2015 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 into 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 and physiology of the Integumentary, Immune, and Cardiovascular 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 two rockets designed to stay aloft for the greatest amount of time.
MS-ETS1-2,3,4; 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**
3. **Planning and carrying out investigations**
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5. **Using mathematics and computational thinking**
6. **Constructing explanations (for science) and designing solutions (for engineering)**

BRIDGE – The objective of this event is for the team to design and build the lightest bridge with the highest structural efficiency that can span a given opening meeting the requirements as specified in these rules.
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)**

CAN'T JUDGE A POWDER – The intent of this event is for students to make and record observations. Students will test and characterize one pure substance and then, based only on data they collect, answer a series of questions about the substance. Students WILL NOT be asked to identify the solid. Emphasis of this event is on the quality of data collected, answering questions about the substance and providing data to support their answers.
MS-PS1-2; Science and Engineering Practices 3-4

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.

Science and Engineering Practices

3. **Planning and carrying out investigations**
4. **Analyzing and interpreting data**

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 use NGSS Science and Engineering Practices such as 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, and engaging in argument from evidence and obtaining, evaluating, and communicating information to 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-ETS1-2,3,4; 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)**

ENTOMOLOGY – Students will be asked to identify insects and selected immature insects by order and family, answer questions about insects and use or construct a dichotomous key.

MS-LS4-2

MS-LS4 Biological Evolution: Unity and Diversity

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.

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**
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**

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 answer questions involving the history and consequences of human impact on our environment, solutions to reversing trends and sustainability concepts.

MS-LS2-1,2,3,4,5; 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-ESS3-3 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 – Teams will use science process skills to demonstrate a multidisciplinary understanding of the Earth systems and anthropogenic factors that influence world climate.

MS-ESS2-4,5,6; MS-ESS3-5

MS-ESS2 Earth's Systems

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and force of gravity. [

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

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.

MS-ESS3 Earth and Human Activity

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

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(s) guesses the terms 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**

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

2. **Developing and using models**

ROBO-CROSS – Teams design and build a robot capable of performing certain tasks on a prescribed Field.
MS-ETS1-2,3,4; Science and Engineering Practices 2-8

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**
3. **Planning and carrying out investigations**
4. **Analyzing and interpreting data**
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7. **Engaging in argument from evidence**
8. **Obtaining, evaluating, and communicating information**

SIMPLE MACHINES – This event includes activities and questions related to simple machines.
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)**

SOLAR SYSTEM – Students will demonstrate an understanding and knowledge of the properties and evolution of extraterrestrial ice and water in the solar system.
MS-ESS1-3; MS-ESS2-4

MS-ESS1 Earth's Place in the Universe

MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.

MS-ESS2 Earth's Systems

MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

WHEELED VEHICLES – Competitors must design, build, and test one vehicle that uses a non-metallic, elastic material as its sole means of propulsion to travel a specific distance and around an obstacle as quickly as possible and stop as close as possible to a Finish Dot.

MS-ETS1-2,3,4; 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

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3. **Planning and carrying out investigations**
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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**