

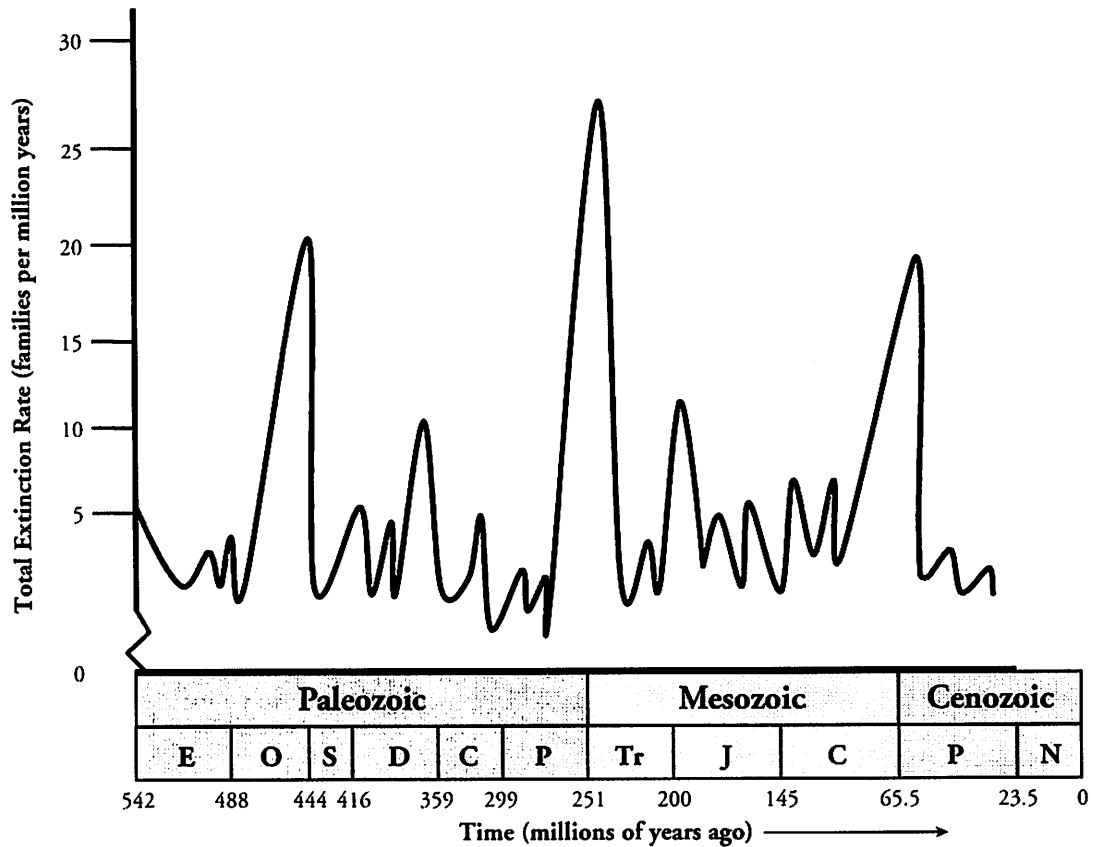
Mass Extinctions

What is the biological significance of mass extinctions?

Why?

Evidence suggests that five mass extinctions have occurred throughout the history of the Earth—the most famous of which led to the extinction of the dinosaurs. Scientists are still studying the causes of these catastrophic events. What can we learn from mass extinctions, and what is their impact on the diversity of life forms found on Earth?

Model 1 – Extinction Over Time



1. What are the names of the three eras identified on the x-axis in Model 1?
2. To what does the y-axis on the graph in Model 1 refer? (Include the unit of this variable.)
3. According to Model 1, approximately how long did each of these eras last?
 - a. Paleozoic
 - b. Mesozoic
 - c. Cenozoic

4. The letters below each era refer to discrete time periods that are listed in the table below. Complete the columns to indicate the approximate length of time each period lasted.

Era	Period	Length of time (in millions of years)
Paleozoic	Edicaran	
	Ordovician	
	Silurian	
	Devonian	
	Carboniferous	
	Permian	
Mesozoic	Triassic	
	Jurassic	
	Cretaceous	
Cenozoic	Paleogene	
	Neogene	

5. Circle the five major mass extinctions on the graph in Model 1.
6. List the period in which each mass extinction begins and ends.
- Mass Extinction 1 begins in _____ and ends in _____.
- Mass Extinction 2 begins in _____ and ends in _____.
- Mass Extinction 3 begins in _____ and ends in _____.
- Mass Extinction 4 begins in _____ and ends in _____.
- Mass Extinction 5 begins in _____ and ends in _____.
7. What appears to be one criterion that scientists use when defining the timing of geologic periods?



8. Scientists name mass extinctions using the name of the time period during which the extinction began. Using this information, with your group name each of the five mass extinctions.
9. Carefully study the graph in Model 1.
- a. The line on the graph is never flat. What does this tell you about the rate of extinctions over time?
- b. The line never reaches zero. What does this tell you?



10. Species may become extinct for many different reasons. Brainstorm with your group and list five different factors that might cause a large number of species to become extinct.

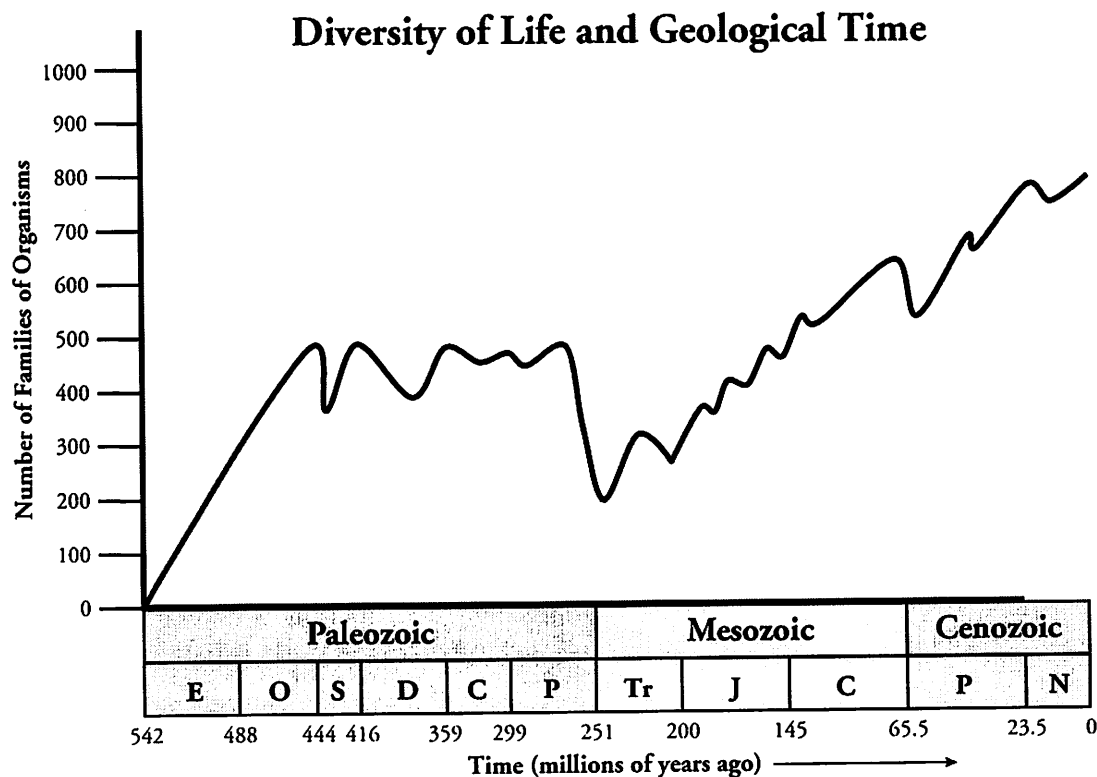
Read This!

During the Permian extinction, 96% of all marine animal species became extinct. One suggested explanation for this is a series of massive volcanic eruptions that produced enough CO₂ to warm the global climate by approximately 6 °C. The leading theory for the Cretaceous extinction (which led to the disappearance of dinosaurs), is that a large extraterrestrial object collided with the Earth and resulted in a cloud of debris that disturbed the global climate.

11. Look at your group's answers to Question 10. Were any of the explanations given in the *Read This!* box also on your list? If not, add them now.



Model 2 – Diversity of Life



12. How is the dependent variable in Model 2 different from that in Model 1?

13. What is the overall trend shown in the graph in Model 2?

14. The number of families of organisms is an indicator of **biodiversity**. Looking at the graph, what can you conclude about the biodiversity on Earth over the time period shown?

15. On the graph in Model 2, mark the location of the five mass extinction events depicted in Model 1 with arrows.
16. What is the *immediate effect* of mass extinctions on the number of families of organisms?

17. Using the graph in Model 2, estimate how long it takes for the number of families to recover after a mass extinction.

Read This!

Mass extinctions leave behind niches in ecosystems that can be filled by new or existing species that exhibit adaptations allowing them to survive in those spaces. This process is called **adaptive radiation**. For example, the fossil record shows that mammals living more than 65.5 million years ago were mostly small, rodent-like, burrowing creatures without much diversity. After the Cretaceous mass extinction, however, there was a dramatic increase in the number and types of mammals.

18. Propose an explanation for why small rodents were able to survive the Cretaceous mass extinction.



19. How did the extinction of the dinosaurs allow the adaptive radiation of mammals to occur?

20. What evidence do you see from Model 2 that large scale adaptive radiation occurred following the five mass extinctions?

21. Predict what would have happened if all of the early mammals living 66 million years ago had died out in the Cretaceous mass extinction?

22. Many biologists propose that we are currently in a sixth major extinction. If this is true, this mass extinction event may be the first caused by one of the Earth's inhabitants—humans. What human actions do you think may be the cause of the increased rate of extinction today?

23. What data could you collect that would support the idea that we are currently at the start of the sixth mass extinction?

24. In light of your group's answers to the previous questions, what would you predict to be the long-term result of a sixth mass extinction?

Extension Questions

25. What is the source of the data collected to produce the graphs used in this activity?
26. Every mass extinction leads to the rise of prominence of new groups of organisms. Using resources from the Internet, research what type of organisms were dominant after each of the five mass extinctions.