

# **Barringer Crater Curriculum with Next Generation Science Standards**

## **Lesson 1: From Above or Below: Volcanic Craters vs. Impact Craters**

- NGSS MS-ESS2-2 Construct an explanation based on evidence for how geological processes have changed Earth's surface (and Mars and the Moon) at varying time and spatial scales.
- NGSS Disciplinary Core Ideas: ESS2.A: Earth's Materials and Systems (MS-ESS2-2) The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.

New York ES Unit 5 Earth History  
NYS Science Standards

- Major Understandings 1.2d: Asteroids, comets, and meteors are components of our solar system.
  - Impact craters can be identified in Earth's crust

## **Lesson 2: Where on Earth are Impacts? A Global Perspective**

- NGSS MS-ESS2-2 Construct an explanation based on evidence for how geological processes have changed Earth's surface at varying time and spatial scales.
- NGSS Disciplinary Core Ideas: ESS2.A: Earth's Materials and Systems (MS-ESS2-2) The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.

Common Core State Standards Connections - Mathematics

- 6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (latitude/longitude)

New York ES Unit 5 Earth History  
NYS Science Standards

- Major Understandings 1.2d Asteroids, comets, and meteors are components of our solar system.
  - Impact craters can be identified in Earth's crust
  - Impact events have been correlated with mass extinction and global climate change.
- NYS MST Standard 2: Students will access, generate, process, and transfer information using appropriate technologies

### **Lesson 3: Observing Impacts**

- NGSS Crosscutting Concepts: Scale, Proportion, and Quantity (MS-ESS2-2)  
Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.  
The significance of a phenomenon is dependent on the scale, proportion, and quality at which it occurs.  
Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to be observed directly.
- NGSS MS-ESS2-2 Construct an explanation based on evidence for how geological processes have changed Earth's surface at varying time and spatial scales.
- NGSS Crosscutting Concepts: Stability and Change: Stability might be disturbed either by sudden events or gradual changes that accumulate over time.
- NGSS Crosscutting Concepts: Systems and System Models (MS-ESS2-2)  
Models can be used to represent systems and their interactions - such as inputs, processes, and outputs - and energy, matter, and information flows within systems.
- NGSS Cross-Cutting Concepts  
Cause and Effect: Mechanism and Prediction:  
Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships and the mechanisms by which they are mediated, is a major activity of science and engineering

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- Major Understandings 1.2d Asteroids, comets, and meteors are components of our solar system.
  - Impact craters can be identified in Earth's crust
- NYS MST Key Idea 2: Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design

### **Lesson 4: Are Craters Always Round? Studying the Effects of Trajectory**

- NGSS Science and Engineering Practices: Planning and Carrying Out Investigations  
Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

- NGSS Constructing Explanations and Designing Solutions  
Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the student’s own experiments) and the assumptions that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future.
- NGSS Science and Engineering Practices: Developing and Using Models  
Develop and use a model to describe phenomena.
- NGSS Crosscutting Concepts: Scale, Proportion, and Quantity (MS-ESS2-2)  
Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
- NGSS Crosscutting Concepts: Systems and System Models  
A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems
- 6.EEB.6 Understand that a variable can represent an unknown number, or depending on the purpose at hand, any number in a specified set (MS-ESS2-2)

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- Major Understandings 1.2d: Asteroids, comets, and meteors are components of our solar system.
  - Impact craters can be identified in Earth’s crust
- NYS MST Learning Standard 1: Students will use mathematical analysis, scientific inquiry and engineering design as appropriate to pose questions, seek answers and develop solutions.

## **Lesson 5: Impact Scenarios**

- NGSS Crosscutting Concepts: Scale, Proportion, and Quantity (MS-ESS2-2)  
Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
  - The significance of a phenomenon is dependent on the scale, proportion, and quality at which it occurs.
  - Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to be observed directly.

- NGSS MS-ESS2-2 Construct an explanation based on evidence for how geological processes have changed Earth’s surface at varying time and spatial scales.
- NGSS MS- ESS3-2: Analyze and Interpret data on natural hazards to forecast future catastrophic events
- NYS MST Key Idea 2: Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design

NYS MST Standard 6 - Interconnectedness: Common Themes

- Key Idea 3: The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems
  - Changes in systems may have various causes that may not have equal effects.

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NYS Science Standards

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  - Impact craters can be identified in Earth’s crust
- NYS MST Learning Standard 1: Students will use mathematical analysis, scientific inquiry and engineering design as appropriate to pose questions, seek answers and develop solutions.
- NYS MST Learning Standard 3: Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Common Core State Standards Connections -Mathematics

- MP.2 Reason abstractly and quantitatively
- 6.EEB.6 Understand that a variable can represent an unknown number, or depending on the purpose at hand, any number in a specified set (MS-ESS2-2)

## **Lesson 6: The Battle for Impact Theory: Barringer Meteor Crater**

NGSS Connections to Nature of Science:

- Scientific Knowledge is open to revision in light of new evidence.

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

Common Core Standard Connections -ELA/Literacy

- RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-2)
- RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Homework Writing Assignment

- WHST.6-8.2: Write informative/explanatory text to examine a topic and convey ideas, concepts, and information through the selection of, organization, and analysis of relevant content. (MS-ESS2-2)
- NYS MST Standard 4: Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.

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**Lesson 7: Final Reflection and Assessment: What Have You Learned about Impact Craters?**

- NYS MST Standard 4: Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.

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Common Core State Standards - ELA/Literacy

- RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-2)
- WHST.6-8.8 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content (MS-ESS2-2)