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Science Standard
7.4.g.

Student Workbook

California Education and the Environment Initiative

Extinction: Past and Present

California Education and the Environment Initiative

Approved by the California State Board of Education, 2010

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California Environmental Protection Agency
California Natural Resources Agency
Office of the Secretary of Education
California State Board of Education
California Department of Education
California Integrated Waste Management Board

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Key Partners:

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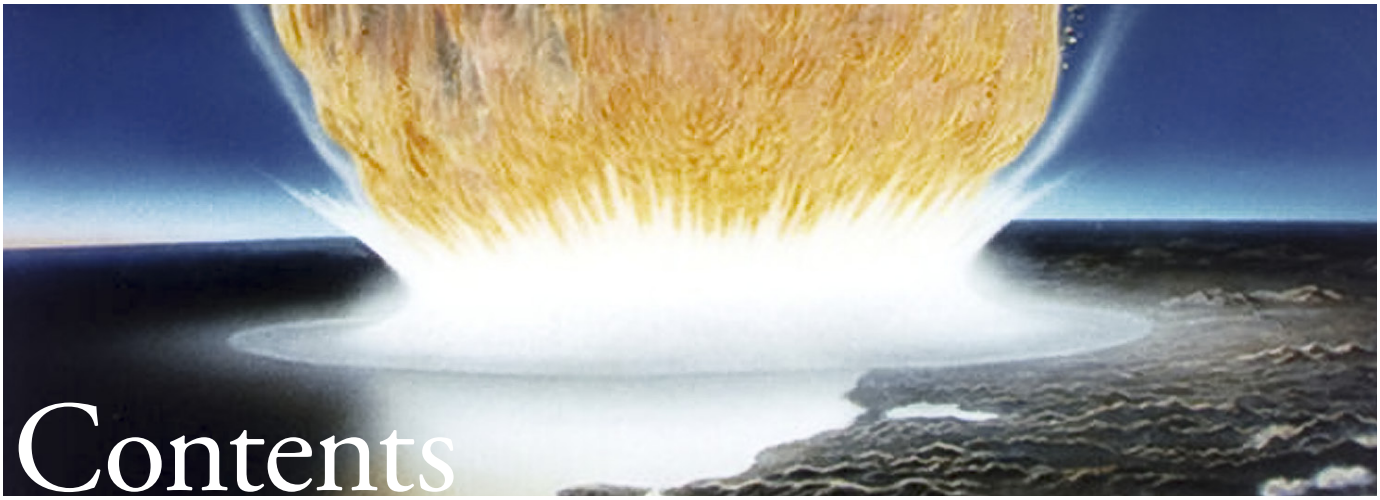

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Background extinction rate: The relatively constant rate at which species become extinct over the course of geologic time.

Biological diversity (biodiversity): A measure of the number of different species of organisms in a specific area.

Climate change: A long-term significant change in the weather patterns of Earth.

Crude oil: The oil before it has been refined and made into gasoline and other products.

Diversification: The increasing variety of species in a system.

Ecosystem goods: Tangible materials, such as timber and food, produced by natural systems, that are essential to human life, economies, and cultures.

Ecosystem services: The functions and processes that occur in natural systems, such as pollination, that support or produce ecosystem goods and help sustain human life, economies, and cultures.

Endangered: The legal status of a plant or animal species that is in danger of becoming extinct.

Extinction: The death of all members of a species or other taxa.

Extinction event: A major decrease in the number of species on Earth in a relatively short period of time.

Fossil: The remains of a plant or animal preserved in rock, another geological deposit, or petrified.

Habitat destruction: Damaging a habitat to the extent that it cannot meet the needs of organisms that live and meet their needs there.

HIPPO: An acronym for the phrase, "habitat destruction, introduced species, pollution, population growth, and overexploitation."

Mass extinction: The extinction of many species at the same time.

Megafauna: Large animals with long lifespans.

Microfossil: Fossils that are very small and usually must be studied using a microscope.

Nonnative species: Organisms that were not originally found in an area, but were transported there through human activity.

Paleontologist: A scientist who studies Earth's past by looking at fossils.

Pleistocene epoch: The geologic era that began 1.8 million years ago and ended about 12,000 BCE, often called the "ice age" because it was characterized by cold periods accompanied by widespread glaciers.

Sedimentary layers: Compacted and "cemented" hard beds or strata of rocks, typically formed where small pieces of minerals and rocks are deposited over a very long time.

Name: _____

Instructions: Read ***California Connections: Puzzle in the "Tar" Pits*** and answer questions 1 and 2 in the chart below.

1. What kinds of fossils from the late Pleistocene epoch have scientists found at the La Brea Tar Pits?

Plant Fossils	Animal Fossils

2. Approximately 12,000 years ago, many of these organisms became extinct. Put an "X" next to the animals in the chart above for which we have not found fossils younger than about 12,000 years.

Name: _____

Instructions: Answer Questions 3-10 in the spaces provided. (2 points each)

3. Based on the fossil evidence, which categories of animals became extinct?

_____

_____

_____

4. What kinds of evidence suggest that humans lived in North America in the late Pleistocene?

_____

_____

_____

_____

_____

5. Examine the fossil evidence you listed in question 1. What does it suggest about how the climate in La Brea in the late Pleistocene was different than it is today?

_____

_____

_____

_____

_____

6. Give two examples of what fossil evidence from the tar pits does not explain. What are fossils not able to tell us?

_____

_____

_____

_____

_____

Name: _____

7. Approximately how long did it take for the climate to change from the end of the Pleistocene to current conditions?

_____

_____

8. In geologic time, is this a rapid change or a gradual change? Why?

_____

_____

_____

_____

_____

9. In geologic time, is the extinction of the megafauna (large animals) at the end of the Pleistocene a rapid change or a gradual change? Why?

_____

_____

_____

_____

_____

10. Scientists do not agree about whether humans influenced extinctions during the Pleistocene. Give one reason why some scientists believe humans may have increased the rate of extinction of megafauna during that time.

_____

_____

_____

_____

_____

Name: _____

Instructions: Use **Data on Global Temperature**, **Data on Atmospheric CO_2**, and **Fossil Data by Era and Period** to complete the chart below describing each of Earth's geologic periods.

Paleozoic Era						
	Cambrian Period	**Ordovician Period**	**Silurian Period**	**Devonian Period**	**Carboniferous Period**	**Permian Period**
Time span						
Plants and Animals						
Climate						
Atmospheric Gases						

Name: _____

	Mesozoic Era			Cenozoic Era
	Triassic Period	**Jurassic Period**	**Cretaceous Period**	**Tertiary and Quaternary Period**
Time Span				
Plants and Animals				
Climate				
Atmospheric Gases				

Name: _____

Instructions: Use the information you collected on **Changes Across Time** to answer the following questions in the spaces provided.

1. Name two periods in which there were rapid changes on the geologic timeline. Describe the changes to the plants and animals, climate, or atmospheric gases that occurred during these periods. (5 points for each example, 10 points total)

_____

_____

_____

_____

_____

_____

_____

_____

_____

2. Name two periods in which there were gradual changes on the geologic timeline. Describe the changes to the plants and animals, climate, or atmospheric gases that occurred during these periods. (5 points for each example, 10 points total)

_____

_____

_____

_____

_____

_____

_____

_____

_____

Name: _____

Instructions: Read each of the **Extinction Case Studies** and complete the chart below.

Case Study	Organism(s) That Went Extinct (1 point per cell)	Was This a Mass Extinction or Not? (1 point per cell)	Other Changes That Occurred During This Time (4 points per cell)
Permian		**Circle one:** yes no	
Mesozoic		**Circle one:** yes no	
Cretaceous		**Circle one:** yes no	

Name: _____

Instructions: Answer the following questions in the spaces provided. (3 points each)

1. In which case study was the rate of extinction the most **rapid**? Explain your answer.

2. In which case study was the rate of extinction the most **gradual**? Explain your answer.

3. In which case study do you think Earth saw the **greatest amount of change** overall? Explain your answer.

Instructions: Use the information from your analysis of the **Late-Permian Extinction Evidence** to answer the following questions in the spaces provided.

1. What differences do you notice between the fossils in the top and bottom layers? _____

_____

_____

2. Where are the oldest fossils? _____

_____

3. What does this fossil evidence show about changes in Earth's past? _____

_____

_____

Archeological Dig Instructions: As you excavate your core sample, use the **Fossil Resource Information** to determine what species you have found. Record your findings in the appropriate columns on the next page. Use the table below to find the age of your samples. Record these years in the "Age of Rock Layer" column. Record the fossils and other evidence in the "Fossils or Geologic Evidence Found" column. Answer the questions in the "Analysis" column. (Notice that Sample A only has two layers. If you have sample A, the last row of your chart will be blank.)

(*Note: Ages of Sample Layers [MYA = million years ago]*)

	Sample A	Sample B	Sample C
Top Layer	500 MYA	190 MYA	35 MYA
Next Layer	600 MYA	206 MYA	50 MYA
Next Layer	none	220 MYA	55 MYA

Name: _____

Core Sample: _____

Age of Rock Layer	Fossils or Geological Evidence Found
	_____ _____ _____ _____ _____
	_____ _____ _____ _____
	_____ _____ _____ _____

Analysis (1 point each)

1. Which fossils were found in all layers of your sample?

   _____

   _____

2. Which fossils in your core sample are the youngest?

   _____

3. Describe some of the changes in organisms that are recorded in fossils and rock from layer to layer.

   _____

   _____

   _____

   _____

   _____

4. Based on the evidence from your core sample, what changes to the number of species on Earth happened during this time? Explain why.

   _____

   _____

Instructions: Answer the following questions in the spaces provided. (5 points each)

4. Based on your analysis, what event described in class might be represented by your core sample? _____

5. Based on your observations in this exercise, what is one piece of evidence about what occurred during this event? _____

_____

Name: _____

Instructions: Read each card about an endangered species in California. As a group, decide which human activities (HIPPO) have affected the rate of extinction of that species. Describe each activity under the HIPPO category it best relates to. (*Note: Not every cell must be completed.*) (1 point per cell)

Species	H (Habitat Destruction)	I (Introduced Species)	P (Pollution)	P (Population Growth)	O (Overcon-sumption)
California freshwater shrimp					
Salt marsh harvest mouse					
San Joaquin antelope squirrel					
Island fox					

Name: _____

Species	H (Habitat Destruction)	I (Introduced Species)	P (Pollution)	P (Population Growth)	O (Overcon-sumption)
California golden trout					
Guadalupe fur seal					
San Joaquin kit fox					
Grizzly bear					

Name: _____

Instructions: Working independently, answer the following questions in the spaces provided.

1. Humans alter the environment in many ways and the changes they bring can affect extinction rates. Explain how each of the following activities can endanger species other than humans. (2 points each)

   Habitat destruction: _____

   _____

   _____

   Introduced (nonnative) species: _____

   _____

   _____

   _____

   Pollution: _____

   _____

   _____

   Population growth: _____

   _____

   _____

   Overconsumption: _____

   _____

   _____

2. Which of the human activities listed above has had the greatest effect on the species extinction rates in California? (2 points)

   _____

   _____

Name: _____

Instructions: Listen to the descriptions for each of these animals and plants. Describe one ecosystem good or ecosystem service that the plant or animal provides to people. Write **EG** if it is an **"ecosystem good"** or **ES** if it is an **"ecosystem service."** (1 point each)

Plant or Animal Species	Ecosystem Good or Ecosystem Service
Black-backed woodpecker	
Bluefin tuna	
Cavendish banana plant	
Chincona	
Coral	
Dung beetle	
Honeybee	
Ladybug	
Little brown bat	
Mangrove tree	
Midge	

Name: _____

Plant or Animal Species	Ecosystem Good or Ecosystem Service
Rat snake	
Red-tailed hawk	
Silkworm	
Teosinte	
Vulture	

Instructions: Read the following statement and answer the questions below in the spaces provided. (2 points each)

The background extinction rate over geologic time is 10–100 species/year.

1. If the current extinction rate is one species every 15 minutes, how many species is that per hour?

   _____

2. How many species is that per day?

   _____

3. How many species is that per year?

   _____

4. Is the current extinction rate more rapid or more gradual than the background extinction rate?

   _____

Name: _____

Instructions: Answer the questions in the spaces provided. (3 points each)

5. Why do scientists think there is a mass extinction or extinction event going on right now?

_____

_____

_____

6. When a species goes extinct, the absence of the species affects the surrounding natural system. Give one example of how the extinction of one (nonhuman) species affects another.

_____

_____

_____

7. Give three examples of how the extinction of a species could affect our human society (the way we live).

_____

_____

_____

_____

_____

_____

_____

8. Why should we care about extinction?

_____

_____

_____

_____

_____

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