SCIENCE OLYMPIAD
Exploring the World of Science

2019 NATIONAL SCIENCE OLYMPIAD
&
NEXT GENERATION SCIENCE STANDARDS ALIGNMENT

DIVISION B (MIDDLE SCHOOL; GRADES 6-9)

ANATOMY AND PHYSIOLOGY – Understand the anatomy and physiology of human body systems.

Middle School Life Science

MS. Structure, Function, and Information Processsing

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

BATTERY BUGGY – Teams will construct a vehicle that uses electrical energy as its sole means of propulsion, quickly travels a specified distance, and stops as close as possible to the Finish Point.

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.

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

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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.

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.

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

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DENSITY LAB – Participants compete in activities and answer questions about mass, density, number density, area density, concentration, pressure, and buoyancy.

Middle School Physical Science

MS. Matter and Its Interactions

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. Structure 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.

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 – Students will use process skills to complete tasks related to glaciers, glaciation, and long-term climate change.

Middle School Earth and Space Sciences

MS. History of Earth

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. 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. 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.

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

MS. Weather and Climate

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

ELASTIC LAUNCHED GLIDER – Prior to the tournament teams design, construct, and test elastic-launched gliders to achieve the 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

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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.

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.

FOSSILS – Teams use fossils to date and correlate rock units as well as demonstrate their knowledge of ancient life by completing tasks related to fossil identification and classification.

Middle School Earth and Space Science

MS. Earth's Systems

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

Middle School Life Science

MS. Natural Selection and Adaptations

MS-LS 4-1. - 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-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.

GAME ON – This event will determine a team's ability to design and build an original computer game using the program Scratch incorporating the scientific theme provided to them by the supervisor.

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.

Control - Programmers select and combine control structures, such as loops, event handlers, and conditionals, to create more complex program behavior.

Modularity - Programs use procedures to organize code, hide implementation details, and make code easier to reuse. Procedures can be repurposed in new programs. Defining parameters for procedures can generalize behavior and increase reusability.

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.

6-8 Data and Analysis

Inference and Models - Computer models can be used to simulate events, examine theories and inferences, or make predictions with either few or millions of data points. Computer models are abstractions that represent phenomena and use data and algorithms to emphasize key features and relationships within a system. As more data is automatically collected, models can be refined.

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.

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.

HERPETOLOGY – Participants will be assessed on their knowledge of amphibians and reptiles.

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.

METEOROLOGY – This event emphasizes understanding of basic meteorological principles with emphasis on analysis and interpretation of meteorological data, graphs, charts, and images.

Middle School Earth and Space Sciences

MS. Weather and Climate

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. Human Impact

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.

MYSTERY ARCHITECTURE – At the beginning of the event, teams will be given a bag of building materials and instructions for designing and building a device that can be tested.

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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.

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.

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.

Middle School Earth and Space Sciences

MS. History of Earth

MS-ESS 2-3. – 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. Erath's Systems

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

ROLLER COASTER – Prior to the competition, teams design, build, and test a Roller Coaster track to guide a ball/sphere that uses gravitational potential energy as its sole means of propulsion to travel as close as possible to a Target Time.

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-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. 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 the speed of an object.

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.

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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.

SOLAR SYSTEM – Participants will demonstrate an understanding and knowledge of the geologic characteristics and evolution of the Earth's moon and other rocky bodies of the solar system.

Middle School Earth and Space Sciences

MS. Space Systems

MS-ESS 1-1. – Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

MS-ESS 1-2. – Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

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

THERMODYNAMICS – Teams must construct an insulating device prior to the tournament that is designed to retain heat and complete a written test on thermodynamic concepts.

Middle School Physical Science

MS. Structures and Properties of Matter

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

MS. Energy

MS-PS 3-3. – Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

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.

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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.

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.