

A JOURNEY THROUGH GEOLOGIC TIME

Teacher's Guide Middle School



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A Message from our Company...

Dear Educator:

Thank you for your interest in the educational videos produced by the Visual Learning Company. We are a Vermont-based, family owned and operated business specializing in the production of quality educational science videos and materials.

We have a long family tradition of education. Our grandmothers graduated from normal school in the 1920's to become teachers. Brian's mother was an elementary teacher and guidance counselor, and his father was a high school teacher and superintendent. This family tradition inspired Brian to become a science teacher, and to earn a Ph.D. in education, and led Stephanie to work on science educational programs at NASA.

In developing this video, accompanying teacher's guide, and student activities, our goal is to provide educators with the highest quality materials, thus enabling students to be successful. In this era of more demanding standards and assessment requirements, supplementary materials need to be curricular and standards based - this is what we do!

Our videos and accompanying materials focus on the key concepts and vocabulary required by national and state standards and goals. It is our mission to help students meet these goals and standards, while experiencing the joy and thrill of science.

Sincerely,

Brian and Stephanie Jerome



National Standards Correlations

National Science Education Standards

(Content standards: 5-8, National Academy of Sciences, c. 1996)

Earth and Space Science (Content Standard D) - Earth's History

- The earth's processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past. Earth history is also influenced by occasional catastrophes, such as the impact of an asteroid or comet.
- Fossils provide important evidence of how life and environmental conditions have changed.

Benchmarks for Science Literacy

(Project 2061 – AAAS, c. 1993)

The Living Environment - Evolution of Life (5F)

By the end of 8th grade, students should know that:

- Many thousands of layers of sedimentary rock provide evidence for the long history of the earth and for the long history of changing life forms whose remains are found in the rocks. More recently deposited rock layers are more likely to contain fossils resembling existing species.

Historical Perspectives - Extending Time (10D)

By the end of the 12th grade, students should know that:

- The idea that the earth might be vastly older than most people believed made little headway in science until the publication of *Principles of Geology* by an English scientist, Charles Lyell, early in the 19th century. The impact of Lyell's book was a result of both the wealth of observations it contained on the patterns of rock layers in mountains and the locations of various kinds of fossils, and of the careful logic he used in drawing inferences from his data.



Student Learning Objectives

Upon viewing the video and completing the enclosed student activities, students will be able to do the following:

- Understand that scientifically describing Earth's history is not an easy task.
- Define the concept of Uniformitarianism which proposes present geologic processes are the key to understanding geologic processes and events which have occurred in the past.
- Understand that geologists talk about geologic time in very large blocks of time.
- Differentiate between relative time and absolute time, geologically speaking.
- Describe the Law of Superposition which states that younger layers of rock are found on top of older layers of rock.
- Create a simplified diagram of the geologic time scale outlining the four major geologic eras.
- Differentiate between eras, periods, and epochs on the geologic time scale.
- Briefly explain the main points of the Nebular Hypothesis, stating how it describes the formation of the solar system.
- List some of the major features of the Precambrian era such as the fact that it makes up over 85% of geologic time, it includes the time during which life first appeared, and that simple multicellular life also appeared in this era.
- Briefly describe some of the unique, geologic events of the Paleozoic Era.
- Explain some of the more significant characteristics of the Mesozoic Era including the break up of Pangea, the emergence of flowering plants, and the dominance of dinosaurs.
- Briefly describe some of the significant events of the Cenozoic Era including many changes in global climate, widespread glacial events, and the proliferation of mammals.



Assessment

Preliminary Assessment:

The Preliminary Assessment, provided in the Student Masters section, is an assessment tool designed to gain an understanding of students' pre-existing knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

Video Review:

The Video Review, provided in the Student Masters section, can be used as an assessment tool or as a student activity. There are two main parts. The first part contains questions that can be answered during the video. The second series of ten questions consists of a video quiz to be answered at the conclusion of the video.

Post Assessment:

The Post Assessment, provided in the Student Masters section, can be utilized as an assessment tool following completion of the video and student activities. The results of the Post Assessment can be compared against the results of the Preliminary Assessment to evaluate student progress.



Introducing the Video

Before showing the program, ask students if they have ever heard of geologic time. Write the term on the board. Explain to students that geologists talk about geologic time in very large blocks of time - in millions or even billions of years.

Next, have a couple of students unroll a roll of paper towels that has a length of 46 sheets. Tell students that the length of the entire roll represents geologic time. Designate one end of the roll as the beginning of geologic time on earth 4.6 billion years ago. Demonstrate to students that unicellular life did not appear until the tenth sheet. Dinosaurs did not appear until the forty-fourth sheet. Human life did not appear until the end of the final sheet.

Tell students to pay close attention to the video to learn more about geologic time, and to learn about some of the major events in geologic time. Following the program see what other major events can be charted on the geologic time line (roll of paper towels).

Video Viewing Suggestions

The student Master "Video Review" is provided for distribution to students. You may choose to have your students complete this Master while viewing the program or to do so upon its conclusion.

The program is approximately twenty minutes in length and includes a ten question video quiz. Answers are not provided to the Video Quiz on the video, but are included in this teacher's guide. You may choose to grade student quizzes as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.



Video Script: A Journey Through Time

1. How old are the snow-covered Rocky Mountains seen here in Colorado.
2. When did glaciers scour out the beautiful topography here in Yosemite Valley, California?
3. How long ago did the dinosaurs form these tracks?
4. What is the age of the Bay of Fundy seen here in New Brunswick, Canada?
5. When did these petrified tree trunks flourish in a once moist rainforest?
6. And, how many years ago were the layers of sediment formed which now make up the walls of the Grand Canyon?
7. How do we go about answering these fascinating questions?
8. How do we talk about the history of the Earth?
9. And, how do scientists decipher different parts of Earth's geologic history?
10. How do scientists attempt to figure out the age of things like fossils?...
11. ... or the age of these strange formations seen here in Bryce Canyon National Park?
12. During the next few minutes we are going to attempt to answer these questions...
13. ... and others as we take a journey through geologic time.
- 14. Graphic Transition – Describing Earth History**
15. History is the study of events which have occurred in the past.
16. Each of us has a history.
17. Our history includes information about where and when we were born.
18. ...as well as where we have lived, and who are our family and friends are.
19. Our history also includes some of the things we have accomplished such as grades completed in school...
20. ... and the types of things which interest us.
21. The extent of a person's history is somewhat determined by their age.
22. An older person has a much greater history of events...
23. ... than a much younger person.
24. The Earth too, has a history we can describe much in the same way we describe the history of a person's life.
25. Understanding and describing the geologic history of Earth is not an easy task.
26. There are no records written describing Earth's geologic past, and no witnesses.
27. So, how do geologists go about describing earth's geologic history?
- 28. Graphic Transition- Uniformitarianism**
29. Up until a few hundred years ago, most people thought the Earth's geology was relatively stable and unchanging, and that Earth was only a few thousand years old.



Script (cont.)

30. In 1785, the Scottish scientist, James Hutton brought these principles into question suggesting that the Earth was a dynamic place and that it was a lot older than people previously thought.
31. Hutton proposed that Earth's features, including hills, mountains, and valleys were undergoing constant changes as a result of the forces of...
32. ...erosion, sedimentation, and mountain building.
33. Through observing these modern day processes it became apparent to Hutton that Earth's features were altered by these forces over periods of time much longer than previously thought possible.
34. He believed that the past history of Earth can be explained by what is happening at the present.
35. Other scientists including John Playfair...
36. ...and Charles Lyell elaborated on Hutton's work.
37. And it was Lyell that developed the powerful idea of uniformitarianism which proposes that "the present is the key to the past."
38. **You Predict!** How would geologists predict how these 200 million year old petrified dunes were produced?
39. Geologists believe that present day processes of deposition, such as that seen here in Death Valley and later petrification, produced the ancient dunes.
40. **Graphic Transition – Geologic Time**
41. We describe our age in the amount of years we have lived.
42. Geologists do the same thing when they describe the age of Earth.
43. The main difference however, is that instead of talking about a few years, they may talk about hundreds of millions of years or even billions of years.
44. Scientists tend to talk about geologic time in very large blocks of time.
45. There are two ways of thinking about geologic time: as relative time and as absolute time.
46. Early geologists described geologic time mainly in terms of relative time.
47. In relative time, certain rocks such as the rock layers in this cliff, or certain geologic events are referred to as being younger or older relative to other rocks or other geologic events.
48. **You Decide!** What books in this stack have been on the table longer?
49. The books on the bottom of the stack have been on the table longer.
50. Similarly, when layers of sediment are deposited, forming sedimentary rock, the layers on the bottom are the oldest.
51. The Law of Superposition states that in layers of sedimentary rock, the younger rocks are found at the top and older rocks are found at the bottom.



Script (cont.)

52. The Law of Superposition helps geologists estimate the age of rock layers and geologic events relative to each other.
53. Today, geologists now have the capability using a variety of techniques to date with reasonable accuracy; not only fossils...
54. ... but, rocks themselves. For example, geologists estimate the age of this cinder cone volcano to be 900 years old.
55. And, these fossilized remains of once giant trees are estimated to have lived 225 million years ago.
56. These are absolute geologic ages, meaning the age of the rock is stated in years.
57. Using techniques such as radio active dating, scientists can now estimate the age of rocks that are hundreds of millions years old.
- 58. Graphic Transition – The Geologic Time Scale**
59. Geologists generally estimate the earth to be approximately 4,600 million years or 4.6 billion years old!
60. Geologists represent the span of geologic events over time on a geologic time line. Let us see how this works.
61. This roll of paper towels has 46 sheets.
62. Let us say each sheet represents 100 million years.
63. When we unroll 46 sheets it looks like this.
64. The length along the entire roll represents geologic time, with the beginning of time at the far end.
65. The first unicellular life did not appear on earth until the tenth sheet.
66. Dinosaurs did not appear until the forty-fourth sheet.
67. And, the human species first appeared near the very end of the final sheet.
- 68. You Compare!** How does human history compare to the Earth's geologic history.
69. The existence of human life on earth is a mere blink of an eye compared to the geologic history of Earth.
70. In order to divide geologic time into workable segments, geologists have developed something called a geologic time scale.
71. There are three general types of subdivisions on the geologic time scale including eras, periods, and epochs.
72. Eras are the largest subdivisions which are divided into periods, which are then divided into epochs.
73. The four major eras include the Precambrian Era, Paleozoic Era, Mesozoic Era, and Cenozoic Era.
74. The major eras are based on significant changes in life on our planet.



Script (cont.)

75. Graphic Transition – Precambrian Era

76. Most scientists hypothesize that our solar system originated from a cloud of dust and gas called a nebula. This theory is referred to as The Nebular Theory.
77. According to the Nebular Theory, a nearby star exploded into a massive supernova about five billion years ago. This event seeded a nearby nebula with various elements and chemicals.
78. The force of the explosion was so great that it disrupted the stable gas cloud of the nebula. It is believed the nebula then collapsed, pulling matter toward the center causing the nebula to spin faster. The nebula flattened and formed our sun. Matter revolving around the sun formed planets. Earth became the third planet from the sun.
79. It is estimated that Earth was born 4.6 billion years ago
80. The Precambrian Era spans from earth's early days up to 542 million years ago.
81. It is the longest era by far, lasting nearly four billion years, and it accounts for over 85% of Earth's history.
82. In North America some rocks from the Precambrian era may still be found in parts of Canada, the Great Lakes region, and in New York's Adirondack region.
83. The first life did not appear until at least a billion years later in the early oceans,...
84. ...in the form of microscopic bacteria similar to these bacteria seen here magnified hundreds of times.
85. Early plants also developed in ocean water, similar to modern day algae.
86. Toward the end of the Precambrian Era, simple ocean animal life appeared in the form of jellyfish, worms, sponges, and corals.

87. Graphic Transition – The Paleozoic Era

88. The beginning of the Paleozoic Era, 542 million years ago, began with the land being lifeless.
89. Life in the seas however, was beginning to flourish.
90. Six armed starfish as well...
91. ...as these strange looking creatures called trilobites became abundant in the oceans.
92. Two shelled organisms called brachiopods formed these fossils.
93. And fish, the first animals with backbones, filled the seas.
94. Toward the middle of the Paleozoic era the land became inhabited.
- 95. You Decide!** What were the first living things to inhabit land?
96. It is believed plants were the first living things to inhabit land.
97. In the Paleozoic era large forests of ferns blanketed the earth.
98. As did cycads, whose imprint is seen in these fossils.



Script (cont.)

99. The remains of plant matter collected over thousands of years created this piece of coal which can be burned for fuel.
100. Toward the end of the Paleozoic, the first land vertebrates appeared.
101. Amphibian-like creatures emerged from the water with legs enabling them to walk on land.
102. And, at the end of the Paleozoic, the first animals with scaly skin – the reptiles developed and would eventually rule the Earth in the Mesozoic Era.
- 103. Graphic Transition – Mesozoic Era**
104. The Mesozoic Era, which began 251 million years ago was a time of great change.
105. During this era the super continent of Pangea began to break apart.
106. The Sierra Nevada mountains formed...
107. ...and, the Rocky Mountains were created.
108. The Mesozoic saw great changes in living things.
109. The bones seen here in this rock face in Colorado date back to about 150 million years ago.
110. They belong to dinosaurs who dominated Earth in the Mesozoic.
111. Giants such as this allosaurus were ferocious carnivores feeding on other dinosaurs.
112. These bones belong to a camarasaurus which was among the largest dinosaurs to have ever walked the Earth.
113. The dominance of these great dinosaurs is often referred to as the “Age of Reptiles”.
114. But, other life forms also emerged including flowering plants,...
115. ...early birds, and the first mammals.
116. The close of the Mesozoic Era, about 65 1/2 million years ago saw the widespread extinction of many of these animals including the great dinosaurs.
- 117. Graphic Transition – The Cenozoic Era**
118. The Cenozoic Era includes the last 65 1/2 million years of the history of earth and includes the era in which we live today.
119. During this era Flowering plants thrived.
120. The Cenozoic Era saw many changes in global climate from warm, mild climates...
121. ...to bitter cold ones with widespread glaciers covering huge areas.
122. Animal and plant life reflected these changing conditions.
123. Earlier in the Cenozoic mammals such as early horses began to proliferate.
124. During the past two million years the earth witnessed many cooling episodes where glaciers covered large parts of North America and Europe...
125. ...carving out the Great Lakes, and sculpting the landscape in Yosemite National Park.



Script (cont.)

126. During this time period large mammals such as the elephant – like the woolly mammoth,...
127. ...and the fierce saber tooth tiger roamed!
128. It was also during this period that pre-humans appeared.
129. Over thousands of years they developed into homo sapiens, the human species we belong to.

130. Graphic Transition – Summing Up

131. During the past few minutes we have taken a brief journey through geologic time.
132. We began by taking a look at some of the early work of geologists such as James Hutton who proposed that Earth is much older than previously thought.
133. And, we explored the notion of uniformitarianism proposed by Charles Lyell, which states that the present is the key to the past.
134. We discussed the vastness of geologic time...
135. ...and we saw how geologic time can be viewed in two ways: as relative time and as absolute time.
136. The way in which geologic time is divided into workable segments in the form of the geologic time scale was covered.
137. Some of the highlights of each of the four major geologic eras was discussed as well.
138. So, the next time you pick up a rock...
139. ...look at a mountain...
140. ...or view a fossil, think about some of the things we have discussed during the past few minutes.
141. You just might think about Earth, and geologic time a little differently.

142. Graphic Transition- Video Assessment

Fill in the correct word to complete the sentence. Good luck and let's get started.

1. Uniformitarianism suggests that the _____ is the key to the past
2. The Law of _____ states younger rocks are found above older rocks.
3. _____ geologic age states the actual age of a rock.
4. The span of geologic time can be represented on a _____.
5. _____ are the largest subdivisions on the geologic time scale.
6. Humans appeared in the _____ era
7. It is estimated the Earth is 4.6 _____ years old.
8. The _____ era spans over 85% of Earth's history.
9. Early life is believed to have developed in the _____.
10. The Earth's climate and surface has been constantly _____.

Answers can be found on page 17



Student Assessments and Activities

Assessment Masters:

- Preliminary Assessment
- Video Review
- Post Assessment

Student Activity Masters:

- Early Ideas in Geology
- Superposition
- Geologic Time Line
- *Vocabulary of A Journey Through Time*



Answers to Student Assessments

Preliminary Assessment (pgs. 20-21)

1. present
2. uniformitarianism
3. relative
4. superposition
5. absolute
6. billion
7. time scale
8. Precambrian
9. ocean
10. change
11. false
12. true
13. true
14. false
15. true
16. true
17. false
18. false
19. true
20. false

Video Review (pg. 22)

1. Geologists would look at present day processes of deposition and petrification and conclude that is how the dunes were produced.
2. The books on the bottom of the stack have been on the table longer.
3. The existence of human life on earth is a mere blink of an eye compared to the geologic history of Earth.
4. The first living things to inhabit land were plants.

Video Quiz (p. 22)

1. present
2. superposition
3. absolute
4. time line
5. eras
6. Cenozoic
7. billion
8. Precambrian
9. oceans
10. changing

Post Assessment (pgs. 23-24)

1. absolute
2. oceans
3. present
4. Precambrian
5. billion
6. uniformitarianism
7. change
8. superposition
9. time scale
10. relative
11. false
12. true
13. false
14. true
15. true
16. true
17. false
18. false
19. true
20. false



Answers to Student Activities

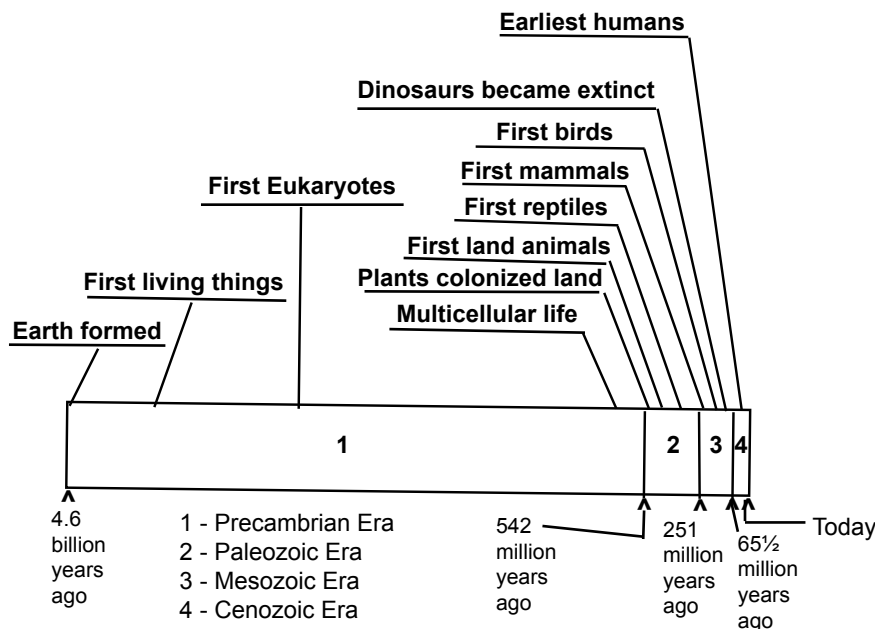
Early Ideas in Geology (p. 25)

1. Most people thought Earth was relatively unchanging, and it was only a few thousand years old.
2. In 1785 Hutton proposed that Earth was a very dynamic place and that it was a lot older than people previously thought.
3. Examples include volcanic eruptions, earthquakes, mountain building, erosion, and deposition.
4. Lyell proposed the idea of Uniformitarianism which suggests the present is the key to the past.
5. The principle of Uniformitarianism suggests that by observing current processes such as erosion, sedimentation, and mountain building, we can understand how Earth's features were created thousands, if not millions of years ago.

Superposition (pgs. 26-27)

1. There are five layers of sedimentary rock.
2. Layer #1 is the oldest layer. Layer #2 is the next oldest.
3. The hardened magma intrusion is younger than the rock layers it penetrated (#1,2,3, and 4). We do not know if layer five is older or younger than layer #5.
4. The sides of layers #4 and #5 were worn away via weathering and erosion. This occurred after the layers were formed.
5. The fault moved layers #1,2,3 and 4 as well as the magma intrusion #7. Therefore, we can conclude that the fault is younger than these layers and the magma intrusion.

Geologic Time line (Pgs. 28-29)



Vocabulary of A Journey Through Time (p. 30)

1. e - geologic history
2. h - uniformitarianism
3. b - Law of Superposition
4. j - relative time
5. a - absolute time
6. c - geologic time scale
7. d - nebular theory
8. i - era
9. g - Precambrian era
10. f - Cenozoic era

Assessment and Student Activity Masters



Preliminary Assessment

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. Much of earth's past history can be explained by what is happening in the _____.
2. _____ proposes that the present is the key to the past.
3. In _____ geologic time, certain geologic events are referred to as being older or younger relative to each other.
4. The Law of _____ proposes that younger rock layers are located on top of older layers below.
5. _____ geologic age states the age of a rock in years.
6. Geologists estimate earth to be 4.6 _____ years old.
7. In order to divide geologic time into workable segments, the geologic _____ was developed.
8. The _____ era makes up over 85% of geologic time.
9. Early life diversified in the _____.
10. During the course of geologic time, life and earth's surface has gone through great _____.

superposition
absolute
billion
present
change

relative
oceans
time scale
uniformitarianism
Precambrian

Preliminary Assessment

Directions: Decide whether the statement is true (T) or false (F).

- | | | |
|--|---|---|
| 11. Figuring out the history of earth has been an easy job for geologists. | T | F |
| 12. Most geologists now popularly think earth is 4.6 billion years old. | T | F |
| 13. Through observing modern-day geologic processes, scientists try to interpret past geologic events. | T | F |
| 14. According to the Law of Superposition, the oldest rocks are found above younger rock layers. | T | F |
| 15. Geologists now are able to use different techniques to identify the absolute ages of rocks. | T | F |
| 16. Human history occupies a small part of geologic history. | T | F |
| 17. The Nebular Theory proposes that our solar system has always been in existence. | T | F |
| 18. The Precambrian era was only a few thousand years ago. | T | F |
| 19. Abundant life in the oceans was established before life on land. | T | F |
| 20. Earth's climate has been relatively unchanged throughout time. | T | F |

Video Review

Directions: During the course of the program, answer the questions as they are presented in the video. At the end of the video, answer the Video Quiz questions.

You Predict!

1. How would geologists predict how these 200 million year old petrified dunes were produced?

You Decide!

2. What books in this stack have been on the table longer?

You Compare!

3. How does human history compare to the Earth's geologic history?

You Decide!

4. What were the first living things to inhabit land?

Video Quiz:

1. Uniformitarianism suggests that the _____ is the key to the past.
2. The Law of _____ states younger rocks are found above older rocks.
3. _____ geologic age states the actual age of a rock.
4. The span of geologic time can be represented on a _____.
5. _____ are the largest subdivisions on the geologic time scale.
6. Humans appeared in the _____ era.
7. It is estimated the Earth is 4.6 _____ years old.
8. The _____ era spans over 85% of Earth's history.
9. Early life is believed to have developed in the _____.
10. The Earth's climate and surface has been constantly _____.

Post Assessment

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. _____ geologic age states the age of a rock in years.
2. Early life diversified in the _____.
3. Much of earth's past history can be explained by what is happening in the _____.
4. The _____ era makes up over 85% of geologic time.
5. Geologists estimate earth to be 4.6 _____ years old.
6. _____ proposes that the present is the key to the past.
7. During the course of geologic time, life and earth's surface has gone through great _____.
8. The Law of _____ proposes that younger rock layers are located on top of older layers below.
9. In order to divide geologic time into workable segments, the geologic _____ was developed.
10. In _____ geologic time, certain geologic events are referred to as being older or younger relative to each other.

uniformitarianism	present
oceans	superposition
time scale	billion
absolute	change
relative	Precambrian

Post Assessment

Directions: Decide whether the statement is true (T) or false (F).

- | | | |
|--|---|---|
| 11. Earth's climate has been relatively unchanged throughout time. | T | F |
| 12. Geologists now are able to use different techniques to identify the absolute ages of rocks. | T | F |
| 13. Figuring out the history of earth has been an easy job for geologists. | T | F |
| 14. Human history occupies a small part of geologic history. | T | F |
| 15. Abundant life in the oceans was established before life on land. | T | F |
| 16. Most geologists now popularly think earth is 4.6 billion years old. | T | F |
| 17. According to the Law of Superposition, the oldest rocks are found above younger rock layers. | T | F |
| 18. The Nebular Theory proposes that our solar system has always been in existence. | T | F |
| 19. Through observing modern-day geologic processes, scientists try to interpret past geologic events. | T | F |
| 20. The Precambrian era was only a few thousand years ago. | T | F |

Early Ideas in Geology

Directions: Read the following information and then answer the questions below:

Until relatively recently (the 18th century) most scientists popularly thought Earth's surface changed little. It was also thought Earth was only a few thousand years old. But, in 1785 a Scottish scientist by the name of James Hutton brought these ideas into question. He proposed that Earth was a very dynamic place, constantly changing, and that it was a lot older than people previously thought.



James Hutton

Later, in the early 19th century, another scientist, Charles Lyell, built upon Hutton's ideas. Lyell formally developed the idea of Uniformitarianism. The principle of Uniformitarianism proposes that "the present is the key to the past. In other words, by observing current processes such as erosion, sedimentation, and mountain building, we can understand how features such as canyons, mountains, and hills were formed in the past. While today we take the ideas of Hutton and Lyell for granted, at the time they were quite revolutionary. These scientists and others laid the foundation for the study of modern geology.



Charles Lyell

Questions:

1. Prior to James Hutton, what did most scientists think about Earth and its age?
2. What revolutionary ideas did James Hutton propose?
3. What evidence suggests Earth is a dynamic place?
4. What principle did Charles Lyell develop?
5. In your own words, describe the principle of Uniformitarianism.

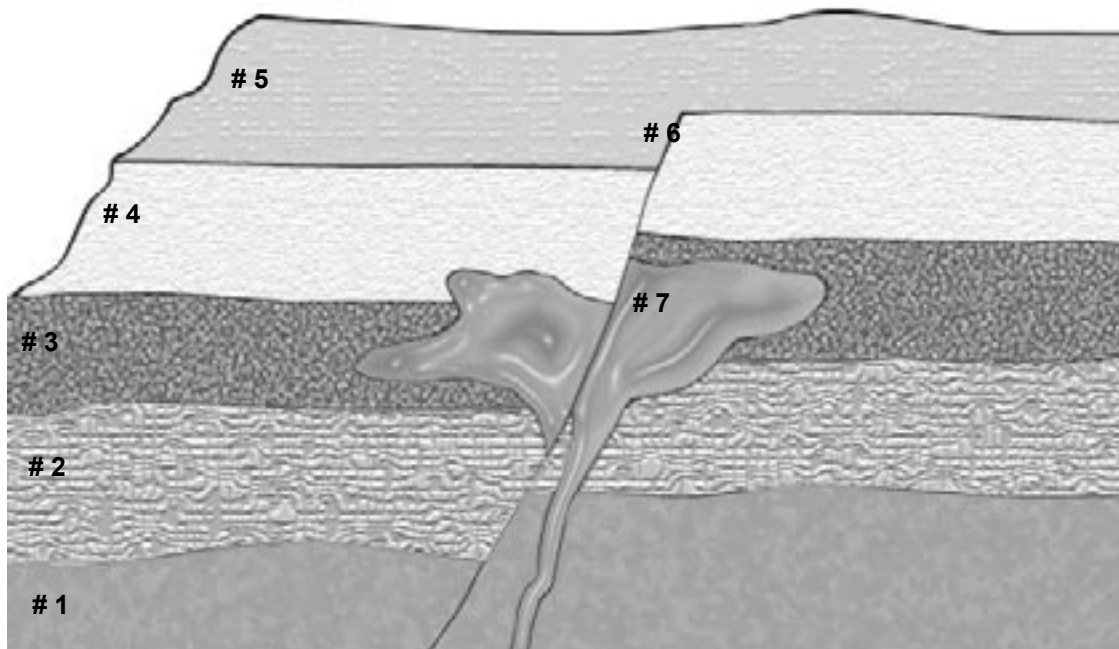
Superposition

One of the important tasks of geologists is to interpret past geologic events. It is not easy to interpret events that occurred thousands, if not hundreds of million years ago. In order to understand the past, geologists attempt to determine the age of rocks and geologic events.

There are two ways of thinking about geologic time: as relative time and as absolute time. Until relatively recently, scientists had few tools to provide an absolute date of a given rock. Absolute geologic age states the age of a rock in years. Scientists can now state the absolute ages using a number of sophisticated techniques. Early geologists described geologic time mainly in terms of relative time. In relative time, certain rocks or geologic events are referred to as being younger or older relative to other rocks or geologic events. The Law of Superposition helps scientists age rocks and geologic events relative to other rocks and geologic events. The Law of Superposition states that in layers of sedimentary rocks, the younger rocks are found at the top and the older rocks are found at the bottom.

Directions:

Below is a diagram of a cross-section of sedimentary rocks with a magma intrusion. Study the diagram and answer the questions.



Superposition Cont.

Questions:

1. How many layers of sedimentary rock are there in the cross-section?
2. To the best of your knowledge, what layers do you think are the oldest?
3. Number 7 represents a hardened magma intrusion. State its relative age compared to the surrounding rock layers.
4. What do you think happened to the sides of rock layers #4 and #5?
5. The structure labeled #6 is a fault. Describe when the fault occurred relative to surrounding rocks.

Geologic Time Line

Background: When someone asks you your age, you answer by telling them your age in years. We calculate our age from the time we are born to the present. Geologists do the same thing when they describe the age of Earth or rocks. The main difference however, is that instead of talking about a few years, geologists may talk about geologic time in hundreds of millions of years, or even billions of years.

In order to divide geologic time into workable segments, geologists have developed something called a geologic time scale. The geologic time scale breaks geologic time into different segments based on changes in ancient life or on geologic events. These different segments can be visually represented on a geologic time line. In this activity you will create your own geologic time line. On this time line you will place some of the major events which have occurred during the history of earth.

Materials: colored pencils

Directions:

1. On the following page is a simple sketch of a geologic time line. As you can see, it is blank. Your job is to fill it in.
2. Obtain some colored pencils and a copy of the "Your Geologic Time Line".
3. Label the major geologic eras on your time line. Color each of the eras a different color.

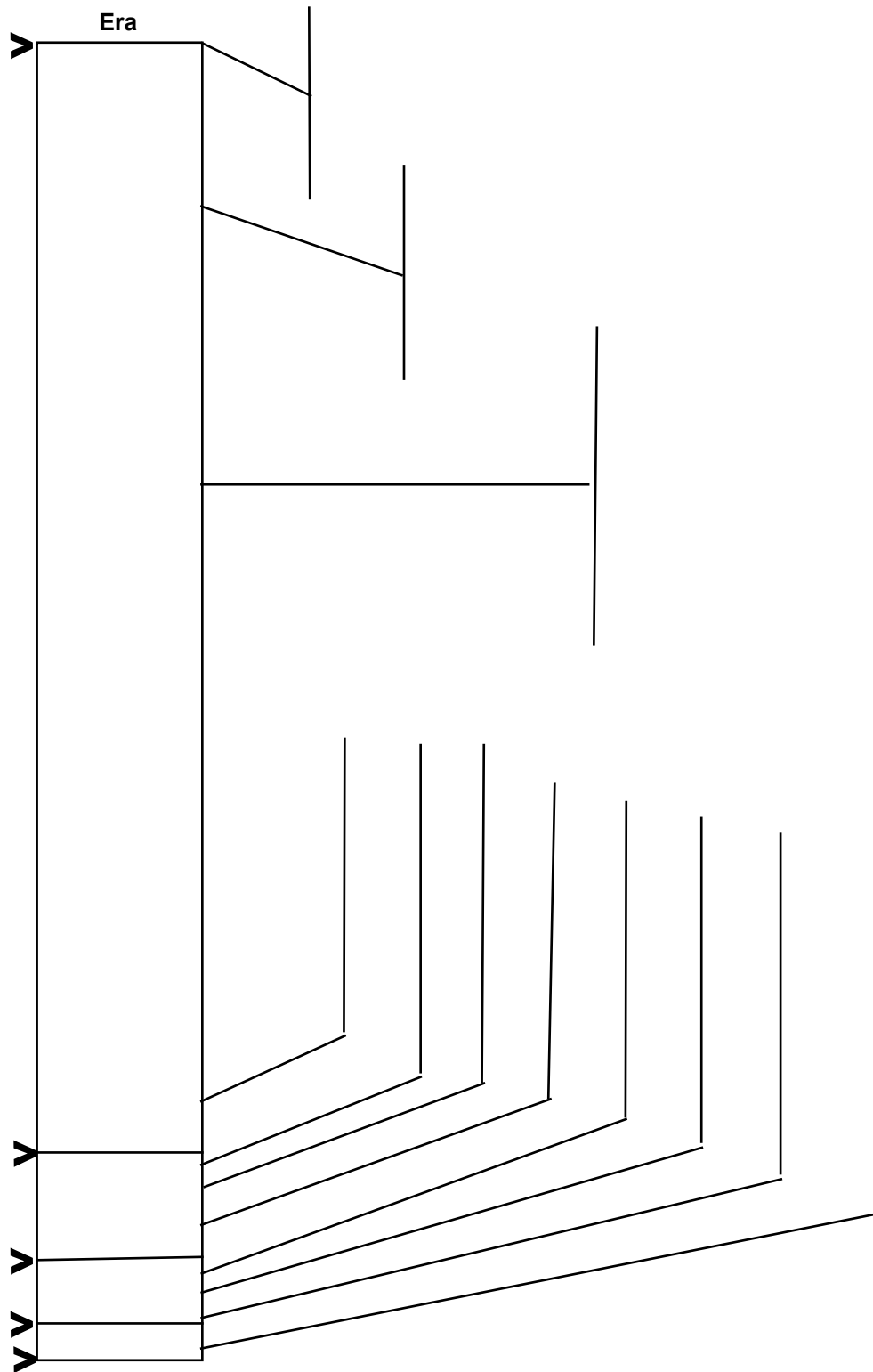
Precambrian Era 4.6 billion - 542 million years ago
Paleozoic Era 542 - 251 million years ago
Mesozoic Era 251 - 65½ million years ago
Cenozoic Era 65½ million years ago to present

4. Place these major events on your time line:

First birds - 160 million years ago
First living things (bacteria-like organisms) - 3.6 billion years ago
Earliest Humans - 500,000 years ago
Plants colonized land - 400 million years ago
Multicellular life developed - 700 million years ago
First reptiles - 290 million years ago
Earth formed 4.6 billion years ago
First land animals - 360 million years ago
First mammals - 200 million years ago
Dinosaurs became extinct - 65 million years ago
First eukaryotes (cells with nucleus) - 1.5 billion years ago

5. Using reference books, find your own facts about geologic history or early life to place on your geologic time line.

Your Geologic Time Line



Vocabulary of A JOURNEY THROUGH TIME

Directions: Unscramble the vocabulary words in the first column. Match the words to the definitions in the second column.

____ 1. ggcooiel syiohrt _____

____ 2. ftuimirsnaiamoin

____ 3. alw of uepstosroiinp _____

____ 4. aieevrtl mtei _____

____ 5. belatous meit _____

____ 6. ooggliec mite Isaac _____

____ 7. unrbael ohyret _____

____ 8. rea _____

____ 9. mnaarrcpbei aer _____

____ 10. zccoonie ear _____

a. means of stating the age of a rock in years.

b. states that younger rock layers are found on top of older rock layers.

c. the span of geologic time on earth divided into segments.

d. a possible explanation of how the solar system was created.

e. the study of the geologic processes which have occurred on earth in the past.

f. includes the last 65½ million years of earth's history.

g. the span of time which represents over 85% of earth's geologic history.

h. the idea that present day geologic processes are fundamental in understanding geologic events in the past.

i. largest segment of geologic time.

j. means of dating geologic events relative to other geologic events.