2018 NATIONAL SCIENCE OLYMPIAD
AND
NEXT GENERATION SCIENCE STANDARDS ALIGNMENT

C (HIGH SCHOOL) DIVISION

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

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 food borne illness.
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 – 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**

FERMI QUESTIONS – Teams provide answers to a series of "Fermi Questions"; science related questions that seek fast, rough estimates of a quantity, which is either difficult or impossible to measure directly.

Science and Entineering Practices 5

Science and Engineering Practices

5. **Using mathematics and computational thinking**

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

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**

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**

HELICOPTERS – Teams will design, build, and test free flight helicopters 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**
6. **Constructing explanations (for science) and designing solutions (for engineering)**

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**
4. **Analyzing and interpreting data**
5. **Using mathematics and computational thinking**
6. **Constructing explanations (for science) and designing solutions (for engineering)**

MATERIALS SCIENCE – Students will answer questions or complete tasks involving the science process of chemistry focused in the area of materials science.

HS-PS1–3; HS-PS2–6; Science and Engineering Practices 2-8

HS-PS1 Matter and Its Interactions

HS-PS1–3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. [

HS-PS2 Motion and Stability: Forces and Interactions

HS-PS2–6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Science and Engineering Practices

2. **Developing and using models**
3. **Planning and carrying out investigations**
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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.

Science and Engineering Practices

2. **Developing and using models**
3. **Planning and carrying out investigations**
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MOUSETRAP VEHICLE – Teams must design, build and test a vehicle using one, or two, snap mousetraps as its sole means of propulsion.
Science and Engineering Practices 2-8

Science and Engineering Practices

2. **Developing and using models**
3. **Planning and carrying out investigations**
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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.

REMOTE SENSING – Participants will use remote sensing imagery, data, and computational processes skills to complete tasks related to climate change processes in the Earth system.
HS-PS4–1, 2, 5; HS-ESS2–2, 4-5

HS-PS4 Waves and their Applications in Technologies for Information Transfer

HS-PS4–1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

HS-PS4–2. Evaluate questions about the advantages of using a digital transmission and storage of information.

HS-PS4–5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

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-ESS2–4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

HS-ESS2–5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

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.

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

2. **Developing and using models**
3. **Planning and carrying out investigations**
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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

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)**

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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