# Aligning with Next Generation Science Standards: For Educators, By Educators

## Terminal Velocity: Investigating Forces and Motion in Our Universe

JASON Learning's forces and motion curriculum is aligned to Next Generation Science Standards (NGSS), Common Core and individual state science standards. JASON's NGSS Task Force, based in Rhode Island and comprised of administrators and classroom teachers, created this table to describe the alignments to NGSS. Performance Expectations, Disciplinary Core Ideas, Crosscutting Concepts, and Science and Engineering Practices supported by the chapter readings, labs, and field assignments for each expedition are included here for grades 5-12. This table does not include alignments to elementary school levels though they may be present. Alignments to Common Core, and state and local standards are searchable from within the JASON Mission Center (JMC). The Digital Library in the JMC includes more detailed alignments of individual resources (articles, images, videos, labs, field assignments, and digital simulations) to these standards.

*** (Asterisk):** The lab activity or field assignment engages students in three-dimensional learning as presented in *A Framework for K-12 Science Education* (National Research Council, 2012), and prepares students to reach associated performance expectations by the end of the grade or grade bands. Readings deepen and support student understanding of core ideas, crosscutting concepts, and science and engineering practices.

**E (Extension):** The lab activity or field assignment provides the opportunity to prepare students to reach associated performance expectations and develop core ideas, cross-cutting concepts and science & engineering practices by extending the existing lesson as suggested in the teaching tips section (teacher's edition) or through simple modification.

| | **Expedition 1 Critical Measurements** | | | | | **Expedition 2 A Universe of Motion** | | | | | **Expedition 3 Fundamental Forces** | | | | | **Expedition 4 Make It Work** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chapter Readings | **Lab 1.1** Measuring with Tools | **Lab 1.2** Measuring Mysteries | **Lab 1.3** Targeting, Accuracy & Precision | **Field Assignment** Stringing Along | Chapter Readings | **Lab 2.1** Calculating Speed & Velocity | **Lab 2.2** Acceleration | **Lab 2.3** Momentum | **Field Assignment** Performing Crash Tests | Chapter Readings | **Lab 3.1** A Touch of Force | **Lab 3.2** It's a Blast | **Lab 3.3** Cartesian Driver | **Field Assignment** To Infinity & Beyond | Chapter Readings | **Lab 4.1** Work | **Lab 4.2** Simple Machines | **Lab 4.3** Complex Machines | **Field Assignment** Man vs. Machine |
| **Performance Expectations** | | | | | | | | | | | | | | | | | | | | |
| **MS-PS2-1** Apply Newton's 3rd law to design a solution to a problem involving the motion of two colliding objects. | | | | | | | | | * | | * | | * | | | | | | | |
| **MS-PS2-2** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. | | | | | | * | E | * | * | * | * | E | * | | * | * | | E | | * |
| **MS-PS2-4** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. | | | | | | | | | | | * | | E | | | | | | | |
| **MS-PS3-5** Construct, use and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. | | | | | | * | E | | E | | * | | E | | * | * | | | E | |
| **MS-ESS3-3** Apply Scientific principles to design a method for monitoring and minimizing a human impact on the environment. | | | | | | | | | | | | | | | | * | | | | |
| **MS-ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. | * | E | * | * | E | | E | * | | * | | | * | | * | | | | | * |
| **MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. | | | | | | | | | | E | | | * | * | * | | | | | * |
| **MS-ETS1-3** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. | | E | | E | E | | * | * | | E | | * | * | * | * | | | | | * |
| **MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that optimal design can be achieved. | | | | E | E | * | E | * | | * | | * | * | * | E | | | | | * |
| **HS-PS2-1.** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass and its acceleration. | | | | | | | | | | | * | E | * | | E | | | | | |

JASON Learning

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| | Expedition 1 Critical Measurements | | | | | Expedition 2 A Universe of Motion | | | | | Expedition 3 Fundamental Forces | | | | | Expedition 4 Make It Work | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chapter Readings | **Lab 1.1** Measuring with Tools | **Lab 1.2** Measuring Mysteries | **Lab 1.3** Targeting, Accuracy & Precision | **Field Assignment** Stringing Along | Chapter Readings | **Lab 2.1** Calculating Speed & Velocity | **Lab 2.2** Acceleration | **Lab 2.3** Momentum | **Field Assignment** Performing Crash Tests | Chapter Readings | **Lab 3.1** A Touch of Force | **Lab 3.2** It's a Blast | **Lab 3.3** Cartesian Driver | **Field Assignment** To Infinity & Beyond | Chapter Readings | **Lab 4.1** Work | **Lab 4.2** Simple Machines | **Lab 4.3** Complex Machines | **Field Assignment** Man vs. Machine |
| **HS-PS2-2** Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. The total momentum of a system of objects is conserved when there is no net force on the system. | | | | | | | | | * | * | | | | | | | | | | |
| **HS-PS2-3.** Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. | | | | | | * | | | | * | | | | | | | | | | |
| **Disciplinary Core Ideas** | | | | | | | | | | | | | | | | | | | | |
| **PS1.A** Structure and Properties of Matter | | | E | | | | | | | | | | | | | * | | | * | |
| **PS2.A** Forces and Motion | * | * | | | | * | E | * | * | * | * | * | * | E | * | * | | * | * | * |
| **PS2.B** Types of Interactions | | | | | | | E | | | | | * | * | | | | | | | |
| **PS3.A** Definitions of Energy | | | | | | | | | | | | | | | | | | | | |
| **PS3.B** Conservation of Energy and Energy Transfer | | | | | | * | | | E | | * | * | * | * | * | | | | | |
| **PS3. C** Relationship Between Energy and Forces | | | | | | * | E | | E | | * | * | * | * | * | * | E | E | E | E |
| **ETS1.A** Defining and Delimiting Engineering Problems | * | E | | * | E | * | * | * | | * | | | * | | * | | | | | * |
| **ETS1.B** Designing Solutions to Engineering Problems | | E | | * | E | | E | | | | | * | * | | * | | | | | * |
| **ETS1.C** Optimizing the Design Solution | | E | | * | E | | * | | | | | * | * | | * | | | | | * |
| **Crosscutting Concepts** | | | | | | | | | | | | | | | | | | | | |
| Patterns | * | * | * | * | * | * | * | * | * | * | | | | | * | | | | | |
| Cause and Effect | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| Scale, Proportion, and Quantity | * | * | * | * | * | * | * | * | * | * | * | * | * | | * | * | * | * | * | * |
| Systems and System Models | | | | | | * | * | * | * | | * | * | * | * | * | * | | * | * | * |
| Energy and Matter | | | | | | | | | | * | * | * | * | | * | | | | | |
| Structure and Function | | * | | * | * | | | | | | * | | * | | * | * | | * | * | * |
| Stability and Change | | | | | * | * | * | | | * | * | | | | * | | | | | * |
| **Science and Engineering Practices** | | | | | | | | | | | | | | | | | | | | |
| Asking Questions and Defining Problems | | * | * | * | * | | * | | | * | * | * | * | * | * | | | | | * |
| Developing and Using Models | * | * | * | * | * | | | * | * | * | * | * | * | * | * | | | | | * |
| Planning and Carrying Out Investigations | * | * | * | * | * | | * | | * | * | * | * | * | * | * | | | | | * |
| Analyzing and Interpreting Data | * | * | * | * | * | | * | | * | * | * | * | * | | * | | * | * | | |
| Using Mathematics and Computational Thinking | * | * | * | * | * | * | * | | * | * | * | * | * | | * | * | * | * | * | * |
| Constructing Explanations and Designing Solutions | | * | | * | | | | | * | * | * | * | * | * | * | | * | | | * |
| Engaging in Argument from Evidence | | * | * | | * | | | * | | * | * | * | * | * | * | | | * | | * |
| Obtaining, Evaluating, and Communicating Information | | * | * | * | * | * | * | * | | * | * | * | * | * | * | | * | * | * | * |