2017 NATIONAL SCIENCE OLYMPIAD
AND
NEXT GENERATION SCIENCE STANDARDS ALIGNMENT

B (MIDDLE SCHOOL) DIVISION

ANATOMY – 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.

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**
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-ESS2–3, 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)**

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**

FOOD SCIENCE –. Teams will study the chemistry of food and build a calorimeter to determine the energy content of solid food.
Science and Engineering Practices 3-8

Science and Engineering Practices

3. **Planning and carrying out investigations**
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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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6. **Constructing explanations (for science) and designing solutions (for engineering)**

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 severe storms.
MS-ESS2–5; MS-ESS3–2

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.

MS-ESS3 Earth and Human Activity

MS-ESS3–2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

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.

MISSION POSSIBLE – Prior to competition, competitors will design, build, test, and document a Rube Goldberg®-like device that completes a required task through an optional series of simple machines.
HS-PS3; 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.

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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.

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

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.

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

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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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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

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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

2. **Developing and using models**
3. **Planning and carrying out investigations**
4. **Analyzing and interpreting data**
5. **Using mathematics and computational thinking**
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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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5. **Using mathematics and computational thinking**
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