

**2010 NATIONAL SCIENCE OLYMPIAD
and
NATIONAL SCIENCE STANDARDS ALIGNMENT**

B (Middle School) Division

ANATOMY – This event encompasses structure and function of the major parts of the nervous and skeletal system and the effects of aging and diseases on them.

M.C.1.e, f – M.F.1.c, d

C. Life Science – Life science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.C.1 Structure and function in living systems

- e. The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease. These systems interact with one another.
- f. Disease is a breakdown in structures or functions of an organism. Some diseases are the result of intrinsic failures of the system. Others are the result of damage by infection by other organisms.

F. Science in Personal and Social Perspectives - A personal and social perceive of science helps a student to understand and act on personal and social issues. This perspective builds a foundation for future decision making.

M.F.1 Personal health

- c. The use of tobacco increases the risk of illness. Students should understand the influence of short-term social and psychological factors that lead to tobacco use, and the possible long-term detrimental effects of smoking and chewing tobacco.
- d. Alcohol and other drugs are often abused substances. Such drugs change how the body functions and can lead to addiction.

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 center of the finish line.

M.E.1.b-d

E. Science and Technology – An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

M.E.1 Abilities of technological design

- b. Design a solution or product.
- c. Implement a proposed design.
- d. Evaluate completed technological designs or products.

BIO-PROCESS LAB – This event is a lab-oriented competition involving the fundamental science processes of a middle school biology lab program.

M.A.1. b-e, h

M.A.1 Abilities necessary to do scientific inquiry

- b. Design and conduct a scientific investigation.
- c. Use appropriate tools and techniques to gather, analyze, and interpret data.
- d. Develop descriptions, explanations, predictions, and models using evidence.
- e. Think critically and logically to make the relationships between evidence and explanations.
- h. Use mathematics in all aspects of scientific inquiry.

CAN'T JUDGE A POWDER – Students will test and characterize one pure substance and answer a series of questions about that substance.

M.B.1.a,b

M.B.1 Properties and changes of properties in matter

- a. A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances often can be separated into the original substances using one or more of the characteristic properties.
- b. Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties. In chemical reactions, the total mass is conserved. Substances often are placed in categories or groups if they react in similar ways; metals are an example of such a group.

COMPUTE THIS – This event integrates personal computing (PC) technology, the Internet, and quantitative data analysis. Teams are presented with a problem that requires quantitative data capture from the public Internet and the organization and presentation of data in a graphical format. Short answer questions related to the problem are also included.

M.A.1.c-h

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.

M.A.1 Abilities necessary to do scientific inquiry

- c. Use appropriate tools and techniques to gather, analyze, and interpret data.
- d. Develop descriptions, explanations, predictions, and models using evidence.
- e. Think critically and logically to make the relationships between evidence and explanations.
- f. Recognize and analyze alternative explanations and predictions.
- g. Communicate scientific procedures and explanations.
- h. Use mathematics in all aspects of scientific inquiry.

DISEASE DETECTIVES – Students will use their investigative skills in the scientific study of disease, injury, health, and disability in populations or groups of people. There will be a focus on environmental causes of public health problems.

H.F.1.b, c, e, f – H.F.2.a-c – H.G.1.c

F. Science in Personal and Social Perspectives – A personal and social perspective of science helps a student to understand and act on personal and social issues. This perspective builds a foundation for future decision making.

H.F.1 Personal and community health

- b. The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease-producing organism. Many diseases can be prevented, controlled, or cured. Some diseases, such as cancer, result from specific body dysfunctions and cannot be transmitted.
- c. Personal choice concerning fitness and health involves multiple factors. Personal goals, peer and social pressures, ethnic and religious beliefs, and understanding of biological consequences can all influence decisions about health practices.
- e. Selection of foods and eating patterns determine nutritional balance. Nutritional balance has a direct effect on growth and development and personal well-being. Personal and social factors—such as habits, family income, ethnic heritage, body size, advertising, and peer pressure—influence nutritional choices.
- f. Families serve basic health needs, especially for young children. Regardless of the family structure, individuals have families that involve a variety of physical, mental, and social relationships that influence the maintenance and improvement of health.

H.F.2 Population growth

- a. Populations grow or decline through the combined effects of births and deaths, and through emigration and immigration. Populations can increase through linear or exponential growth, with effects on resource use and environmental pollution.
- b. Various factors influence birth rates and fertility rates, such as average levels of affluence and education, importance of children in the labor force, education and employment of women, infant mortality rates, costs of raising children, availability and reliability of birth control methods, and religious beliefs and cultural norms that influence personal decisions about family size.
- c. Populations can reach limits to growth. Carrying capacity is the maximum number of individuals that can be supported in a given environment. The limitation is not the availability of space, but the number of people in relation to resources

and the capacity of earth systems to support human beings. Changes in technology can cause significant changes, either positive or negative, in carrying capacity.

H.G.1. Science as a human endeavor

- c. Scientists are influenced by societal, cultural, and personal beliefs and ways of viewing the world. Science is not separate from society but rather science is a part of society.

DYNAMIC PLANET – Students will use process skills to complete tasks related to earthquakes and volcanoes.

M.D.1.a-d – H.D.1.a-b

D. Earth and Space Science - Earth and space science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.D.1 Structure of the earth system

- a. The solid earth is layered with a lithosphere; hot, convecting mantle; and dense, metallic core.
- b. Lithospheric plates on the scales of continents and oceans constantly move at rates of centimeters per year in response to movements in the mantle. Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.
- c. Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.
- d. Some changes in the solid earth can be described as the "rock cycle." Old rocks at the earth's surface weather, forming sediments that are buried, then compacted, heated, and often recrystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.

H.D.1 Energy in the earth system

- a. Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the earth's original formation.
- b. The outward transfer of earth's internal heat drives convection circulation in the mantle that propels the plates comprising earth's surface across the face of the globe.

ECOLOGY – Students will answer questions involving content knowledge and process skills in the area of ecology and adaptation in featured North American biomes.

M.C.4.a-d

C. Life Science – Life science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.C.4 Populations and ecosystems

- a. A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.
- b. Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some micro-organisms are producers—they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.
- c. For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.
- d. The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

ELEVATED BRIDGE – The objective of this event is to design and build the most efficient bridge meeting the design specifications. Each team may enter only on bridge, which must be built prior to the competition.

M.E.1.b-d

E. Science and Technology – An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

- M.E.1 Abilities of technological design
- Design a solution or product.
 - Implement a proposed design.
 - Evaluate completed technological designs or products.

ENVIRONMENTAL CHEMISTRY – This event will focus on soil chemistry related to environmental chemistry.

H.F.4.a-c

F. Science in Personal and Social Perspectives – A personal and social perceive of science helps a student to understand and act on personal and social issues. This perspective builds a foundation for future decision making.

- H.F.4 Environmental quality
- Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.
 - Materials from human societies affect both physical and chemical cycles of the earth.
 - Many factors influence environmental quality. Factors that students might investigate include population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth.

EXPERIMENTAL DESIGN – This event will determine a team’s ability to design, conduct, and report the findings of an experiment actually conducted on site.

M.A.1.a-h

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.

- M.A.1 Abilities necessary to do scientific inquiry
- Identify questions that can be answered through scientific investigations.
 - Design and conduct a scientific investigation.
 - Use appropriate tools and techniques to gather, analyze, and interpret data.
 - Develop descriptions, explanations, predictions, and models using evidence.
 - Think critically and logically to make the relationships between evidence and explanations.
 - Recognize and analyze alternative explanations and predictions.
 - Communicate scientific procedures and explanations.
 - Use mathematics in all aspects of scientific inquiry.

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 and the use of fossils to date and correlate rock units.

M.D.2.b – H.D.3.b

D. Earth and Space Science - Earth and space science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

- M.D.2 Earth’s history
- Fossils provide important evidence of how life and environmental conditions have changed.

- H.D.3 Origin and evolution of the earth system
- Geologic time can be estimated by observing rock sequences and using fossils to correlate the sequences at various locations. Current methods include using the known decay rates of radioactive isotopes present in rocks to measure the time since the rock was formed.

JUNKYARD CHALLENGE – Competitors will construct a device on-site to solve a creative engineering challenge using only the materials and tools that will fit in a “junk box” of specified dimensions.

M.E.1.b-e

E. Science and Technology – An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

- M.E.1 Abilities of technological design
- b. Design a solution or product.
 - c. Implement a proposed design.
 - d. Evaluate completed technological designs or products.
 - e. Communicate the process of technological design.

METEOROLOGY – This event emphasizes understanding of basic meteorological principles with emphasis on interpretation and analysis of meteorological data.

M.D.1.f,h,i,j - H.D.1.c,d

D. Earth and Space Science - Earth and space science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

- M.D.1 Structure of the earth system
- f. Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.
 - h. The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations.
 - i. Clouds, formed by the condensation of water vapor, affect weather and climate.
 - j. Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.
- H.D.1 Energy in the earth system
- c. Heating of earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.
 - d. Global climate is determined by energy transfer from the sun at and near the earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the earth's rotation, and static conditions such as the position of mountain ranges and oceans.

ORNITHOLOGY – This event will test knowledge of North American birds.

H.C.3.e

C. Life Science – Life science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

- H.C.3 Biological evolution
- e. Biological classifications are based on how organisms are related. Organisms are classified into a hierarchy of groups and subgroups based on similarities which reflect their evolutionary relationships. Species is the most fundamental unit of classification.

PENTATHLON – Teams will complete in an academic pentathlon that will demonstrate the team’s overall understanding of the five major Science Olympiad content areas as they complete a challenge course.

M.B.1 – M.B.2 – M.B.3 – M.C.1 – M.C.2 – M.C.3 – M.C.4 – M.C.5 – M.D.1 – M.D.2 – M.D.3

B. Physical Science - Physical science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.B.1 Properties and changes of properties in matter

M.B.2 Motion and forces

M.B.3 Transfer of Energy

C. Life Science – Life science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.C.1 Structure and function in living systems

M.C.2 Reproduction and heredity

M.C.3 Regulation and behavior

M.C.4 Populations and ecosystems

M.C.5 Diversity and adaptations of organisms

D. Earth and Space Science - Earth and space science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.D.1 Structure of the earth system

M.D.2 Earth’s history

M.D.3 Earth in the solar system

PHYSICAL SCIENCE LAB: WIND POWER – Teams will build a rotor blade assembly (similar to a propeller) attached to a compact disc (CD), which will be used to capture wind power and generate voltage. They will also participate in an activity testing their knowledge about alternative energies.

M.E.1.b-d – H.F.6.b,d

E. Science and Technology – An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

M.E.1 Abilities of technological design
b. Design a solution or product.
c. Implement a proposed design.
d. Evaluate completed technological designs or products.

H.F.6 Science and technology in local, national, and global challenges
b. Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science- and technology-related challenges. However, understanding science alone will not resolve local, national, or global challenges.
d. Individuals and society must decide on proposals involving new research and the introduction of new technologies into society. Decisions involve assessment of alternatives, risks, costs, and benefits and consideration of who benefits and who suffers, who pays and gains, and what the risks are and who bears them. Students should understand the appropriateness and value of basic questions—"What can happen?"—"What are the odds?"—and "How do scientists and engineers know what will happen?"

ROAD SCHOLAR – Participants will respond to interpretative map questions based on one or more state highway maps, internet-generated maps, or a road atlas, and one or more USGS topographic maps.

M.U.2.b

U. Unifying Concepts and Processes – Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.

M.U.2 Evidence, models, and explanation

- b. Models–Models are tentative schemes or structures that correspond to real objects, events, or classes of events, and that have explanatory power. The goal is to help students learn how to make and use many models, including physical objects, plans, mental constructs, mathematical equations, and computer simulations.

SCIENCE CRIME BUSTERS – Given a scenario and some possible suspects, students will perform a series of tests, which along with other evidence or test results will be used to solve a crime.

M.A.1.d,e – M.B.1.a,b

A. Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.

M.A.1 Abilities necessary to do scientific inquiry

- d. Develop descriptions, explanations, predictions, and models using evidence.
- e. Think critically and logically to make the relationships between evidence and explanations.

B. Physical Science – Physical science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.B.1 Properties and changes of properties in matter

- a. A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances often can be separated into the original substances using one or more of the characteristic properties.
- b. Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties. In chemical reactions, the total mass is conserved. Substances often are placed in categories or groups if they react in similar ways; metals are an example of such a group.

SHOCK VALUE – Students will compete in activities involving basic understanding of electricity, magnetism and simple electrical devices.

M.B.3.a,d,e

B. Physical Science – Physical science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

M.B.3 Transfer of Energy

- a. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.
- d. Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.
- e. In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.

SOLAR SYSTEM – This event will address the Sun, planets and their satellites, dwarf planets, comets, asteroids, the asteroid belt, meteoroids, Oort Cloud and the Kuiper Belt.

M.D.3.a,c

D. EARTH AND SPACE SCIENCE - EARTH AND SPACE SCIENCE FOCUSES ON SCIENCE FACTS, CONCEPTS, PRINCIPLES, THEORIES, AND MODELS THAT ARE IMPORTANT FOR ALL STUDENTS TO KNOW, UNDERSTAND, AND USE.

M.D.3 Earth in the solar system

- a. The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system.
- c. Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system. Gravity alone holds us to the earth's surface and explains the phenomena of the tides.

TRAJECTORY – Teams will design, construct, calibrate, and shoot a device capable of launching a ball into a target area and collect data to develop a series of graphs relating launch configuration to target distance and height.

M.E.1.b-d

E. Science and Technology – An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

M.E.1 Abilities of technological design

- b. Design a solution or product.
- c. Implement a proposed design.
- d. Evaluate completed technological designs or products.

WRIGHT STUFF – Teams will construct and test up to two rubber-powered monoplanes to achieve maximum flight times.

M.E.1.b-d

E. Science and Technology – An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

M.E.1 Abilities of technological design

- b. Design a solution or product.
- c. Implement a proposed design.
- d. Evaluate completed technological designs or products.

WRITE IT/DO IT – This event will test a competitor's ability to effectively communicate with a colleague in writing by having their partner construct a device from a written description.

M.E.1.e

E. Science and Technology – An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

M.E.1 Abilities of technological design

- e. Communicate the process of technological design.