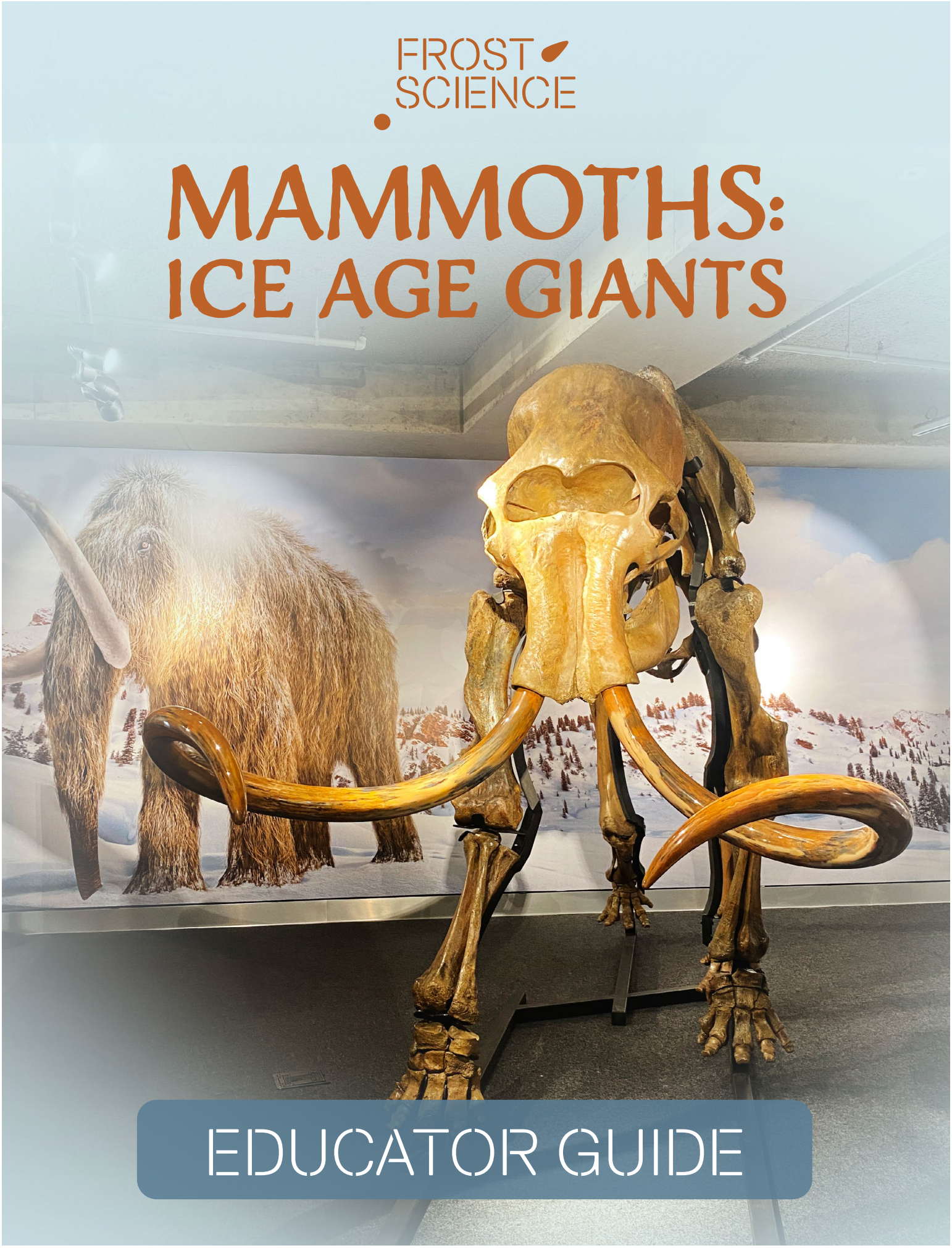
FROST SCIENCE

MAMMOTHS: ICE AGE GIANTS



EDUCATOR GUIDE

MAMMOTH: ICE AGE GIANTS
EDUCATOR GUIDE

Need to escape the heat? Enter the Ice Age world of the woolly mammoth (*Mammuthus primigenius*). In this special exhibition, you'll discover life at the peak of the last glaciation through the eyes of the charismatic megafauna, or giant animals, that dominated the landscape 10,000 years ago. In our immersive theatre, you'll hear from leading researchers as you learn about their work to bring the past to life.

At the heart of the exhibition, you'll come face to face with a juvenile mammoth skeleton from the personal collection of Dr. Aaron J. Rollins. Don't let the word juvenile fool you – our mammoth skeleton stands about 10 feet tall.

Mammoths weren't the only Ice Age creatures that roamed North America 10,000 years ago. In this exhibition, you'll see the skulls and teeth of mastodons, sabre tooth cats and American lions, all creatures that shared their habitat with the woolly mammoth. You'll also learn more about how mammoths and mastodons relate to their living elephant relatives.

Did humans play a role in the woolly mammoth's extinction? You'll hear about how humans and mammoths interacted throughout North America and get to weigh evidence to make your own decisions.

In this educator guide, you'll find resources for supporting your students as they visit this exhibition. In our K-2 guide, your students will delight in measuring mammoths and learning about how the mammoth's size helped them in the Ice Age. 3rd-5th graders will "Grow up Mammoth" as they explore evolutionary life history and figure out the age of our specimen. Finally, middle schoolers will explore two competing hypotheses for mammoth extinction in a lesson all about the nature of science.

K-2 Extension – Mammoth Measurements

Your students will enjoy expanding their math and scientific measurement skills as they tackle an Ice Age animal of *mammoth* proportions. Students will make comparisons about relative size before seeing a woolly mammoth on display in the *Mammoth: Ice Age Giants* exhibition. They will then explore how scientists understand changes in past weather by measuring ice cores.

ACTIVITY GOALS

1. Explore measurement and units through a series of Ice Age activities.
2. Make comparisons and draw conclusions based on measurements.
3. Learn how scientists have used measurements to make predictions about the past.

CPALMS STANDARDS

SC.1.N.1.3, SC.K.N.1.3-5, SC.2.N.1.1, SC.K.P.8.1, SC.1.L.14.1, SC.2.L.17.1-2, MAFS.K12.MP.1, MAFS.K12.MP.5.

PRE-VISIT ACTIVITY

Supplies

1. Butcher paper
2. Scissors
3. Rulers or measuring tape

Activity Guide

1. Introduce the *Mammoths: Ice Age Giants* exhibition by asking students what they know about mammoths.
2. Explain that the mammoth was a big animal that is close cousins with the elephant. It went extinct about 4,000 years ago. Even though we no longer can observe the mammoth in the wild, scientists can use measurements to understand information about the animal.
3. Tell the students that they are going to be doing a series of experiments to help them measure mammoths. They are first going to measure themselves, then compare their measurements to the mammoth.
4. Have a student volunteer for measuring height. Roll out the butcher paper and have the student lay on it. Make a line at the head and feet. Have other students measure the height using rulers. Write this on the paper, cut, and hang up. Make sure to use proper units.
5. Have other students measure out the height of the mammoth in butcher paper (10 feet, or use the height of the ceiling to the floor if your space is less than 10 feet tall). Write the height of the mammoth on the paper and hang it up beside the student height measurement.
6. Ask students what differences they notice between the two heights. Ask students to imagine what it would be like if a 10-foot mammoth were in the classroom.
7. Repeat the comparisons with other measurements as time permits, including stride length, hand/foot size circumference, and weight.
8. Have a student volunteer take a normal step from a line drawn on butcher paper, measure the student's step, then measure out how far a mammoth would travel in a single step. Write these results with proper units then attach to the floor.

PRE-VISIT ACTIVITY (CONTINUED)

Activity Guide (Continued)

9. Remind students that mammoth hands and feet were very similar. Have a student trace their hand, then draw a circle around it and cut it out. As a class, compare the size of the two prints. Older students may be able to measure the diameter of the circle using a ruler.
10. Ask students to volunteer their weight (or just assume 50 lbs). Explain that it would take 240 students to weigh as much as one mammoth. You may want to illustrate this by explaining how many different classes it would take all together to make up the weight of one mammoth.
11. Finally, have students calculate the amount of time they spend eating each day. As a class, work on adding these numbers up and coming to a total number of minutes (should be between 45 and 90). Reveal that an elephant eats up to 960 minutes a day. Explain that because a mammoth eats lots of plants, it has to spend most of its time chewing.
12. Review what the students learned about mammoths. Explain that they are going to see a real mammoth skeleton up close on their field trip to *Mammoths: Ice Age Giants*.

Measurement	Human	Mammoth
Height (feet)		10 feet
Stride Length (feet)		5 feet
Hand size circumference (inches)		23 inches
Weight (lbs)		12000 lbs
Time spent chewing (minutes)		960 minutes

DURING THE VISIT

Supplies

1. *Mammoths: Ice Age Giants* Worksheet
2. Pens or pencils
3. Clipboards (Optional)

Activity Guide

1. Distribute the Mammoths: Ice Age Giants worksheet. Encourage students to start their exploration of the exhibition by watching the short video near the entrance of the exhibition.
2. After watching the video and taking notes, encourage students to discuss their answers in groups.

Mammoths: Ice Age Giants Worksheet

Name: _____ Date: _____

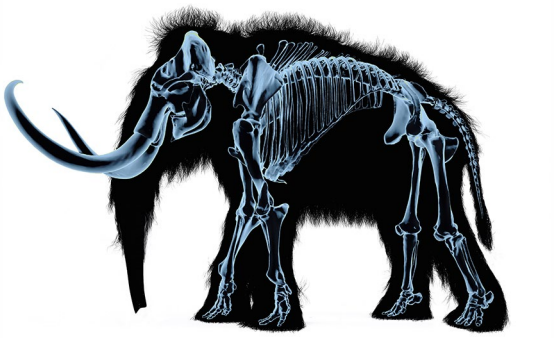
Answer the following questions as you explore the exhibition.

1. What is something you learned about the Ice Age? Write or draw your answer.

2. Name or draw three animals that lived during the Ice Age.

3. What modern animals are closely cousins of mammoths? Write or draw your answer.

4. Below is a diagram of the woolly mammoth. Go measure yourself on the wall, then draw yourself to the appropriate size.



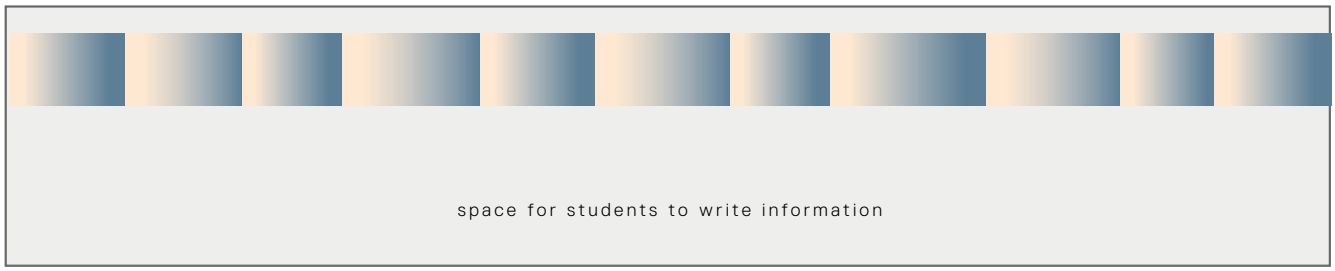
POST VISIT ACTIVITY

Supplies

1. Butcher paper
2. Rulers

Prep

1. Using butcher paper, make an ice core using the measurements below (six feet is needed at least to provide enough space for the ice core). Draw the ice core towards the top of the page, as students will be writing information below. (Note: Ice cores typically have two layers per year, representing the summer and winter season. We suggest that instead of making two separate layers, shading one side of the layer darkly and leaving the other light as shown below).



Activity Guide:

1. Ask your students how scientists might be able to know how cold it was in the past. Get the students excited about using the tools that scientists use to measure the past.
2. Tell your students that you are going to use ice cores to measure past temperature. Tell your students how ice cores were made and how they are collected.
   This video can be a useful resource: https://www.youtube.com/watch?v=tgp-v7mcjFM
3. Unroll the ice core you made before class and tape it to the board. Tell your students that they are going to measure an ice core that was made between 10 and 20 years ago.
4. Tell them that every time they see a line, that another year has passed. The space between two lines shows us how much snow has fallen.
5. Ask students if a big distance between two lines indicates a warm year or a cold year (Answer: Cold year, lots of snow has fallen).
6. First, have the students practice counting between 10 and 20. Write down the numbers below the ice core as you count them.
7. Next, have 11 students volunteer to take measurements. They should hold the ruler up to one line and measure to the next. After measuring, they should write the number of inches below the year.
8. After each year has been measured, have another 11 students volunteer to draw one, two or three snowflakes on each measured year, depending on the total amount of snowfall. 2 or 4 inches should be one snowflake, 6 or 8 inches should be two snowflakes, and 10 or more inches should be three snowflakes. You may have to show students how to draw intersecting lines to make a snowflake.
9. Finally, as a class count the total number of one, two and three snowflake years and write that down on the paper.
10. Tell your students that scientists have measured cores that go all the way back to the dinosaurs! (Note: Not all of these cores are ice cores, but sediment cores work very similarly). Ask your students what they think an ice core from the Ice Age might look like.

Time (Years Ago)	Inches
10	4 ❄
11	8 ❄❄
12	2 ❄
13	6 ❄❄
14	10 ❄❄❄
15	8 ❄❄
16	4 ❄
17	2 ❄
18	2 ❄
19	10 ❄❄❄
20	10 ❄❄❄

3-5 Extension: Growing Up Mammoth

Students have probably realized that humans grow more slowly than most common pets, but they may not have yet realized that these timing differences reflect different survival strategies. In the first part of the lesson, students will examine the life history traits of many familiar animals and start to build hypotheses about why humans grow up differently from other animals. After visiting Mammoths: Ice Age Giants, students will be able to apply observations made in the exhibition to life history analysis, as they step into the role of paleontologist and solve a mystery of mammoth proportions.

ACTIVITY GOALS

1. Learn the basics of life history theory by comparing across multiple mammals.
2. Understand the strengths and weaknesses of different life history strategies.
3. Use measurements to make predictions.
4. Understand how scientists use living animals and past measurements to make predictions about the life of extinct animals.

CPALMS STANDARDS

SC.3.N.1.3, SC.3.N.1.7, SC.3.L.15.1, SC.4.L.16.3, SC.4.L.16.2, SC.4.L.16.4, SC.5.L.17.1, SC.5.L.14.2

PRE-VISIT ACTIVITY

Supplies

1. Whiteboard or chart paper
2. Access to internet or encyclopedias

Prep

1. Create a chart similar to the one shown below.

Key Terms

Life History: a field of science that examines how the timing of different stages of a life cycle
Gestation: the time when a baby is growing in the mother's womb
Litter size: the average number of babies born at a time

Activity Guide

1. Ask students if they have heard of life history.
2. Tell your students that they are going to study the life history of their class. It is okay if they do not have answers to all the questions, you can just provide the average listed below. Ask students to report:
    a. How long their gestation took
    b. Whether they were a twin singleton or multiple birth (litter size)
    c. How big they were at birth
    d. What age they lost their first baby tooth
    e. What age they think they will be when they are fully grown physically
    f. How big they think they will be when they grow up
    g. How long they think humans live
3. As the students give their responses, write down each response under the "human" column of the chart. Make sure to use units!
4. After filling out all this information in a class chart, your students will probably notice that while there is some variation in the class, that many of the answers cluster around the same responses. Ask students why they think variation exists.

PRE-VISIT ACTIVITY (CONTINUED)

3 -5 Extention Activity Guide (Continued)

5. Now, tell your students that they are going to be able to compare human life history with the life history of other animals. Ask your students if they think all animals grow up in the same way. (Your students may have heard, for example, that one human year is equivalent to seven dog years. While this isn't exactly true, it can be a great starting point for discussion.)
6. Divide your students into groups and assign them each one of the following five animals: mouse, border collie, domestic cat, African elephant, Orca. Give them time to research that animal's life history. Make sure they use reputable sources when searching online. (Note: The numbers below represent an average from several sources. Your students may find slightly different numbers).
7. Have each group report the numbers to the class.
8. Discuss the results as a class:
    a. Which animal grows up most quickly? (Answer: A mouse!)
    b. Which animal grows up least quickly? (Answer: Both humans and elephants!)
    c. Do animals where who typically have more than 4 babies at birth grow up slowly or quickly? (Answer: They grow up quickly.)
    d. Do animals who typically have one baby at birth grow up slowly or quickly? (Answer: They grow up slowly.)
    e. Why do you think that animals that grow up slowly have only one baby at a time? (Answer: Elephants, orcas and humans have relatively big babies. Also, the offspring of these animals tend to need more support from parents finding food.)
    f. What are some of the advantages and disadvantages of the mouse life history? (Answer: Advantages: lots of offspring so some infant mortality is okay, reach maturity quickly so don't need a lot of parental investment. Disadvantage: Limit on how much an offspring can learn from a parent.)
9. Tell your students that they are going to explore the growth of an extinct close cousin of the elephant, the woolly mammoth. Ask students to make a prediction about how the mammoth might grow up. Do they think it will grow up like a mouse, a border collie or an elephant? (Answer: Elephant, as animals that are closely related to one another tend to grow up in the same way).
10. After the activity, keep the chart your students made, as it will be helpful to complete the post-visit activities.

Trait	HUMAN	MOUSE	BORDER COLLIE	DOMESTIC CAT	COW	AFRICAN ELEPHANT	ORCA
Gestation Length							
Litter Size							
Size at Birth (note shifting units)							
Age at first tooth loss							
Age at maturity							
Size at Maturity							
Lifespan							

ANSWER KEY

Trait	HUMAN	MOUSE	BORDER COLLIE	DOMESTIC CAT	COW	AFRICAN ELEPHANT	ORCA
Gestation Length	~250 days	20 days	60-65 days	60-65 days	280 days	~600 days	~500 days
Litter Size	1+ humans	~8 mice	~4 dogs	~4 cats	1-2 cows	1 elephant	1 whale
Size at Birth (note shifting units)	~8 lbs	1-2 grams	7-14 ounces	3-5 ounces	80 lbs	200 lbs	300 lbs
Age at first tooth loss	72 months (6 years)	(Only one set of teeth)	3 months	3 months	18 months	24 months	(Only one set of teeth)
Age at maturity	18 years	2 MONTHS	1.5 years	1 year	1.5 years	20 years	6 years
Size at Maturity	50-80 inches tall	4 inches long	20 inches tall	9-10 inches	50 inches tall	100-120 inches tall	Up to 350 inches long
Lifespan	~80 years	~1 years	~12 years	~15 years	~20 years	60 - 70 years	45-50 years

DURING THE VISIT

Supplies

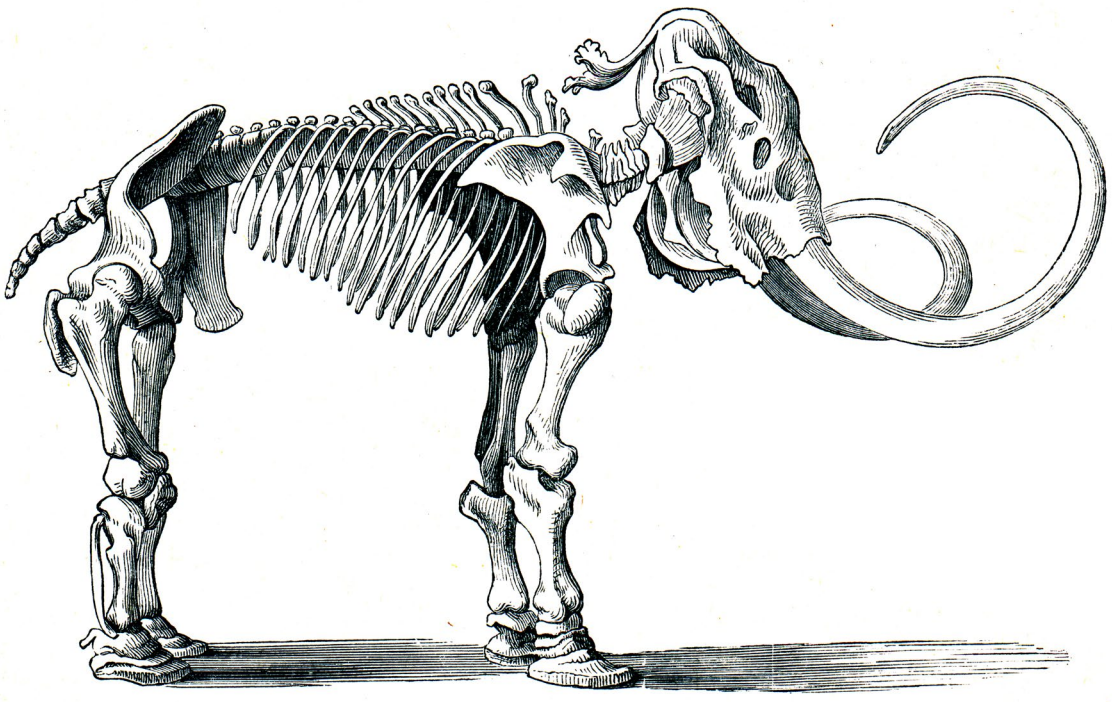
1. *Mammoths: Ice Age Giants* Worksheet
2. Pens or pencils
3. Clipboards (Optional)

Activity Guide

1. Distribute the *Mammoths: Ice Age Giants* worksheet. Encourage students to start their exploration of the exhibition by watching the short video near the entrance of the exhibition.
2. After watching the video and taking notes, encourage the students to discuss their answers in groups.

***Mammoths: Ice Age Giants* Worksheet Question 1 Answer Key**

a. F
b. T
c. F
d. T
e. T
f. F
g. F
h. F



Mammoths: Ice Age Giants Worksheet

Name: ..... Date: .....

Answer the following questions as you explore the exhibition.

1. True or False – Circle whether the statement is true or false once you find the answer in the exhibition.

a.	Mammoths lived at the same time as dinosaurs.	T	F
b.	Mammoths lived at the same time as humans.	T	F
c.	Mammoths primarily ate meat.	T	F
d.	There were mammoths in Ice Age Miami, even if they weren't woolly mammoths.	T	F
e.	Woolly mammoths are more closely related to Asian elephants than they are to African elephants.	T	F
f.	Mastodon is another word for mammoth.	T	F
g.	Mammoths went extinct only about 100 years ago.	T	F
h.	Mammoths were only found in North America.	T	F

2. List one reason why scientists think woolly mammoths may have gone extinct. Write a sentence to describe the evidence.

   Reason:

   .....

   .....

   .....

   Evidence:

   .....

   .....

   .....

3. Draw the relationship between mammoths, Asian elephants, African elephants, and mastodons, as shown on the timeline. Make sure you label the timeline.

POST VISIT ACTIVITY

Supplies

1. Mammoth bones pictures (Pages 13 - 19)

Key Terms

1. **Cartilage:** tough flexible material found between bones that offers cushion and support
2. **Epiphyseal Plate:** section of cartilage between two parts of a bone on children that goes away as the bone fuses
3. **Archaeologist:** a scientist who studies past humans
4. **Paleontologist:** a scientist who studies the past, which may focus on humans, dinosaurs, or even plants
5. **Proximal:** the part of the bone closest to the middle of the body
6. **Distal:** the part of the bone furthest away from the middle of the body

Activity Guide

1. Start by telling your students that you have 206 bones in your body. By show of hands, ask your students to vote whether they have more bones or fewer bones.
2. Surprise your students by telling them they have more than 250 bones in their body, which is more than you. Ask your students why that might be the case?
3. Explain that both human and animal children have more bones in their body than adults. That's because bones start off as separate pieces then grow together over time while maintaining a strong joint.
4. Show your students an example of the juvenile tibia (the big bone between your knee and your ankle). Explain that if the bone grew at the ends, the knee and ankle would be unstable. Instead, the bone is in three different pieces, connected by cartilage. Cartilage is something they can feel by touching the top part of their ears).
5. Tell your students that by counting the number of bones that a human has, you can tell how old that human is.
6. Ask your students why an archaeologist, or someone who studies past humans, might use this to understand the past. (Answer: they can understand how old someone was when they died, giving them a clue to how they lived).
7. Tell your students that paleontologists can use this information in a similar way. Explain that the mammoth they saw yesterday is of age unknown and their job is to figure out how old the mammoth is.
8. Review the names of the long bones (humerus, radius, ulna, femur, tibia, fibula) as well as the words proximal and distal.
9. Show students the photos of an unfused bone, a fusing bone and a fused bone. Show them what they are looking for in each case.

Proximal Humerus (Top of Arm)

Proximal Ulna (Top of Forearm)

Distal Humerus (Bottom of Arm)

Distal Ulna
(Bottom of Forearm)

Distal Radius (Bottom of Forearm)

Proximal Femur
(Top of thigh)

Distal Femur (Bottom of Thigh)

POST-VISIT ACTIVITY (CONTINUED)

3 -5 Extention Activity Guide (Continued)

Bone	**Mammoth Age of fusion**	**Human Age of fusion**	**Dog (~70 lbs) Age of fusion**	**Our Specimen (Unfused/Fusing/Fused)**
Proximal Humerus	40-45 years	15-23 years	10-12 months	
Distal Humerus	10-15 years	10-16 years	5-8 months	
Distal Radius	45-50 years	17-22 years	6-11 months	
Proximal Ulna	30-35 years	14-17 years	5-8 months	
Distal Ulna	45-50 years	18-21 years	6-11 months	
Proximal Femur	45-50 years	16-19 years	6-12 months	
Distal Femur	35-40 years	15-21 years	6-11 months	

3 -5 Extention Activity Guide (Continued)

ANSWER KEY

Bone	**Mammoth Age of fusion**	**Human Age of fusion**	**Dog (~70 lbs) Age of fusion**	**Our Specimen (Unfused/Fusing/Fused)**
Proximal Humerus	40-45 years	15-23 years	10-12 months	Fusing
Distal Humerus	10-15 years	10-16 years	5-8 months	Fused
Distal Radius	45-50 years	17-22 years	6-11 months	Fusing
Proximal Ulna	30-35 years	14-17 years	5-8 months	Fusing
Distal Ulna	45-50 years	18-21 years	6-11 months	Unfused
Proximal Femur	45-50 years	16-19 years	6-12 months	Unfused
Distal Femur	35-40 years	15-21 years	6-11 months	Fused

6-8 Extension: Climate or Hunting?

Scientists have multiple hypotheses for why the woolly mammoth went extinct, and it is up to your students to analyze the evidence and draw conclusions. Your students will explore extinction in animals past and present then analyze the main drivers of extinction. Another main goal of this lesson is to help students build confidence with more advanced nature of science skills including understanding inductive reasoning, articulating uncertainty, and evaluating multiple hypotheses. These skills form the building blocks of the more independent scientific inquiry that will help students be prepared to tackle independent research, both in science and in other subjects.

ACTIVITY GOALS

1. Explore the basic reasons for why animals go extinct.
2. Practice using induction to sort science data into categories.
3. Analyze potentially conflicting hypotheses, being explicit about the presence of uncertainty.

CPALMS STANDARDS

SC.8.N.1.4-6, SC.7.L.15.1-3, SC.8.N.3.2, SC.6.N.3.1

PRE-VISIT ACTIVITY

Supplies

1. Animal cards below
2. Scissors

Activity Guide

1. Ask students what they know about extinction. Students will likely provide answers about animals that have gone extinct, propose a general definition of extinction, or offer some causes of extinction.
2. Ask students to suggest some causes of extinction.
3. Divide your students into groups of 3-4 students. Give each group the extinct animal activity cards and have them cut out each card. Tell them that they are going to use inductive reasoning to sort the 12 animals into categories based on why they went extinct. After they have sorted the species, they should write 1-2 sentences for each grouping that describes how they sorted them. Remind them that there may not be one right answer, but they should be able to justify their categories.
4. Students should spend about 10-15 minutes reading the cards, discussing the categories with their group, then writing a sentence to describe their category. *(Students may use some of the HIPPO categories or may come up with their own classification system).*
5. Once all the groups have finished, have each group present the categories to the class. Discuss why certain groups got different answers.
6. Present the idea of HIPPO as one acronym that scientists use to categorize extinctions. HIPPO stands for **H**abitat loss, **I**nvasive species, **P**ollution, over**P**opulation, and **O**verharvesting. Ask students how closely those categories matched their own. *Note: The goal isn't to say the students are right or wrong, but to present the idea of there being different ways of organizing sets of data.*
7. After every group has presented, note that the extinctions that were discussed today were recent extinctions. Ask students if they have heard of extinct animals that lived a long time ago. Students will likely mention dinosaurs but may also mention Ice Age animals like the woolly mammoth.
8. Ask students how scientists can know which reason an animal went extinct if they cannot observe as closely as an animal that recently went extinct.
9. Introduce *Mammoths: Ice Age Giants* as a field trip and tell your students that they are going to investigate a mystery about why the woolly mammoth went extinct.
10. Introduce the two competing hypotheses. Some scientists believe that woolly mammoths went extinct because they were overhunted by humans. Others believe that woolly mammoths went extinct because of climate change at the end of the Ice Age. Explain that scientists haven't come to a single conclusion yet, so it will be up to them to evaluate the evidence and decide.

6-8 EXTENSION
PRE-VISIT ACTIVITY

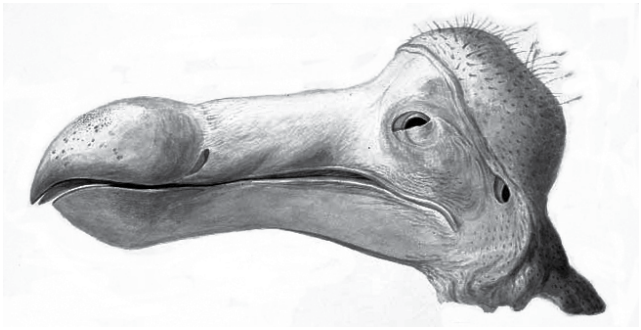
Information for Animal Cards (Pre-visit activity)

Please print the following pages and cut along the dotted lines to make 12 animal cards.

Guam Broadbill

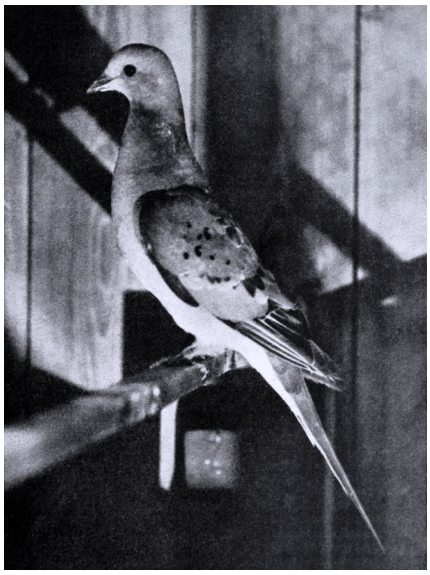
This small bird went extinct in 1983. The Australian brown tree snake, a predator of the bird, was introduced to Guam by a World War II cargo ship in the 1940s. The snake had no predators on Guam and quickly multiplied in number. Scientists believe that it was this increased predation pressure that led to the broadbill's extinction.

Dodos



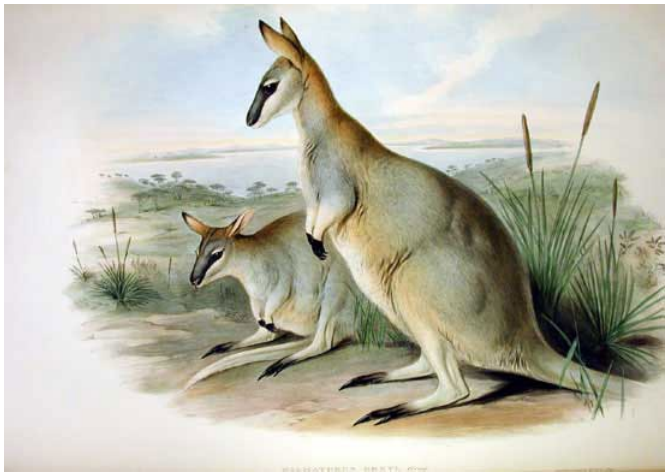
Dodos were a flightless bird that evolved on an island where they had no natural predators. When humans arrived on Mauritius in the 1600s, they were quickly able to capture and kill them. Humans also destroyed the forest habitats of the dodo and introduced other predators to the island, such as pigs. Together, these factors led to the quick extinction of the species by 1700.

Passenger Pigeon



Passenger pigeons were native to the Eastern United States. When European settlers arrived, they started hunting these animals on a massive scale, resulting in extinction by 1914.

Toolache Wallaby

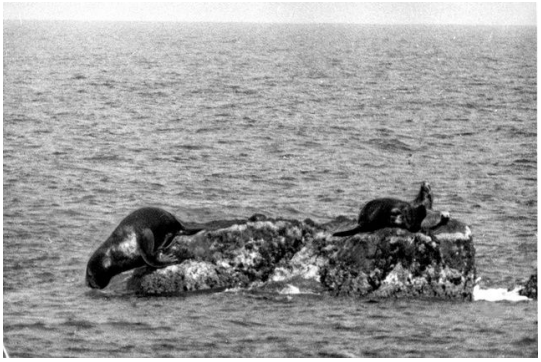


These Australian animals went extinct in the 1930s. Originally this species lived in swamps, but European settlers drained the swamps for farmland. The introduction of the red fox and dingo may have also contributed the extinction.

Xerces Blue Butterflies

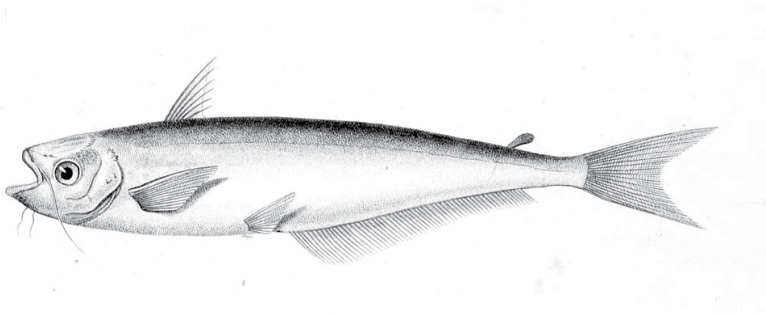
This butterfly used to be common in California. Its food was largely from the lotus plant. When humans disturbed the soils, the lotus plant couldn't grow and the butterfly soon went extinct, likely around 1942.

Japanese Sea Lions



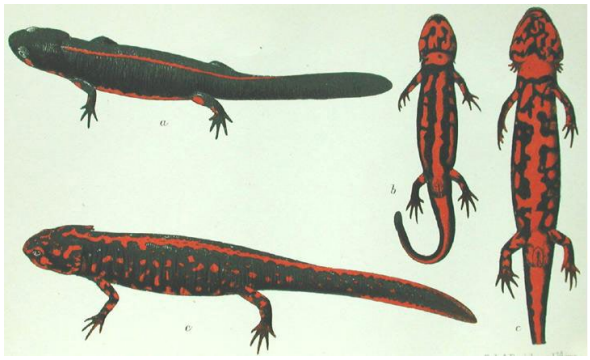
These animals went extinct in the 1970s. Their fat stores were considered a good source of oil and were also harvested for medicine. Scientists think overharvesting led to their extinction.

Siamese Flat-Barbelled Catfish



This Taiwanese species went extinct some time during the 1970s. The damming of rivers and the pollution from industrialization were ultimately thought to be the cause.

Yunnan Lake Newt



This animal went extinct in the 1970s when its lakeside habitat was damaged by pollution. Duck hunting and the introduction of other species to its habitat may have also contributed to the decline of this species.

Golden Toad

This Costa Rican species went extinct in 1987. Habitat disturbances meant that its numbers were low and a drying climate made it easier for fungal infections to take root.

Pinta Giant Tortoise

This species was native to the Galapagos Islands until it went extinct in 2012. Hunting this large, slow species seems to be the primary cause of extinction.

Bramble Cay Melomys

This small rat lived on an island greatly impacted by sea level rise. After increased storm surges caused a decline in this animal's food, it slowly went extinct, ultimately disappearing in 2016.

Kakawahie

This Hawaiian bird went extinct in the 1960s. Both habitat destruction and human introduction of disease-spreading mosquitos led to its extinction.

DURING THE VISIT

Supplies

1. *Mammoths: Ice Age Giants* Worksheet
2. Pens or pencils
3. Clipboards (Optional)

Activity Guide

1. Remind your students that they are visiting to help scientists solve a mystery about why the woolly mammoth went extinct.
2. Tell them that scientists base their theories on facts, so they should spend time in *Mammoths: Ice Age Giants* discovering facts about the woolly mammoth.
3. Distribute the worksheet and have students first start their journey through the exhibition by watching the video and taking notes. Then they should gather evidence to answer the other questions on their worksheets.

Mammoths: Ice Age Giants Worksheet

Name: ..... Date: .....

Scientists are still puzzled by how the woolly mammoth went extinct. Your job today is to first gather basic facts about the woolly mammoth and its Ice Age world, then start recording evidence for the two competing hypotheses.

1. Basic Facts about the woolly mammoth
    a. Where did it live? .....
    b. What habitat did it prefer? .....
    c. When was it first found? .....
    d. When was it last found (when did go extinct)? .....
    e. What type of food did it eat? .....
    f. What other animals lived at the same time (hint: there are at least five listed in the exhibit)?
    .....
    .....

2. The exhibition suggests that there are two reasons the woolly mammoth went extinct, one because of climate change and the other because of human hunting. Fill in the chart below based on your observations and the information presented in the video and exhibition text.

Hypothesis	**Human Hunting**	**Climate Change**
One sentence description ⟶		
Three (or more) pieces of evidence that you find in the exhibition that support this hypothesis. ⟶		

POST VISIT ACTIVITY

Supplies

1. Post-it notes (4 colors)
2. Large white paper
3. Computers or encyclopedias

Prep

1. Divide large white paper into two sections, labeled human hunting and climate change.

Activity Guide

1. Remind students that scientists use evidence to support theories. Even when they interpret evidence differently, their interpretations are all based in evidence. Tell students that they will get the opportunity to evaluate data like a real scientist today.
2. Distribute post-it notes. Ask students to raise their hands and volunteer pieces of evidence to support one of the two hypotheses. As unique evidence for a hypothesis appears, have students write it down on a post-it note and stick it to the chart. If students have a piece of evidence against the hypothesis (for example, mammoths persisted for many after years after the arrival of humans), they should write it down on a second color post-it and stick it on the chart.
3. Once students have shared all of their information from visiting *Mammoths: Ice Age Giants*, ask students what questions they have about each hypothesis that would potentially resolve their thinking. For example, one question could be "Did humans hunt any other Ice Age mammals to extinction?" Write these questions down on a third color post-it note and stick it to the chart.
4. Tell students that they have asked really good questions. Some of the questions may be able to be answered and others may not. Assign each student 2-3 of the questions (multiple students will have the same question) and give them around 15 minutes to research the questions on their own. Remind them to use good sources and practice appropriate internet safety. If a student discovers the answer to the question, have them write it on the fourth color of post-it and attach to the chart.
5. After students have had time to research, as a class review what questions are known and what questions remain unknown.
6. Have volunteers summarize the evidence for each hypothesis, considering this new research.
7. Give students 10 minutes to evaluate the hypotheses and write 3-4 sentences explaining how they interpret the existing evidence. Let them know that an interpretation that includes both causes is also appropriate.
8. After having students reflect, ask them what paleontological find could convince them of the other hypothesis. Have them write this at the end of their reflection.
9. Have students share their results, first with a partner then with the class. *Note: we recommend not counting which hypothesis received more votes. Instead, focus on the approach taken to reach the conclusion.*
10. Congratulate your students on being able to evaluate evidence like real scientists. Point out that scientific discovery doesn't happen by memorizing facts, but by grouping them and analyzing them like they've done today.