2025 NATIONAL SCIENCE OLYMPIAD

DIVISION B (MIDDLE SCHOOL; GRADES 6-9)

EVENT ALIGNMENT TO NATIONAL EDUCATIONAL STANDARDS

ANATOMY AND PHYSIOLOGY – Participants will be assessed on their understanding of the anatomy and physiology for the nervous, special senses, and endocrine systems of the human body.

Middle School Life Science

MS. Structure, Function, and Information Processing

MS-LS 1–3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

BOOMILEVER – Teams will design and build a Boomilever meeting requirements specified in these rules to support a minimum load and achieve the highest structural efficiency.

Middle School Engineering Design

MS. Engineering Design

MS-ETS 1-1. - 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.

MS-ETS 1-2. - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS 1-3. - 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-ETS 1-4. - 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.

CIRCUIT LAB – Participants must complete tasks and answer questions about electricity and magnetism.

Middle School Physical Science

MS. Forces and Interactions

MS-PS 2-3. – Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

MS-PS 2–5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other.

MS. Energy

MS-PS 3-2. – Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

CODEBUSTERS – Teams will cryptanalyze and decode encrypted messages using cryptanalysis techniques for historical and modern advance ciphers.

K-12 Computer Science Framework

6-8 Networks and the Internet

Cybersecurity - Explain how physical and digital security measures protect electronic information.

Cybersecurity - Apply multiple methods of encryption to model the secure transmission of information.

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.

Middle School Physical Science

MS. Chemical Reactions

MS-PS 1-2. - Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS. Structures and Properties of Matter

MS-PS 1–3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Middle School Engineering Design

MS. Engineering Design

MS-ETS 1-1. - 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.

MS-ETS 1-2. - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS 1-3. - 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.

DISEASE DETECTIVES – Participants will use their investigative skills in the scientific study of disease, injury, health, and disability in populations or groups of people.

Middle School Life Science

MS. Growth, Development, and Reproduction of Organisms

MS-LS 1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS. Interdependent Relationships in Ecosystems

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

MS. Matter and Energy in Organisms and Ecosystems

MS-LS 2-4. - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS. Natural Selection and Adaptations

MS-LS 4-4. - Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Middle School Earth and Space Sciences

MS. Human Impacts

MS-ESS 3-4. - Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Middle School Engineering Design

MS. Engineering Design

MS-ETS 1-1. - 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.

MS-ETS 1-2. - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS 1-3. - 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.

DYNAMIC PLANET – Participants will complete tasks related to physical and geological oceanography.

Middle School Earth and Space Sciences

MS. Earth's Systems

MS-ESS 2-4. - Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-ESS 2-6. - 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. Earth and Human Activity

MS-ESS 3-1. – Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

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

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

Middle School Life Science

MS. Growth, Development, and Reproduction of Organisms

MS-LS 1-4. - Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

MS. Natural Selection and Adaptations

MS-LS 4-2. - 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

MS-LS 4-3. - Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

EXPERIMENTAL DESIGN – This event will determine the participant's ability to design, conduct, and report the findings of an experiment conducted entirely on site.

Note: *The exact nature of the experiment conducted during the Experimental Design event changes depending upon the tournament site. Therefore, matching this event to exact standards can be problematic. The standards listed are ones that might be addressed at any given tournament.*

Middle School Physical Science

MS. Chemical Reactions

MS-PS 1-2. - Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS 1-5. - Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

MS. Structures and Properties of Matter

MS-PS 1-4. - Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

MS. Forces and Interactions

MS-PS 2-2. - 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.

MS-PS 2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

MS. Energy

MS-PS 3-1. - Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS 3-4. - Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

Middle School Life Science

MS. Structure, Function, and Information Processing

MS-LS 1–1. - Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS. Matter and Energy in Organisms and Ecosystems

MS-LS 1–6. - Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

Middle School Earth and Space Sciences

MS. Earth's Systems

MS-ESS 2-4. - Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-ESS 2-6. - 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. Earth and Human Activity

MS-ESS 3-1. – Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

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

HELICOPTER – Prior to the tournament, teams will construct, collect data on test flights, analyze and optimize free flight rubber-powered helicopters to achieve maximum time aloft.

Middle School Physical Science

MS. Forces and Interactions

MS-PS 2-1. - Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

MS. Energy

MS-PS 3-5. - 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.

Middle School Engineering Design

MS. Engineering Design

MS-ETS 1-1. - 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.

MS-ETS 1-2. - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS 1-3. - 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-ETS 1-4. - 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.

HEREDITY – Participants will solve problems and analyze data or diagrams using their knowledge of the basic principles of genetics.

Middle School Life Science

MS. Growth, Development, and Reproduction of Organisms

MS-LS 3-1. - Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

MS-LS 3-2. - Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

HOVERCRAFT – Prior to the competition, participants will design, construct, and calibrate a self-propelled air-levitated vehicle that moves down a track.

Middle School Physical Science

MS. Forces and Interactions

MS-PS 2-1. - Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

MS. Energy

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Middle School Engineering Design

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MS-ETS 1-4. - 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.

MACHINES – Teams will construct a lever-based measuring device prior to the tournament to determine the mass ratios between three test masses and complete a written test on simple and compound machine concepts.

Middle School Physical Sciences

MS. Energy

MS-PS 3-5. – Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.

Middle School Engineering Design

MS. Engineering Design

MS-ETS 1-1. - 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.

MS-ETS 1-2. - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS 1-3. - 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.

METEOROLOGY – Participants will use scientific process skills involving qualitative and quantitative analyses to demonstrate an understanding of the factors that influence Everyday Weather through the interpretation of climatological data, graphs, charts, and images.

Middle School Earth and Space Sciences

MS. Earth's Systems

MS-ESS 2-5. - Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

MS-ESS 2-6. - 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. Earth and Human Activity

MS-ESS 3-2. - Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

METRIC MASTERY – Teams will estimate and then measure properties of identical objects including mass, area, volume, density, force, distance, time, and temperature. Teams will also perform metric unit conversions.

Next Generation Science Standards

Science and Engineering Practices

- Use Mathematical and Computational Thinking
- Analyze and Interpret Data

Common Core Mathematics Standard

6.RPA.3 – Understand ratio concepts and use ratio reasoning to solve problems.

7.G.B.6 - Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

8.G.C.9 - Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

MISSION POSSIBLE – Prior to the competition, participants design, build, test, and document a Rube Goldberg®-like Device that completes required Start and Final Actions through a series of specific actions.

Middle School Physical Sciences

MS. Energy

MS-PS 3-5. – Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.

Middle School Engineering Design

MS. Engineering Design

MS-ETS 1-1. - 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.

MS-ETS 1-2. - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS 1-3. - 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-ETS 1-4. - 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.

POTIONS AND POISONS – This event is about chemical properties and effects of specified toxic and therapeutic chemical substances, with a focus on household and environmental toxins or poisons.

Middle School Physical Science

MS. Chemical Reactions

MS-PS 1-2. - Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS. Structures and Properties of Matter

MS-PS 1-3. - Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Middle School Life Science

MS. Matter and Energy in Organisms and Ecosystems

MS-LS 2-3. - Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS 2-4. - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

REMOTE SENSING – Participants will demonstrate an understanding of the basic principles of remote sensing and interpret imagery, data, and maps related to human interactions with land on Earth.

Middle School Physical Science

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.

MS-PS4–3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Middle School Earth and Space Science

MS-ESS2 Earth's Systems

MS-ESS 2–2. Construct an explanation based on evidence for how geoscience processes have changed Erath's surface at varying time and spatial scales..

MS-ESS 2–4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-ESS 2–5. Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

MS-ESS 2–6. 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-ESS 3–1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's minerals, energy, and groundwater resources are the results of past and current geoscience processes.

MS-ESS 3–2.. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

ROCKS AND MINERALS – Participants will demonstrate their knowledge of rocks and minerals.

Middle School Physical Sciences

MS-PS1 Matter and Its Interactions

HS-PS 1–2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Middle School Earth and Space Science

MS-ESS1 Earth's Place in the Universe

MS-ESS 1–4. Construct a scientific explanation based on evidence from rock strata for how the geologic timescale is used to organize Earth's 4.6 billion-year-old history.

MS-ESS2 Earth's Systems

MS-ESS 2–1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

MS-ESS 2–2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

MS-ESS 2–3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions.

SCRAMBLER – Teams design, build, and test a 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 (TB) without breaking the egg.

Middle School Engineering Design

MS. Engineering Design

MS-ETS 1-1. - 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.

MS-ETS 1-2. - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS 1-3. - 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-ETS 1-4. - 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.

SOLAR SYSTEM – Students will demonstrate an understanding and knowledge of planet formation and structure within and beyond the Solar System.

Middle School Earth and Space Sciences

MS-ESS1 Earth's Place in the Universe

MS-ESS 1–3. Analyze and interpret data to determine scale properties of objects in the solar system.

WATER QUALITY – Participants will be assessed on their understanding and evaluation of aquatic environments.

Middle School Life Science

MS. Matter and Energy in Organisms and Ecosystems

MS-LS 2-1. - Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS 2-3. - Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS 2-4. - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS. Interdependent Relationships in Ecosystems

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

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

Common Core English Language Arts Standard

Writing

Writing. Grade 6.2 - Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

Writing. Grade 7.2 - Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

Writing. Grade 8.2 - Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

K-12 Computer Science Framework

6-8 Algorithms and Programming

Algorithms - Algorithms affect how people interact with computers and the way computers respond. People design algorithms that are generalizable to many situations. Algorithms that are readable are easier to follow, test, and debug.

Program Development - People design meaningful solutions for others by defining a problem's criteria and constraints, carefully considering the diverse needs and wants of the community, and testing whether criteria and constraints were met.