2018 NATIONAL SCIENCE OLYMPIAD
AND
NEXT GENERATION SCIENCE STANDARDS ALIGNMENT

B (MIDDLE SCHOOL) DIVISION

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

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.
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**
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)**

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 food borne illness.
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 – Teams will complete tasks related to plate tectonics.
MS-ESS2–2-3; HS-ESS2–2-3

MS-ESS2 Earth's Systems

MS-ESS2–2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

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-ESS2–2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems

HS-ESS2–3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

ECOLOGY – Students will answer questions involving content knowledge and process skills in the area of ecology and adaptations in North American biomes.
MS-LS2–1-5; HS-LS2–1-8

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.

HS-LS2 Ecosystems: Interactions, Energy, and Dynamics

HS-LS2–1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2–2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2–3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

HS-LS2–4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

HS-LS2–5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

HS-LS2–6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2–7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS2–8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

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**

FAST FACTS – TEAMS WILL MATCH TERMS WITH A GIVEN LETTER TO GIVEN SCIENCE CATEGORIES.

Science and Engineering Practices 8

Science and Engineering Practices

8. **Obtaining, evaluating, and communicating information**

HERPETOLOGY – This event will test student knowledge of amphibians and reptiles including turtles and crocodilians.

HS-LS4–2

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.

HOVERCRAFT – Teams will construct a self-propelled air-levitated vehicle.
Science and Engineering Practices 2-6

Science and Engineering Practices

2. **Developing and using models**
3. **Planning and carrying out investigations**
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METEOROLOGY – This event emphasizes understanding factors affecting world climate.
MS-ESS2–6; MS-ESS3–5

MS-ESS2 Earth's Systems

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.

MICROBE MISSION – Teams will answer questions, solve problems, and analyze data about microbes.
MS-LS1–1, 6-7; HS-LS1–1, 3-7

MS-LS1 From Molecules to Organisms: Structures and Processes

MS-LS1–1. 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-LS1–6. 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.

MS-LS1–7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

HS-LS1 From Molecules to Organisms: Structures and Processes

HS-LS1–1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1–3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1–4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS1–5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1–6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HS-LS1–7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

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.

MS-ETS1–2-4

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.

OPTICS – Teams will direct a laser beam towards a target and be tested on their knowledge of geometric and physical optics.

MS-PS4–1-3

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.

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.

5-PS1–2-4; MS-PS1–2; HS-PS1–1

Matter and Its Interactions

5-PS1–2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

5-PS1–3. Make observations and measurements to identify materials based on their properties.

5-PS1–4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

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.

HS-PS1–1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

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**

ROCKS AND MINERALS – Teams will demonstrate their knowledge of rocks and minerals.
MS-PS1–1; MS-ESS2–1; HS-ESS2–3

Matter and Its Interactions

MS-PS1–1. Develop models to describe the atomic composition of simple molecules and extended structures.

Earth's Systems

MS-ESS2−1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

HS-ESS2–3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

ROLLER COASTER – Prior to the competition, teams design, build, and test a roller coaster track to guide a vehicle that uses gravitational potential energy as its sole means of propulsion to travel as close as possible to a target time, while minimizing the height of the vehicle with bonuses for gaps.
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

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SOLAR SYSTEM – Students 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.
MS-ESS1–1-3

MS-ESS1 Earth's Place in the Universe

MS-ESS1–1. 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-ESS1–2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

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

THERMODYNAMICS – Teams must construct an insulated device prior to the tournament that is designed to retain heat and complete a written test on thermodynamic concepts.
MS-ETS1–2-4; Science and Engineering Practices 2-8; MS-PS3–3-4; HS-PS3–4

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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MS-PS3 Energy

MS-PS3–3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

MS-PS3–4. 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.

HS-PS3 Energy

HS-PS3–4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

TOWERS – Prior to the competition teams design and build a tower meeting requirements to achieve the highest structural efficiency.
Science and Engineering Practices 2-6

Science and Engineering Practices

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WRIGHT STUFF – Prior to the tournament teams design, construct, and test free flight rubber-powered monoplanes to achieve maximum time aloft.

Science and Engineering Practices 2-6

Science and Engineering Practices

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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

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