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.

Unit 1: Nature of Science

- **WHAT IS SCIENCE?**
  - MS-LS1-6: Matter and Energy in Organisms and Ecosystems 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: Natural Selection and Adaptations 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.

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- MS-LS2-2: Interdependent Relationships in Ecosystems Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- MS-PS3-4: Energy 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: Forces and Interactions 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: Growth, Development, and Reproduction of Organisms Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- MS-ESS2-2: History of Earth Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- MS-ESS1-4: History of Earth 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: Earth's Systems 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: Natural Selection and Adaptations 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: Structure, Function, and Information Processing 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: Energy 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: Forces and Interactions 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: Human Impacts Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **USING MODELS**

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- MS-LS3-2: Growth, Development, and Reproduction of Organisms 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: Matter and Energy in Organisms and Ecosystems 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: Energy 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: Structure and Properties of Matter 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: Structure and Properties of Matter Develop models to describe the atomic composition of simple molecules and extended structures.
- MS-ESS2-4: Earth's Systems 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: Space Systems Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- MS-ESS1-1: Space Systems 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: Weather and Climate 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: Space Systems Analyze and interpret data to determine scale properties of objects in the solar system.
- MS-LS2-3: Matter and Energy in Organisms and Ecosystems Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- MS-PS1-5: Chemical Reactions 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: Weather and Climate Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
  - MS-PS3-1: Energy 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.

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- MS-LS4-3: Natural Selection and Adaptations 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: Forces and Interactions Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- MS-LS2-1: Matter and Energy in Organisms and Ecosystems 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: Chemical Reactions 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: History of Earth 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: Human Impacts 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: Space Systems Analyze and interpret data to determine scale properties of objects in the solar system.
- MS-LS4-1: Natural Selection and Adaptations 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.

Unit 2: Nature of Matter

- **WHAT IS MATTER?**
  - MS-PS1-1: Structure and Properties of Matter Develop models to describe the atomic composition of simple molecules and extended structures.
- **PROPERTIES OF MATTER**
  - MS-PS1-2: Chemical Reactions 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: Structure and Properties of Matter 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.

Unit 3: Changes in Matter

- **PHYSICAL AND CHEMICAL CHANGES**

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- MS-PS1-2: Chemical Reactions 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: Structure and Properties of Matter 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: Structure and Properties of Matter Develop models to describe the atomic composition of simple molecules and extended structures.
  - MS-PS1-5: Chemical Reactions 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.

Unit 4: Force and Motion

- **DESCRIBING FORCES**
  - MS-PS2-5: Forces and Interactions 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: Forces and Interactions Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- **DESCRIBING MOTION**
  - MS-PS2-1: Forces and Interactions Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

Unit 5: Noncontact Forces

- **ELECTROMAGNETIC FORCES**
  - MS-PS2-3: Forces and Interactions Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
  - MS-PS2-5: Forces and Interactions 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: Forces and Interactions 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.

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- MS-PS2-4: Forces and Interactions Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

Unit 6: Energy

- **DESCRIBING ENERGY**
  - MS-PS3-2: Energy 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: Energy 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: Energy 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: Energy 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: Energy 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.

Unit 7: Thermal Energy and Heat

- **THERMAL ENERGY AND TEMPERATURE**
  - MS-PS1-4: Structure and Properties of Matter 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: Energy 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: Energy Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
  - MS-PS3-4: Energy 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: Energy Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

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- MS-PS1-6: Chemical Reactions Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

Unit 8: Waves

- **MECHANICAL WAVES**
  - MS-PS4-1: Waves and Electromagnetic Radiation 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: Waves and Electromagnetic Radiation 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.

Unit 9: Nature of Life

- **CHARACTERISTICS OF LIFE**
  - MS-LS1-1: Structure, Function, and Information Processing 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: Structure, Function, and Information Processing Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
  - MS-LS3-2: Growth, Development, and Reproduction of Organisms 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: Natural Selection and Adaptations 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: Matter and Energy in Organisms and Ecosystems 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: Matter and Energy in Organisms and Ecosystems 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.

Unit 10: Cells

- **CELL STRUCTURE**
  - MS-LS1-1: Structure, Function, and Information Processing Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of

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cells.

- **CELL NUTRITION AND TRANSPORT**
  - MS-LS1-6: Matter and Energy in Organisms and Ecosystems 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: Matter and Energy in Organisms and Ecosystems 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.

Unit 11: Multicellular Organization

- **SPECIALIZED CELLS AND TISSUES**
  - MS-LS1-1: Structure, Function, and Information Processing 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: Structure, Function, and Information Processing 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: Structure, Function, and Information Processing 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: Structure, Function, and Information Processing Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
  - MS-LS1-4: Growth, Development, and Reproduction of Organisms 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: Structure, Function, and Information Processing Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

Unit 12: Genetics

- **INHERITANCE**
  - MS-LS1-5: Growth, Development, and Reproduction of Organisms Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

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- MS-LS3-2: Growth, Development, and Reproduction of Organisms 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: Growth, Development, and Reproduction of Organisms Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.

Unit 13: Classification and Animal Behavior

- **CLASSIFICATION OF LIVING THINGS**
  - MS-LS4-2: Natural Selection and Adaptations 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: Growth, Development, and Reproduction of Organisms 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.

Unit 14: Ecology

- **CHARACTERISTICS OF ECOSYSTEMS**
  - MS-LS2-1: Matter and Energy in Organisms and Ecosystems 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: Interdependent Relationships in Ecosystems Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
  - MS-LS2-1: Matter and Energy in Organisms and Ecosystems 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: Matter and Energy in Organisms and Ecosystems 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: Matter and Energy in Organisms and Ecosystems Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

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Unit 15: Evolution

- **THEORY OF EVOLUTION**
  - MS-LS4-1: Natural Selection and Adaptations 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: Natural Selection and Adaptations 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: Natural Selection and Adaptations 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: Natural Selection and Adaptations 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: Natural Selection and Adaptations 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.

Unit 16: The Geosphere

- **EARTH'S STRUCTURE AND CYCLES**
  - MS-ESS2-4: Earth's Systems 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: Earth's Systems 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.

Unit 17: The Atmosphere, Hydrosphere, and Cryosphere

- **FRESHWATER AND ICE**
  - MS-ESS2-4: Earth's Systems 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: Weather and Climate 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

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climates.

- **THE ATMOSPHERE**
  - MS-ESS2-6: Weather and Climate 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.

Unit 18: Weather and Climate

- **WEATHER**
  - MS-ESS2-5: Weather and Climate 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: Human Impacts 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: Weather and Climate 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: Weather and Climate Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Unit 19: Humans and Earth's Resources

- **NATURAL RESOURCES**
  - MS-ESS3-4: Human Impacts 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: Earth's Systems 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: Human Impacts 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: Human Impacts Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Unit 20: Our Changing Planet

- **DEFORMING EARTH'S CRUST**

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- MS-ESS2-2: History of Earth Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- MS-ESS3-1: Earth's Systems 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: History of Earth 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: History of Earth 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.

Unit 21: Earth's Plates

- **PLATE TECTONICS**
  - MS-ESS2-2: History of Earth Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
  - MS-ESS2-3: History of Earth 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: History of Earth Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
  - MS-ESS3-2: Human Impacts Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Unit 22: The Solar System

- **SUN-EARTH-MOON SYSTEM**
  - MS-ESS1-2: Space Systems Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
  - MS-ESS1-1: Space Systems 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: Space Systems Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

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

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

Unit 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**

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