

MISA Tutorials for Maryland are designed specifically for the Next Generation Science Standards (NGSS) to prepare students for the Maryland Integrated Science Assessment (MISA). MISA Categories are at the heart of MISA Tutorial structure – bringing category-based learning to the student experience, and category-based performance and progress tracking to the teacher experience.

Science Tutorials offer targeted instruction, practice, and review designed to help students develop scientific literacy, deepen conceptual understanding, and apply scientific practices. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By continually honing their ability to apply knowledge in real-world scenarios, students build the depth of knowledge and higher-order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible to students as they explore the nature of science through focused content, interactive mini-investigations, multi-modal representations, and personalized feedback. The Review It offers a high-impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

Test-Taking Strategies for MISA Tutorials allow students to practice and apply learning approaches that will hone their test-taking skills and focus them for success on the day of their MISA test.

1. NATURE OF SCIENCE

• WHAT IS SCIENCE?

- **MS-LS1-6** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
- **MS-LS4-2** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
- **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- **MS-PS3-4** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- **MS-PS2-5** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
- **MS-LS1-5** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- **MS-ESS1-4** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
- **MS-ESS3-1** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
- **MS-LS4-4** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

• TYPES OF INVESTIGATIONS

- **MS-LS1-1** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- **MS-PS3-4** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- **MS-PS2-5** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between

objects exerting forces on each other even though the objects are not in contact.

- **MS-ESS3-3** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

● USING MODELS

- **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **MS-LS1-7** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- **MS-PS3-2** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- **MS-PS1-4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
- **MS-PS1-1** Develop models to describe the atomic composition of simple molecules and extended structures.
- **MS-ESS2-4** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- **MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- **MS-ESS1-1** Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
- **MS-ESS2-6** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
- **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system.
- **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- **MS-PS1-5** Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

● DISPLAYING AND INTERPRETING DATA

- **MS-ESS2-5** Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- **MS-PS3-1** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
- **MS-LS4-3** Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
- **MS-PS2-3** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- **MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-PS1-2** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- **MS-ESS2-3** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
- **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system.
- **MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

2. NATURE OF MATTER

● WHAT IS MATTER?

- **MS-PS1-1** Develop models to describe the atomic composition of simple molecules and extended structures.

● PROPERTIES OF MATTER

- **MS-PS1-2** Analyze and interpret data on the properties of substances before and after the substances interact to determine

if a chemical reaction has occurred.

- **SOLIDS, LIQUIDS, AND GASES**

- **MS-PS1-4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

3. CHANGES IN MATTER

- **PHYSICAL AND CHEMICAL CHANGES**

- **MS-PS1-2** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

- **CHANGES OF STATE**

- **MS-PS1-4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

- **CHEMICAL EQUATIONS**

- **MS-PS1-1** Develop models to describe the atomic composition of simple molecules and extended structures.
- **MS-PS1-5** Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

4. FORCE AND MOTION

- **DESCRIBING FORCES**

- **MS-PS2-5** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
- **MS-PS2-1** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

- **DESCRIBING MOTION**

- **MS-PS2-1** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

5. NONCONTACT FORCES

- **ELECTROMAGNETIC FORCES**

- **MS-PS2-3** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- **MS-PS2-5** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

- **GRAVITATIONAL FORCE**

- **MS-PS2-5** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
- **MS-PS2-4** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

6. ENERGY

- **DESCRIBING ENERGY**

- **MS-PS3-2** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- **MS-PS3-5** Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- **MS-PS3-1** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an

object and to the speed of an object.

- **ENERGY TRANSFER AND TRANSFORMATION**

- **MS-PS3-5** Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- **MS-PS3-1** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

7. THERMAL ENERGY AND HEAT

- **THERMAL ENERGY AND TEMPERATURE**

- **MS-PS1-4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
- **MS-PS3-4** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

- **HEAT AND THERMAL ENERGY**

- **MS-PS3-3** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- **MS-PS3-4** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

- **ENERGY TRANSFER AND TECHNOLOGY**

- **MS-PS3-3** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- **MS-PS1-6** Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

8. WAVES

- **MECHANICAL WAVES**

- **MS-PS4-1** Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

- **ELECTROMAGNETIC WAVES**

- **MS-PS4-1** Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

9. NATURE OF LIFE

- **CHARACTERISTICS OF LIFE**

- **MS-LS1-1** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- **MS-LS1-3** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **MS-LS4-6** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

- **CHEMISTRY OF LIFE**

- **MS-LS1-6** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

- **MS-LS1-7** *Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.*

10. CELLS

● CELL STRUCTURE

- **MS-LS1-1** *Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.*

● CELL NUTRITION AND TRANSPORT

- **MS-LS1-6** *Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.*
- **MS-LS1-7** *Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.*

11. MULTICELLULAR ORGANIZATION

● SPECIALIZED CELLS AND TISSUES

- **MS-LS1-1** *Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.*
- **MS-LS1-3** *Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.*

● ORGANS AND ORGAN SYSTEMS

- **MS-LS1-1** *Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.*
- **MS-LS1-3** *Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.*
- **MS-LS1-4** *Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.*

● HUMAN ORGAN SYSTEMS

- **MS-LS1-3** *Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.*

12. GENETICS

● INHERITANCE

- **MS-LS1-5** *Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.*
- **MS-LS3-2** *Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.*

● BIOTECHNOLOGY

- **MS-LS4-5** *Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.*

13. CLASSIFICATION AND ANIMAL BEHAVIOR

● CLASSIFICATION OF LIVING THINGS

- **MS-LS4-2** *Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.*

- **ANIMAL BEHAVIOR**

- **MS-LS1-4** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

14. ECOLOGY

- **CHARACTERISTICS OF ECOSYSTEMS**

- **MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

- **INTERACTIONS IN ECOSYSTEMS**

- **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- **MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

- **SUCCESSION AND ECOSYSTEM STABILITY**

- **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

15. EVOLUTION

- **THEORY OF EVOLUTION**

- **MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
- **MS-LS4-2** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
- **MS-LS4-3** Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

- **NATURAL SELECTION**

- **MS-LS4-6** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
- **MS-LS4-4** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

16. THE GEOSPHERE

- **EARTH'S STRUCTURE AND CYCLES**

- **MS-ESS2-4** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

- **MINERALS**

- **MS-ESS3-1** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

17. THE ATMOSPHERE, HYDROSPHERE, AND CRYOSPHERE

- **FRESHWATER AND ICE**

- **MS-ESS2-4** *Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.*

- **OCEANS**

- **MS-ESS2-6** *Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.*

- **THE ATMOSPHERE**

- **MS-ESS2-6** *Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.*

18. WEATHER AND CLIMATE

- **WEATHER**

- **MS-ESS2-5** *Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.*

- **SEVERE WEATHER**

- **MS-ESS3-2** *Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.*

- **CLIMATE**

- **MS-ESS2-6** *Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.*
- **MS-ESS3-5** *Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.*

19. HUMANS AND EARTH'S RESOURCES

- **NATURAL RESOURCES**

- **MS-ESS3-4** *Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.*
- **MS-ESS3-1** *Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.*

- **IMPACTS OF HUMANS**

- **MS-ESS3-4** *Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.*
- **MS-ESS3-3** *Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*

20. OUR CHANGING PLANET

- **DEFORMING EARTH'S CRUST**

- **MS-ESS2-2** *Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.*
- **MS-ESS3-1** *Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.*

- **WEATHERING AND EROSION**

- **MS-ESS2-2** *Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.*

- **GEOLOGIC TIME**

- **MS-ESS1-4** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

21. EARTH'S PLATES

- **PLATE TECTONICS**

- **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- **MS-ESS2-3** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

- **EARTHQUAKES AND VOLCANOES**

- **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

22. THE SOLAR SYSTEM

- **SUN-EARTH-MOON SYSTEM**

- **MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- **MS-ESS1-1** Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

- **OUR SOLAR SYSTEM**

- **MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system.

- **SPACE EXPLORATION**

- **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system.

23. TEST-TAKING STRATEGIES

- **STUDY HABITS**

- **BEING PREPARED AND GETTING STARTED**

- **WORDING IN TEST QUESTIONS**

- **WORDING IN ANSWER CHOICES**

- **QUESTIONS WITH PASSAGES AND VISUAL DATA**

- **ESSAY AND SHORT ANSWER QUESTIONS**

- **WORD PROBLEMS**