2023 NATIONAL SCIENCE OLYMPIAD

DIVISION C (HIGH SCHOOL; GRADES 9-12)

EVENT ALIGNMENT TO NATIONAL EDUCATIONAL STANDARDS

ANATOMY AND PHYSIOLOGY – Participants will be assessed on their understanding of the anatomy and physiology for the human **Respiratory, Digestive, and Immune** systems.

High School Life Science

HS. Structure and Function

HS-LS 1–2. Develop and use a model to illustrate the hierarchical organization of interacting systems to provide specific functions within multicellular organisms.

HS-LS 1–3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

ASTRONOMY – Teams will demonstrate an understanding of **Stellar Evolution & Variability.**

High School Earth and Space Science

HS. Space Systems

HS-ESS 1–2. 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-ESS 1–3. Communicate scientific ideas about the way stars, over their life cycle, produce elements.

BRIDGE – Teams will design and build a Bridge (Structure) meeting requirement specified in these rules to achieve the highest structural efficiency.

High School Engineering Design

HS. Engineering Design

HS-ETS 1-2. – 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-ETS 1-3. – 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.

HS-ETS 1-4. – Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

CELL BIOLOGY – This event integrates content knowledge and process skills in the areas of cell biology and **cellular** biochemistry.

High School Life Science

HS. From Molecules to Organisms: Structures and Processes

HS-LS 1-1. – 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-LS 1-3. – Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS 1-4. – Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS 1-5. – Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS 1-6. – Construct and revise an explanation based on evidence fr 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-LS 1-7. – 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 the net transfer of energy.

High School Physical Sciences

HS. Motion and Stability: Forces and Interactions

HS-PS 2–6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

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 Oxidation/Reduction and Periodicity.

High School Physical Science

HS. Structure and Properties of Matter

HS-PS 1–1. 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.

HS-PS 1–2. 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-PS 1–3. 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-PS 1–4. 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-PS 1–5. 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-PS 1–6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

HS-PS 1–7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

CODEBUSTERS – Teams will cryptanalyze (decode) encrypted messages using cryptanalysis techniques and show skill with advanced ciphers by encrypting or decrypting a message.

K-12 Computer Science Framework

9-12 Computing Systems

Devices - Computing devices are often integrated with other systems, including biological, mechanical, and social systems. These devices can share data with one another. The usability, dependability, security, and accessibility of these devices, and the systems they are integrated with, are important considerations in their design as they evolve.

9-12 Algorithms and Programming

Algorithms - People evaluate and select algorithms based on performance, reusability, and ease of implementation. Knowledge of common algorithms improves how people develop software, secure data, and store information.

9-12 Networks and the Internet

Cybersecurity - Network security depends on a combination of hardware, software, and practices that control access to data and systems. The needs of users and the sensitivity of data determine the level of security implemented.

DETECTOR BUILDING – Teams will build a durable Mass/Force-sensing Device that will accurately measure and display both voltage and actual masses of different solid samples ranging from 30 to 1,000 grams.

High School Physical Science

HS. Motion and Stability: Forces and Interactions

HS-PS 2-1. – Analyze data to support the claim that Newton's Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS 2-3. – Apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

HS-PS 2-4. – Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

HS. Energy

HS-PS 3-3. – Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

High School Engineering Design

HS. Engineering Design

HS-ETS 1-2. – 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-ETS 1-3. – 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.

HS-ETS 1-4. – Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

DISEASE DETECTIVES – Participants will use their investigative skills in the scientific study of disease, injury, health, and disability in populations or groups of people.

High School Life Science

HS. Structure and Function

HS-LS 1–2. Develop and use a model to illustrate the hierarchical organization of interacting systems to provide specific functions within multicellular organisms.

HS-LS 1–3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS. Interdependent Relationships in Ecosystems

HS-LS 2-1. – Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

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

HS-LS 2-6. – 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-LS 2-7. – Design, evaluate, and refine a solution for reducing the impact of human activities on the environment and biodiversity.

HS-LS 2-8. – Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS 4-6. – Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HS. Natural Selection and Evolution

HS-LS 4-3. – Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking the trait.

HS-LS 4-4. – Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS 4-5. – Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

High School Engineering Design

HS. Engineering Design

HS-ETS 1-1. – Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS 1-3. – 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.

HS-ETS 1-4. – Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

DYNAMIC PLANET – Students will use process skills to complete tasks related to Earth's fresh waters.

High School Earth and Space Sciences

HS. Earth's Systems

HS-ESS 2-1. – 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.

HS-ESS 2-4. – 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-ESS 2-5. – Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

HS-ESS 2-6. – Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

HS. Earth and Human Activity

HS-ESS 3-1. – Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

HS-ESS 3-4. – Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ESS 3-5. – Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

HS-ESS 3-6. – Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

ENVIRONMENTAL CHEMISTRY – This event will focus on fresh water (e.g., residential, industrial or natural), the identified pages of The Clean Water Act (1972 & 1977), wastewater operator's certification manual (Indiana March 2018 revision) and its applications, and various testing of particular analytes using standardized curves (either interpreted or created), stabilization ponds, and introduction to the National Pretreatment Program.

High School Physical Science

HS. Structure and Properties of Matter

HS-PS 1–1. 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.

HS-PS 1–2. 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-PS 1–3. 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-PS 1–4. 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-PS 1–5. 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-PS 1–6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

HS-PS 1–7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

High School Life Science

HS. Ecosystems: Interactions, Energy, and Dynamics

HS-LS 2–1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS 2–7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS. Biological Evolution: Unity and Diversity

HS-LS 4–6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

High School Earth and Space Science

HS. Earth and Human Activity

HS-ESS 3–4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

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 below might be addressed at a given tournament.*

High School Physical Science

HS. Chemical Reactions

HS-PS 1-4. – 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-PS 1-5. – 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-PS 1-6. – Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

HS. Forces and Interactions

HS-PS 2-1. – Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS 2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

HS-PS 2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

HS. Energy

HS-PS 3-3. – Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

HS-PS 3-4. – 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).

HS-PS 3-5. – Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

High School Life Science

HS. Structure and Function

MS-LS 1–3. – Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS. Earth's Systems

HS-ESS 2-6. – Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

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.

Note: *The exact nature of Fermi Questions event changes depending upon the tournament site. Therefore, matching this event to exact standards can be problematic. The standards listed below might be addressed at a given tournament.*

High School Physical Science

HS. Matter and Its Interactions

HS-PS 1-7 – Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

HS-PS 1-8 – Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

HS. Motion and Stability: Forces and Interactions

HS-PS 2-1- Analyze data to support the claim that Newton's Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS 2-2 – Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

HS- PS 2-4 – Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

High School Life Science

HS. Ecosystems: Interactions, Energy, and Dynamics

HS-LS 2-1 – Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

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

HS-LS 2-4 – Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

HS-LS 2-5 – Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

High School Earth and Space Science

HS. Earth's Place in the Universe

HS-ESS 1-4 – Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

HS. Earth's Systems

HS-ESS 2- 6 – Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

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

High School Physical Science

HS. Forces and Interactions

HS-PS 2-1. – Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS. Energy

HS-PS 3-3. – Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

High School Engineering Design

HS. Engineering Design

HS-ETS 1-2. – 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-ETS 1-3. – 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.

HS-ETS 1-4. – Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

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.

High School Physical Science

HS. Structure and Properties of Matter

HS-PS 1-1. – 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.

HS-PS 1-3. – 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.

High School Life Science

HS. Inheritance and Variation of Traits

HS-LS 3-1. – Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS 3-3. – Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

High School Engineering Design

HS. Engineering Design

HS-ETS 1-3. – 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.

FORESTRY – Participants will be assessed on their knowledge of trees found in the United States that are on the 2023 Official Science Olympiad National Tree List.

High School Life Science

HS. Interdependent Relationships in Ecosystems

HS-LS 2-8. - Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS. Natural Selection and Evolution

HS-LS 4-1. - Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS 4-2. - 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.

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.

High School Life Sciences

HS. Ecosystems: Interactions, Energy, and Dynamics

HS-LS 2–1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

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

HS-LS 2–7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS. Biological Evolution: Unity and Diversity

HS-LS 4–6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

High School Earth and Space Science

HS. Earth and Human Activity

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

HS-ESS 3–4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ESS 3–6. 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.

High School Physical Sciences

HS. Matter and Its Interactions

HS-PS 1–5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of reacting particles on the rate at which a reaction occurs.

HS. Motion and Stability: Forces and Interactions

HS-PS 2–6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

HS. Energy

HS-PS 3–3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

High School Engineering Design

HS. Engineering Design

HS-ETS 1-2. – 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-ETS 1-3. – 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.

HS-ETS 1-4. – Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

REMOTE SENSING – Participants will use remote sensing imagery, data, and computational process skills to complete tasks related to climate change processes in the Earth system.

High School Physical Science

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.

High School Earth and Space Science

HS-ESS2 Earth's Systems

HS-ESS 2–2. 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-ESS 2–4. 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-ESS 2–5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

HS-ESS3 Earth and Human Activity

HS-ESS 3–1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

HS-ESS 3–5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.

HS-ESS 3–6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

ROCKS AND MINERALS – Participants will demonstrate their knowledge of rocks and minerals.

High School Physical Sciences

HS-PS2 Motion and Stability: Forces and Interactions

HS-PS 2–6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

High School Earth and Space Science

HS-ESS1 Earth's Place in the Universe

HS-ESS 1–6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Erath's formation and early history.

HS-ESS2 Earth's Systems

HS-ESS 2–1. 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.

HS-ESS 2–3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

SCRAMBLER – Teams design, build, and test a mechanical device, which uses the energy from a failing mass to transport an egg along a straight track as quickly as possible and stop as close to the center of a Terminal Barrier (TB) without breaking the egg.

High School Physical Sciences

HS. Motion and Stability: Forces and Interactions

HS-PS 2-1. – Analyze data to support the claim that Newton's Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS. Energy

HS-PS 3-3. – Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

High School Engineering Design

HS. Engineering Design

HS-ETS 1-2. – 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-ETS 1-3. – 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.

HS-ETS 1-4. – Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

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.

High School Physical Sciences

HS. Motion and Stability: Forces and Interactions

HS-PS 2-1. – Analyze data to support the claim that Newton's Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS 2–6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

HS. Energy

HS-PS 3-1. – Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

HS-PS 3-3. – Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

High School Engineering Design

HS. Engineering Design

HS-ETS 1-2. – 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-ETS 1-3. – 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.

HS-ETS 1-4. – Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

WIFI LAB – Teams must construct an antenna device prior to the tournament that is designed to transmit a signal at 2.4 GHz and complete a written test on the principles of electromagnetic wave propagation.

High School Physical Sciences

HS. Motion and Stability: Forces and Interactions

HS-PS 2–6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

HS. Energy

HS-PS 3-5. – Develop and use a model of two objects interacting through electrical or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

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.

High School Engineering Design

HS. Engineering Design

HS-ETS 1-2. – 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-ETS 1-3. – 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.

HS-ETS 1-4. – Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

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 9-10.2 - Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

Writing. Grade 11-12.2 - Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

K-12 Computer Science Framework

9-12 Algorithms and Programming

Algorithms - People evaluate and select algorithms based on performance, reusability, and ease of implementation. Knowledge of common algorithms improves how people develop software, secure data, and store information.

Program Development – Diverse teams can develop programs with a broad impact through careful review and by drawing on the strengths of members in different roles. Design decisions often involve tradeoffs. The development of complex programs is aided by resources such as libraries and tools to edit and manage parts of the program. Systematic analysis is critical for identifying the effects of lingering bugs.