

2011 NATIONAL SCIENCE OLYMPIAD
and
NATIONAL SCIENCE STANDARDS ALIGNMENT

B (Middle School) Division

Anatomy – Teams will be tested on their knowledge of anatomy and health concepts including respiratory and muscular systems.

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.

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.

Awesome Aquifers – Students will construct an aquifer and answer questions about groundwater concepts - includes a presentation.

M.D.1.f – M.U.2.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

- 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.

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.

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.

Bottle Rockets – Prior to the tournament, teams construct up to 2 rockets designed to stay aloft for the greatest amount of time.

M.E.1.b-e

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- 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.

Can't Judge a Powder – Students will test and characterize one pure substance and then, based only on data they collect, answer a series of questions about that substance.

M.B.1.a,b

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.

Compute This – Teams will be presented with a problem which requires quantitative data capture from the Internet and the presentation of data in a graphical format.

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.

Crime Busters – Teams will identify the perpetrators of a crime or crimes by using paper chromatography and analysis of unknown solids, liquids, and plastics found at the scene of 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.

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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.

Disease Detectives – This event requires students to apply principles of epidemiology to a published report of a real-life health situation or problem. (Food Borne Illness)

H.F.1.b, c, e – H.G.1.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.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.

G. History and Nature of Science - The history and nature of science illustrates different aspects of scientific inquiry, the human aspects of science, and the role that science has played in the development of various cultures.

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 – Teams will work at stations that display a variety of earth science materials and related earth science questions.
(Earth's Fresh Waters)

M.D.1 f-i

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.
- g. Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.
- 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.

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 by examining different ecosystems. (Tundra/Taiga)

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.

Experimental Design – Given a set of unknown objects, teams will design, conduct, analyze and write-up an experiment.

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 – Students will identify, describe, and classify various specimens.

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 – Students will partially pre-construct an device with final construction and adaptation onsite to complete a published challenge.

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
- Design a solution or product.
 - Implement a proposed design.
 - Evaluate completed technological designs or products.
 - Communicate the process of technological design.

Meteorology – This event involves the use of process skills as applied to meteorology (Severe Storms).

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.

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- 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.

Microbe Mission – Teams will answer questions, solve problems and analyze data pertaining to microbes.

H.C.1.a

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.1 The cell

- a. Cells have particular structures that underlie their functions. Every cell is surrounded by a membrane that separates it from the outside world. Inside the cell is a concentrated mixture of thousands of different molecules which form a variety of specialized structures that carry out such cell functions as energy production, transport of molecules, waste disposal, synthesis of new molecules, and the storage of genetic material.

Optics – Teams compete in activities and answer questions related to geometric and physical optics.

M.B.3.c - H.B.6.a-c

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

- c. Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object—emitted by or scattered from it—must enter the eye.

H.B.6 Interactions of energy and matter

- a. Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter.
- b. Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, x-rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.
- c. Each kind of atom or molecule can gain or lose energy only in particular discrete amounts and thus can absorb and emit light only at wavelengths corresponding to these amounts. These wavelengths can be used to identify the substance.

Ornithology – This event will test knowledge of North American birds on the official list.

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.

Road Scholar – Requires the accurate interpretation and understanding of various map features using a variety of road and 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.

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 – Teams will demonstrate knowledge of 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.

Storm the Castle – Prior to the tournament, teams design, construct and calibrate a device that uses only the energy of a falling counterweight to launch a projectile as far and as accurately as possible.

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.
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Towers – Team members design and build the most efficient tower.

M.E.1.b-d

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- b. Design a solution or product.
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Write It/Do It – A technical writing exercise where students write a description of a contraption and other students will attempt to recreate it using only the 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.