

**2008 NATIONAL SCIENCE OLYMPIAD
and
NATIONAL SCIENCE STANDARDS ALIGNMENT**

B (Middle School) Division

AMPHIBIANS AND REPTILES – This event will test knowledge of amphibians, turtles, crocodiles, and reptiles.

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.

ANATOMY – This event encompasses structure and function of the major parts of the nervous and circulatory system and how they are affected by the use of addictive substances.

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.

BALLOON LAUNCH GLIDER – Teams will construct and fly monoplane gliders that will be launched from a balloon to achieve a maximum flight time.

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.

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

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
- 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.

CRAVE THE WAVE – In this event students will demonstrate knowledge and process skills needed to solve problems and answer questions regarding all types of areas of waves and wave motion.

H.B.5.b – H.B.6.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.*

- H.B.5 Conservation of energy and increase in disorder
- b. All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.
- 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.

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.

M.A.1.d,e,h – M.C.1.f – M.F.1.a-g – H.F.1.a-g

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.
 - h. Use mathematics in all aspects of scientific inquiry.

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
- 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

- a. Regular exercise is important to the maintenance and improvement of health. The benefits of physical fitness include maintaining healthy weight, having energy and strength for routine activities, good muscle tone, bone strength, strong heart/lung systems, and improved mental health. Personal exercise, especially developing cardiovascular endurance, is the foundation of physical fitness.
- b. The potential for accidents and the existence of hazards imposes the need for injury prevention. Safe living involves the development and use of safety precautions and the recognition of risk in personal decisions. Injury prevention has personal and social dimensions.
- 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.
- e. Food provides energy and nutrients for growth and development. Nutrition requirements vary with body weight, age, sex, activity, and body functioning.
- f. Sex drive is a natural human function that requires understanding. Sex is also a prominent means of transmitting diseases. The diseases can be prevented through a variety of precautions.
- g. Natural environments may contain substances (for example, radon and lead) that are harmful to human beings. Maintaining environmental health involves establishing or monitoring quality standards related to use of soil, water, and air.

H.F.1 Personal and community health

- a. Hazards and the potential for accidents exist. Regardless of the environment, the possibility of injury, illness, disability, or death may be present. Humans have a variety of mechanisms—sensory, motor, emotional, social, and technological—that can reduce and modify hazards.
- 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.
- d. An individual's mood and behavior may be modified by substances. The modification may be beneficial or detrimental depending on the motives, type of substance, duration of use, pattern of use, level of influence, and short- and long-term effects. Students should understand that drugs can result in physical dependence and can increase the risk of injury, accidents, and death.
- 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.
- g. Sexuality is basic to the physical, mental, and social development of humans. Students should understand that human sexuality involves biological functions, psychological motives, and cultural, ethnic, religious, and technological influences. Sex is a basic and powerful force that has consequences to individuals' health and to society. Students should understand various methods of controlling the reproduction process and that each method has a different type of effectiveness and different health and social consequences.

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

FOOD SCIENCE – Students will answer questions and perform developmentally appropriate experiments pertaining to food chemistry.

H.C.5.b,c

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.5 Matter, energy, and organization in living systems

- b. The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.
- c. The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compound called ATP.

METEOROLOGY: SEVERE STORMS – This event emphasizes the use of process skills with designated meteorological topics. Skills to be addressed and evaluated may include generating inferences, making predictions, problem solving, observing, formulating and evaluating hypotheses, and analyzing and interpreting data.

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.

METRIC MASTERY – Students will demonstrate an intuitive feeling for estimating, and later for measuring, different events/objects using S.I. metric units for mass, volume, area, force, distance, time and temperature.

M.U.3.c

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.3 Change, constancy, and measurement

- c. Measurement—Measurement makes quantitative observations about objects, events, or systems. The goal is to help students use tools of measurement and measurement systems and to achieve understandings of scales and rates.

MYSTERY ARCHITECTURE – During this event teams will be given a bag of building materials and instructions to build a device that can be tested.

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.

OCEANOGRAPHY – Participants will use process skills to complete tasks related to physical and geological oceanography.

M.D.1.b,c,j,k – M.D.3.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

- 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.
- 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.
- k. Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.

M.D.3 Earth 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.
- d. The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.

REACH FOR THE STARS – Students will demonstrate an understanding and basic knowledge of the properties and evolution of sun-sized and massive stars, open clusters and globular clusters, and normal and star-forming galaxies.

H.D.4.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.

H.D.4 Origin and evolution of the universe

- a. The origin of the universe remains one of the greatest questions in science. The "big bang" theory places the origin between 10 and 20 billion years ago, when the universe began in a hot dense state; according to this theory, the universe has been expanding ever since.
- b. Early in the history of the universe, matter, primarily the light atoms hydrogen and helium, clumped together by gravitational attraction to form countless trillions of stars. Billions of galaxies, each of which is a gravitationally bound cluster of billions of stars, now form most of the visible mass in the universe.
- c. Stars produce energy from nuclear reactions, primarily the fusion of hydrogen to form helium. These and other processes in stars have led to the formation of all the other elements.

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.B.2.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.2 Motion and forces

- b. An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.

ROBOCROSS – The object of this event is to design and build a robot capable of performing certain tasks on a prescribed playing field.

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.

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

M.D.1.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

- 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.

SCIENCE CRIME BUSTERS – The objective is to correctly 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. Students may also be asked to interpret the results of DNA evidence, hair, fibers, shoe prints, tire tread, or fingerprints.

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.

SCIENCE WORD – Team members will take turns giving verbal clues to scientific terms or concepts from across all science disciplines while the other team member attempts to identify the term.

M.A.1.e,f

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

e. Think critically and logically to make the relationships between evidence and explanations.

f. Recognize and analyze alternative explanations and predictions.

SCRAMBLER – Prior to the competition the participants will design and build a mechanical device, which uses the energy from a falling mass to transport an egg along a straight track, stopping as close to a terminal barrier as possible without breaking the egg. The distance to be traveled will be announced at the beginning of the event after the devices have been impounded. Participants must bring and wear proper eye protection when warranted by their device.

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.

SIMPLE MACHINES – Teams will be given a target IMA, AMA, or Efficiency and be required to construct a machine that matches the given parameters. Only non-programmable calculators are allowed to be used.

M.U.3.c

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.3 Change, constancy, and measurement

c. Measurement—Measurement makes quantitative observations about objects, events, or systems. The goal is to help students use tools of measurement and measurement systems and to achieve understandings of scales and rates.

TOWER BUILDING – The objective of this event is to design and build the lightest tower, with the highest structural efficiency, capable of supporting a load of up to 15 kg. Each team may bring and enter only one tower. Teams should maintain and submit a log at check-in containing data to help them improve future designs. The log will be used only for breaking ties.

M.E.1.b-d

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- 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.

TRAJECTORY – Prior to the tournament, teams will design, construct, and calibrate a device capable of launching a ball using energy provided by nonmetallic elastic solids into a target area of sand, kitty litter, or sand-like material. Participants must bring and wear safety spectacles with side shields. See: www.soinc.org/general/protection.

M.E.1.b-d

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- M.E.1 Abilities of technological design
- b. Design a solution or product.
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WRITE IT/DO IT – Technical writing skills are an important part of an engineer’s or a scientist’s abilities to communicate precisely and clearly. This event will test a competitor’s ability to effectively communicate with a colleague in writing by having their partner construct a device from this written description.

M.E.1.e

- M.E.1 Abilities of technological design
- e. Communicate the process of technological design.