_id=6477243) This lesson is part of a larger unit on rockets found here: [https://guides.library.uncc.edu/ld.php?content\\_id=6477237](https://guides.library.uncc.edu/ld.php?content_id=6477237)

**Lesson Plan: Feel the Heat** - Students will use a liquid passing through tubes to collect heat energy from a source location and move it, just like the heat rejection engineers working on the Curiosity and Mars 2020 rovers. Geared for middle school students, but addresses conduction, convection and radiation occur in a water heater. <https://www.jpl.nasa.gov/edu/teach/activity/feel-the-heat/>

#### **Articles:**

- **Boiling it down to the bubbles: It is about heat transfer**  
[https://blogs.nasa.gov/ISS\\_Science\\_Blog/2011/04/15/post\\_1301433765536/](https://blogs.nasa.gov/ISS_Science_Blog/2011/04/15/post_1301433765536/)
- **Turning the Tide to Energy: New Concept Could Harness the Power of Ocean Waves** <https://www.nasa.gov/topics/earth/features/tideenergy.html>

**For NC PSc. Obj. PSc.3.2** Understand the nature of waves.

**Lesson Plan: Gravitational Waves** - Students explore the idea of gravitational waves and how they were discovered by Nobel prize winners Hulse and Taylor.

[https://cosmictimes.gsfc.nasa.gov/teachers/downloads/lessons/1993/Gravitational\\_Waves.pdf](https://cosmictimes.gsfc.nasa.gov/teachers/downloads/lessons/1993/Gravitational_Waves.pdf)

### Videos:

- **Launchpad: Wave Motion** - Join NASA astronauts on-board the International Space Station to learn about different kinds of waves and the transfer of energy that creates waves. Find out why NASA engineers are working to reduce the impact of waves on sensitive station equipment.  
<https://nasaclips.arc.nasa.gov/video/launchpad/launchpad-wave-motion>

**For NC PSc. Obj. PSc.3.3** Understand electricity and magnetism and their relationship.

**Lesson Plan: Supernova Activities** - This series of four lessons investigates magnetic fields and pulsars and contains suggested questions and answers.

<http://epo.sonoma.edu/xmm/edu/supernova/snguide5.pdf>

**Lesson Plan: Exploring Earth's Magnetic Field** - This resource explores Earth's magnetic field, how to measure it and the oscillations that occur. There are also connections to stars, aurora and mathematical relationships.

<https://spacemath.gsfc.nasa.gov/NASADocs/magbook2002.pdf>