

**2016 NATIONAL SCIENCE OLYMPIAD  
AND  
NEXT GENERATION SCIENCE STANDARDS  
ALIGNMENT**

**B (MIDDLE SCHOOL) DIVISION**

**AIR TRAJECTORY** – Prior to the competition, teams will design, construct, and calibrate a single device capable of launching projectiles onto a target and collect data regarding device parameters and performance.

*MS-ETS1–2-4; MS-PS2–2; Science and Engineering Practices 2-6*

MS-ETS1 Engineering Design

**MS-ETS1–2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

**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.**

**MS-ETS1–4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

MS-PS2 Motion and Stability: Forces and Interactions

**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.**

Science and Engineering Practices

2. **Developing and using models**
3. **Planning and carrying out investigations**
4. **Analyzing and interpreting data**
5. **Using mathematics and computational thinking**
6. **Constructing explanations (for science) and designing solutions (for engineering)**

**ANATOMY** – Understand the anatomy of the integumentary, skeletal, and muscular systems.

*MS-LS1–3*

MS-LS1 From Molecules to Organisms: Structures and Processes

**MS-LS1–3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.**

**BIO PROCESS LAB** – This event is a lab-oriented competition involving the fundamental science processes of a middle school life science/biology lab program.

*Science and Engineering Practices 1-2, 4-6*

Science and Engineering Practices

1. **Asking questions (for science) and defining problems (for engineering)**
2. **Developing and using models**
4. **Analyzing and interpreting data**
5. **Using mathematics and computational thinking**
6. **Constructing explanations (for science) and designing solutions (for engineering)**

**BOTTLE ROCKET** – Prior to the tournament, teams construct up to two rockets designed to stay aloft for the greatest amount of time while carrying a raw Grade A large Chicken egg that survives impact.

*MS-ETS1–2-4; Science and Engineering Practices 2-6*

MS-ETS1 Engineering Design

**MS-ETS1–2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

**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.**

**MS-ETS1–4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

Science and Engineering Practices

2. Developing and using models
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**BRIDGE BUILDING** – Prior to the competition teams design and build a Bridge meeting these requirements to achieve the highest structural efficiency while being tested upon uneven surfaces.

*Science and Engineering Practices 2-6*

Science and Engineering Practices

2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)

**CRAVE THE WAVE** – In this event competitors must demonstrate knowledge and process skills needed to solve problems and answer questions regarding all types and areas of waves and wave motion.

*MS-PS4–1-2*

MS-PS4 Waves and Their Applications in Technologies for Information Transfer

**MS-PS4–1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.**

**MS-PS4–2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.**

**CRIME BUSTERS** – Given a scenario, a collection of evidence, and possible suspects, students will perform a series of tests. The test results along with other evidence will be used to solve a crime.

*MS-PS1–2-3; Science and Engineering Practices 3-4, 8*

MS-PS1 Matter and Its Interactions

**MS-PS1–2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.**

**MS-PS1–3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.**

Science and Engineering Practices

3. Planning and carrying out investigations
4. Analyzing and interpreting data
8. Obtaining, evaluating, and communicating information

**DISEASE DETECTIVES** – Students will use their investigative skills in the scientific study of disease, injury, health, and disability in populations or groups of people with a focus on Population Growth.

*MS-ETS1–2-3; MS-ESS3–4; Science and Engineering Practices 2*

MS-ETS1 Engineering Design

**MS-ETS1–2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

**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.**

MS-ESS3 Earth and Human Activity

**MS-ESS3–4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth’s systems.**

Science and Engineering Practices

2. Developing and using models

**DYNAMIC PLANET—OCEANOGRAPHY** – Teams will complete tasks related to physical and geological oceanography.

*MS-ESS2–3, 6; Science and Engineering Practices 2, 4, 6*

MS-ESS2 Earth’s Systems

**MS-ESS2–3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.**

**MS-ESS2–6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.**

Science and Engineering Practices

2. Developing and using models
4. Analyzing and interpreting data
6. Constructing explanations (for science) and designing solutions (for engineering)

**ELASTIC LAUNCH GLIDER** – Prior to the tournament teams design, construct, and test elastic-launched gliders to achieve the maximum time aloft.

*MS-PS2-1; MS-ETS1-2-4; Science and Engineering Practices (2-6)*

MS-PS2 Motion and Stability: Forces and Interaction

**MS-PS2-1. Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.**

MS-ETS1 Engineering Design

**MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

**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.**

**MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

Science and Engineering Practice

2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)

**EXPERIMENTAL DESIGN** – This event will determine a team’s ability to design, conduct, and report the findings of an experiment actually conducted on site.

*Science and Engineering Practices 1-8*

Science and Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
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6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
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**FOOD SCIENCE—DAIRY** – Teams will study the science behind food items such as cheese, yogurt, milk, ice cream, and cottage cheese and experiment with ingredients and physical parameters to produce and analyze these products.

*Science and Engineering Practices 3-8*

Science and Engineering Practices

3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
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**FOSSILS** – Teams will demonstrate their knowledge of ancient life by completing selected tasks at a series of stations. Emphasis will be on fossil identification and ability to answer questions about classification, habitat, ecologic relationships, behaviors, environmental adaptations and the use of fossils to date and correlate rock units.

*MS-ESS2-3; HS-ESS2-7; MS-LS4-1-2*

MS-ESS2 Earth's Systems

**MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.**

HS-ESS2 Earth's Systems

**HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.**

MS-LS4 Biological Evolution: Unity and Diversity

**MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.**

**MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.**

**GREEN GENERATION** – Students will demonstrate an understanding of general ecological principles, the history and consequences of human impact on our environment, solutions to reversing trends and sustainability concepts

*MS-LS2-1-5; MS-ESS3-3*

MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

**MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.**

**MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.**

**MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.**

**MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.**

**MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.**

MS-ESS3 Earth and Human Activity

**MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.**

**INVASIVE SPECIES** – This event will test student knowledge of invasive species in local and national ecosystems.

*HS-LS4–2; MS-ESS3–3*

HS-LS4 Biological Evolution: Unity and Diversity

**HS-LS4–2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.**

MS-ESS3 Earth and Human Activity

**MS-ESS3–3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.**

**METEOROLOGY** – This event emphasizes understanding of basic meteorological principles with emphasis on interpretation and analysis of meteorological data.

*MS-ESS2–5*

MS-ESS2 Earth’s Systems

**MS-ESS2–5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.**

**MISSION POSSIBLE** – Prior to competition, competitors will design, build, test, and document a Rube Goldberg<sup>®</sup>-like device that completes a required task through an optional series of simple machines.

*HS-PS3–3); Science and Engineering Practices 2-8*

*HS-PS3–3; Science and Engineering Practices 2-8*

HS-PS3 Energy

**HS-PS3–3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.**

Science and Engineering Practices

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**PICTURE THIS** – The objective is to have team members take turns drawing representations of a set of scientific terms/concepts (not scientists) while other team member guesses the term being drawn.

*Science and Engineering Practices 2, 6, 8*

Science and Engineering Practices

2. Developing and using models
6. Constructing explanations (for science) and designing solutions (for engineering)
8. Obtaining, evaluating, and communicating information

**REACH FOR THE STARS** – Students will demonstrate an understanding of the properties and evolution of stars especially star forming regions and supernova remnants and their observation with different portions of the electromagnetic spectrum: Radio, Infrared, Visible, Ultraviolet, X-Ray and Gamma Ray.

*HS-ESS1-2-3*

HS-ESS1 Earth's Place in the Universe

**HS-ESS1-2. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.**

**HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements.**

**ROAD SCHOLAR** – Teams will answer interpretive questions that may use one or more state highway maps, USGS topographic maps, Internet-generated maps, a road atlas or satellite/aerial images.

*Science and Engineering Practices 2*

Science and Engineering Practices

## **2. Developing and using models**

**SCRAMBLER** – Prior to the competition, competitors must design, build, and test one mechanical device, which uses the energy from a falling mass to transport an egg along a track as quickly as possible and stop as close to the center of a Terminal Barrier without breaking the egg.

*MS-ETS1-2-4; Science and Engineering Practices 2-6*

MS-ETS1 Engineering Design

**MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

**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.**

**MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

Science and Engineering Practices

- 2. Developing and using models**
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**WIND POWER** – Teams will build a blade assembly that consists of any kind of propeller/pinwheel/rotor attached to a compact disc (CD), which will be used to capture wind power. Students will also be tested on their knowledge regarding alternative energy.

*Science and Engineering Practices 2-8*

Science and Engineering Practices

- 2. Developing and using models**
- 3. Planning and carrying out investigations**
- 4. Analyzing and interpreting data**
- 5. Using mathematics and computational thinking**
- 6. Constructing explanations (for science) and designing solutions (for engineering)**
- 7. Engaging in argument from evidence**
- 8. Obtaining, evaluating, and communicating information**

**WRITE IT/DO IT** – One student will write a description of an object and how to build it, and then the other student will attempt to construct the object from this description.

*Science and Engineering Practices 2, 5-8*

Science and Engineering Practices

- 2. Developing and using models**
- 5. Using mathematics and computational thinking**
- 6. Constructing explanations (for science) and designing solutions (for engineering)**
- 7. Engaging in argument from evidence**
- 8. Obtaining, evaluating, and communicating information**