SCIENCE 3D

TIGER REALM

SCIENCE PERFORMANCE EXPECTATIONS AND DISCIPLINARY CORE IDEAS

In this Middle School Mission, students will address the general topics below. For a complete list of NGSS standards covered in each segment of the mission, continue reading after the general standards. *Note: Be sure to complete the Mission Reader and Mission Research before viewing the full Mission Video. Explore How to Use Science 3D to get suggestions on how to pace the mission and options for the order of activities. Math and Language Arts Standards will be added shortly.*

- In the **Mission Reader**, Tiger Realm, students will learn about biomes, how local climates are affected by differential heating, the flow of air, ocean currents, and landforms, and how seasons influence ecosystems. They will also learn about human impacts on animals, animal behavior, hybrid animals and the impact of invasive species on wildlife and ecosystems.
- During **Mission Research**, students will use what they learned in the Mission Reader to make diagrams that explain how global patterns influence the distribution of climates on Earth. Then, they will explore the biomes that form in different climates.
- In the **Science Mission**, students explore how changes in human population and land use in India affect animal populations. They will graph data and interpret maps to help make connections. Then, they will analyze data to test their predictions on how human interventions might influence animal populations. Finally, they will explore genetic variation and patterns of genotypes across India and use these data to propose management strategies for tigers. There is an optional essay component to this mission.
- In the **STEM Project**, students will use what they have learned to design a study using camera traps to monitor populations of cats with different body sizes and behaviors. Then, they will use the engineering design process to develop solutions to minimize human-tiger conflict.
- The **Explore Your Backyard** activity has two options. The first option has students explore seasons in their local area and compare these to other regions. In the second option, students explore a local protected area and investigate its benefits for species.

SCIENCE/ENGINEERING AND DESIGN DISCIPLINARY CORE IDEAS AND PERFORMANCE EXPECTATIONS

MISSION READER

MS-ESS1-4	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives the process.
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.
ESS2.C	The roles of water in Earth's surface processes: water cycle.
ESS2.C	The roles of water in Earth's surface processes: how winds, landforms, ocean temp and currents affect movement of water in atmosphere and weather.
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.
ESS2.D	Weather and climate: ocean has major impact on weather and climate.
ESS2.D	Weather and climate: influenced by interactions involving sunlight, ocean, atmosphere, ice, landforms, living things; geography affects these.
ESS3.C	Human impacts on Earth systems.
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.
LS1.B	Growth and development of organisms: plant and animal reproduction and behavior.
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.
LS2.A	Interdependent relationships in ecosystems: dependence on environment and may compete; resource limitation on organisms and populations.
MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
PS4.C	Information technologies and Instrumentation.

*ELA and Math standards to come

MISSION RESEARCH

MS-ESS1-4	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives the process.
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.
ESS2.C	The roles of water in Earth's surface processes: water cycle.
ESS2.C	The roles of water in Earth's surface processes: how winds, landforms, ocean temp and currents affect movement of water in atmosphere and weather.
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.
ESS2.D	Weather and climate: ocean has major impact on weather and climate.
ESS2.D	Weather and climate: influenced by interactions involving sunlight, ocean, atmosphere, ice, landforms, living things; geography affects these.
LS3.A	Inheritance of traits: genes and how they work. Lion-tiger hybrids discussed including the inheritance from each parent.
LS3.A	Inheritance of Traits: variation comes from getting a subset of chromosomes from each parent. Lion-tiger hybrids discussed including the inheritance from each parent.

SCIENCE MISSION

ESS3.C	Human impacts on Earth systems.
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.
ESS3.C	Human impacts on Earth systems: link to population size and need for solutions.
LS2.A	Interdependent relationships in ecosystems: dependence on environment and may compete; resource limitation on organisms and populations.
MS-LS2-4	Construct and argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
LS2.C	Ecosystem dynamics, functioning and resilience: change through time possible.
MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
LS4.D	Biodiversity and humans.
MS-LS3-1	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of organisms. Covered partially in terms of benefits of genetic variation and how variation is distributed across India and effects of population declines.
PS4.C	Information technologies and instrumentation.

STEM PROJECT

MS-ETS1-1	Define the criteria and constrains of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
ETS1.A	Defining and delimiting engineering problems: more precision in constraints and criteria is better.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
ETS1.B	Developing possible solutions: systematic processes for evaluating solutions to make sure they meet criteria and constraints.
ETS1.B	Developing possible solutions: systematic processes for evaluating solutions to make sure they meet criteria and constraints - can combine different parts from past designs.
MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
ESS3.C	Human impacts on Earth systems.
MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
LS4.D	Biodiversity and humans.
ETS1.B	Developing possible solutions: process, criteria and constraints.
PS4.C	Information technologies and instrumentation.

EXPLORE YOUR BACKYARD

MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
ESS3.C	Human impacts on Earth systems.
MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
LS4.D	Biodiversity and humans.

*ELA and Math standards to come

CROSS CUTTING CONCEPTS

Patterns Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Cause and Effect: Mechanisms and Predictions Reader, Mission Research, Science Mission, STEM Project
Scale, Proportion and Quantity Mission Research, Science Mission
System and System Models Reader, Mission Research, Science Mission
Energy and Matter Reader, Science Mission
Structure and Function Reader, STEM Project
Stability and Change Reader, Science Mission, Explore Your Backyard

CONNECTION TO ENGINEERING, TECHNOLOGY AND APPLICATIONS OF SCIENCE

Interdependence of Science, Engineering and Technology Reader, Science Mission, STEM Project
Influence of Science, Engineering and Technology on Society and the Natural World Science Mission, STEM Project

CONNECTION TO NATURE OF SCIENCE

Scientific Investigations Use a Variety of Methods Science Mission, STEM Project
Scientific Knowledge is Based on Empirical Evidence Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Scientific Knowledge is Open to Revision in Light of New Evidence Science Mission
Science Models, Laws, Mechanisms and Theories Explain Natural Phenomena Reader, Mission Research, Science Mission, STEM Project
Science is a Way of Knowing Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Scientific Knowledge Assumes an Order and Consistency in Natural Systems Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Science is a Human Endeavor Science Mission, STEM Project, Explore Your Backyard
Science Addresses Questions About the Natural and Material World Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard

SCIENCE AND ENGINEERING PRACTICES

Asking Questions and Defining Science Mission, STEM Project, Explore Your Backyard
Developing and Using Models Mission Research, Science Mission, STEM Project
Planning and Carrying Out Investigations Science Mission, STEM Project, Explore Your Backyard
Analyzing and Interpreting Data Science Mission, STEM Project, Explore Your Backyard
Using Mathematics and Computational Thinking Science Mission
Constructing Explanations and Designing Solutions Mission Research, Science Mission, STEM Project, Explore Your Backyard
Engaging in Argument from Evidence Mission Research, Science Mission, STEM Project, Explore Your Backyard
Obtaining, Evaluating and Communicating Information Mission Research, Science Mission, STEM Project, Explore Your Backyard

*ELA and Math standards to come