2016 NATIONAL SCIENCE OLYMPIAD
AND
NEXT GENERATION SCIENCE STANDARDS ALIGNMENT

C (HIGH SCHOOL) DIVISION

AIR TRAJECTORY – Prior to the competition, teams will design, construct, and calibrate a single device capable of launching projectiles onto a target and collect data regarding device parameters and performance.
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)**

ANATOMY AND PHYSIOLOGY – Understand the anatomy and physiology of the integumentary, skeletal, and muscular systems.
HS-LS–2-3

HS-LS1 From Molecules to Organisms: Structures and Processes

HS-LS1–2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

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

ASTRONOMY – Teams will demonstrate an understanding of the basic concepts of mathematics and physics relating to stellar evolution and star formation and exoplanets.
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.

BRIDGE BUILDING – Prior to the competition teams design and build a Bridge meeting these requirements to achieve the highest structural efficiency while being tested upon uneven surfaces.
Science and Engineering Practices 2-6

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CELL BIOLOGY – This event integrates content knowledge and process skills in the areas of cell biology and cellular biochemistry.
HS-LS1–2-7

HS-LS1 From Molecules to Organisms: Structures and Processes

HS-LS1–2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

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.

CHEMISTRY LAB – Teams will complete one or more tasks and answer a series of questions involving the Science processes of chemistry focused in the areas of kinetics and gases.\
HS-PS1–2, 4-5, 7

HS-PS1 Matter and Its Interactions

HS-PS1–2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

HS-PS1–4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

HS-PS1–5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. [

HS-PS1–7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

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.
HS-ESS3–4; HS-ETS1–2-3; Science and Engineering Practices 2

HS-ESS3 Earth and Human Activity

HS-ESS3–4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ETS1 Engineering Design

HS-ETS1–2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1–3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Science and Engineering Practices

2. **Developing and using models**

DYNAMIC PLANET — OCEANOGRAPHY – Teams will complete tasks related to physical and geological oceanography
HS-ESS2–1; Science and Engineering Practices 2, 4, 6

HS-ESS2 Earth's Systems

HS-ESS2–1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Science and Engineering Practices

2. **Developing and using models**
4. **Analyzing and interpreting data**
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ELECTRIC VEHICLE – Teams must design, build, and test one vehicle that uses electrical energy as its sole means of propulsion to travel as quickly as possible and stop as close to a target point.
Science and Engineering Practices 2-8

Science and Engineering Practices

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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**

FORENSICS – Given a scenario and some possible suspects, students will perform a series of tests. These tests, along with other evidence or test results will be used to solve a crime.
Science and Engineering Practices 2-8

Science and Engineering Practices

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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.

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

Science and Engineering Practices 2, 5

Science and Engineering Practices

2. **Developing and using models**
5. **Using mathematics and computational thinking**

GEOLOGIC MAPPING – Teams will demonstrate understanding in the construction and use of topographic maps, geologic maps, and cross sections, and their use in forming interpretations regarding subsurface structures and geohazard risks.

HS-ESS2–1; Science and Engineering Practices 2

HS-ESS2 Earth's Systems

HS-ESS2–1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Science and Engineering Practices

2. **Developing and using models**

GREEN GENERATION – Students will demonstrate an understanding of general ecological principles, the history and consequences of human impact on our environment, solutions to reversing trends and sustainability concepts.
HS-LS2–1-8; HS-ESS3–4

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.

HS-ESS3 Earth and Human Activity

HS-ESS3–3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

HYDROGEOLOGY – Students will manipulate a groundwater computer model, answer questions about groundwater concepts, and evaluate solutions, based on hydrogeological evidence, to reduce anthropogenic effects on groundwater.
HS-ESS3–4, 6; Science and Engineering Practices 2, 5-6, 8

HS-ESS3 Earth and Human Activity

HS-ESS3–4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ESS3–6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

IT'S ABOUT TIME – Teams will answer questions related to time and they may construct and bring one non-electrical device to measure time intervals between 10 and 300 seconds.
Science and Engineering Practices 2-8

Science and Engineering Practices

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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.

PROTEIN MODELING – – Students will use computer visualization and online resources to guide the construction of physical models of proteins and to understand how protein structure determines function. Students will model proteins involved in the biosynthesis of the neurotransmitters dopamine and serotonin, and in the subsequent signaling by these neurotransmitters as they bind to receptor proteins on post-synaptic cells. Students will also learn about a rare genetic condition resulting from a deficiency in dopamine synthesis.
HS-LS1–1, 6; Science and Engineering Practices 2

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-LS1–6. 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.

Science and Engineering Practices

2. **Developing and using models**

ROBOT ARM – Prior to the competition, teams must design, build, document, and test one robotic device to move Scorable Items**.**
Science and Engineering Practices 2-8

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

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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

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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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