

**2013 NATIONAL SCIENCE OLYMPIAD
AND
NATIONAL SCIENCE STANDARDS ALIGNMENT**

B (MIDDLE SCHOOL) DIVISION

Anatomy – Students will be tested on their knowledge of anatomy and health concepts including neurons and digestive 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.

Boomilever – Students will design and build the most efficient boomilever.

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.

Crime Busters – Students 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.c-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

- 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.

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.

Disease Detectives – This event requires students to apply principles of epidemiology to a real-life health situation or problem with a focus on environmental quality.

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 – Students will use process skills to complete tasks related to glaciation and long-term climate change.

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.

Experimental Design – Given a set of objects, students 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.

Food Science – Students will use their understanding of the chemistry of baking ingredients to answer questions at a series of stations.

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 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.
 - 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.

Forestry – This event will test knowledge of North American trees 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
- 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.

Helicopters – Teams will construct and fly free flight rubber-powered helicopters to achieve maximum flight times.

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.

Heredity – Students will solve problems and analyze data using the basic principles of genetics.

H.C.2.a-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.2 Molecular basis of heredity

- a. In all organisms, the instructions for specifying the characteristics of the organism are carried in DNA, a large polymer formed from subunits of four kinds (A, G, C, and T). The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "letters") and replicated (by a templating mechanism). Each DNA molecule in a cell forms a single chromosome.
- b. Most of the cells in a human contain two copies of each of 22 different chromosomes. In addition, there is a pair of chromosomes that determines sex: a female contains two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and a sperm unite to form a new individual. The fact that the human body is formed from cells that contain two copies of each chromosome—and therefore two copies of each gene—explains many features of human heredity, such as how variations that are hidden in one generation can be expressed in the next.
- c. Changes in DNA (mutations) occur spontaneously at low rates. Some of these changes make no difference to the organism, whereas others can change cells and organisms. Only mutations in germ cells can create the variation that changes an organism's offspring.

Keep the Heat – Students construct a device designed to retain heat.

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 – Students will demonstrate an understanding of basic meteorological principles.

M.D.1.f, h-j – H.D.1.c-d – 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.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.

- H.D.3 Origin and evolution of the Earth system
- b. 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.

Metric Mastery – Students will estimate and measure objects in metric units.

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.

Mission Possible – Students will design, build, and test one “Rube Goldberg-like device” that completes a required Final Task.

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.

Mousetrap Vehicle – Students will construct a vehicle that uses one mousetrap as its sole means of propulsion to reach a target quickly and close as possible to their predicted time.

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.

Reach for the Stars – Students will demonstrate knowledge of properties and evolution of stars, open and globular clusters, 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 – Students will interpret 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.

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

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.

Rotor Egg Drop – Students will construct an unpowered helicopter device to safely transport a chicken egg from a specified height.

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.

Shock Value – Students will compete in activities involving 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.

Sounds of Music – Prior to the competition, students will build one wind instrument and one percussion instrument based on a 12 tone tempered scale describe the principles behind their operation, and be able to perform a major scale, a required melody, and a chosen melody with each.

H.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.

- H.E.1 Abilities of technological design
- b. Propose designs and choose between alternative solutions.
 - c. Implement a proposed solution.
 - d. Evaluate the solution and its consequences.
 - e. Communicate the problem, process, and solution.

Water Quality – Students will evaluate aquatic environments.

M.A.1.c-e

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.

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.