

Name: Student Answers

(Six pages)

Regular Classroom Row Number: \_\_\_\_\_

**HOUR EXAMINATION #2**

Geology/Interdepartmental 100: History of Life

April 7, 2017

(All tests are due at 8:50 a.m.)

1. The **Cambrian Explosion** was life's most spectacular adaptive radiation. Please list (no need to describe) below in the appropriate boxes the possible **extrinsic** causes (outside of life processes) and **intrinsic** causes (within life itself) of this evolutionary event. [10 points]

Possible extrinsic causes (list)

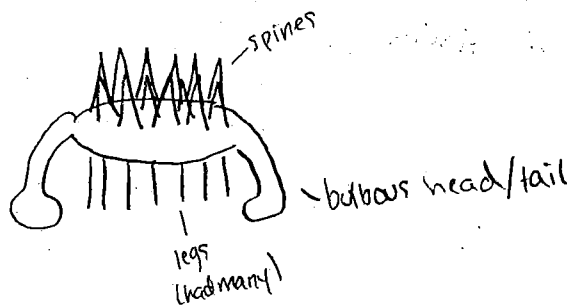
Ozone layer is in place  
O<sub>2</sub> level reaches a critical point

Possible intrinsic causes (list)

Development of the Coelem  
Development of the Skeleton

2. We discussed four genera of animals from the important Burgess Shale fauna of the Cambrian. Pick your favorite (just one), tell me its **name**, draw a simple **diagram** of it, and then describe its **life habits** (movement, feeding, etc.) [8 points]

Hallucigenia was a vagrant (walking) creature. It was a deposit feeder, using its bulbous head/tail (can't really tell them apart) to eat the muck on the sea floor. It protected itself from predators from above with spines on its back



3. Identify, define and/or describe any **three** of the following terms. Be sure to include **dates**, **examples** and **diagrams** where appropriate. For each selected term, state its importance in the History of Life. (If more than three are answered, only the first three are graded.) [15 points total]

homologous structure

A homologous structure is a similar structure or characteristic that indicates common ancestry between creatures. For example, humans and other mammals such as bats and dogs, have the same 21 limb structure (H-R). This is important to history of life because it allows identification of common ancestry between creatures.

Devonian fish (Tiktaalik)  
\* Labyrinthodonts (Acanthostega)  
- Limb structure, teeth

analogous structure

They are the opposite of homologous structures. They are structures that serve similar functions but have different ancestry. Like a birds wing and a bats wing. Both animals have developed flight, but in different ways. It's important to tracking ancestry and evolution as well.

Competitive Exclusion Principle

The competitive exclusion principle states that no two species may occupy the same niche at the same time in the same place. one will be excluded. This is why new organisms fill empty niches only after an extinction has occurred, allowing new species to fill a niche left empty after the species that formerly occupied that niche had gone extinct.

Archosaur

A large group of reptiles that include Crocodylia, Saurischia, Ornithischia, Therapods, and Pterosaurs that emerged in the Triassic. Their main shared feature was the placement of their teeth in sockets within the jaw thus giving them more biting power without fear their teeth will fall out like a shark's is.

nasal turbinates

A series of membranes found in the nasal cavities of endotherms that moisten and warm air coming in to the lungs, and dry and cool air coming out. Because endotherms breathe so much, this is necessary to preserve moisture and core temperature. It's possible that dros also had these.



(The cross-section was grossy)

4. The current hypothesis of the cause of the Permian extinctions is that massive volcanism began a process of global warming that led to catastrophe. Please answer the following questions about it --

What is our **evidence** for this Late Permian volcanic activity? [2 points]

The evidence are the Siberian traps which are layers of basalt.

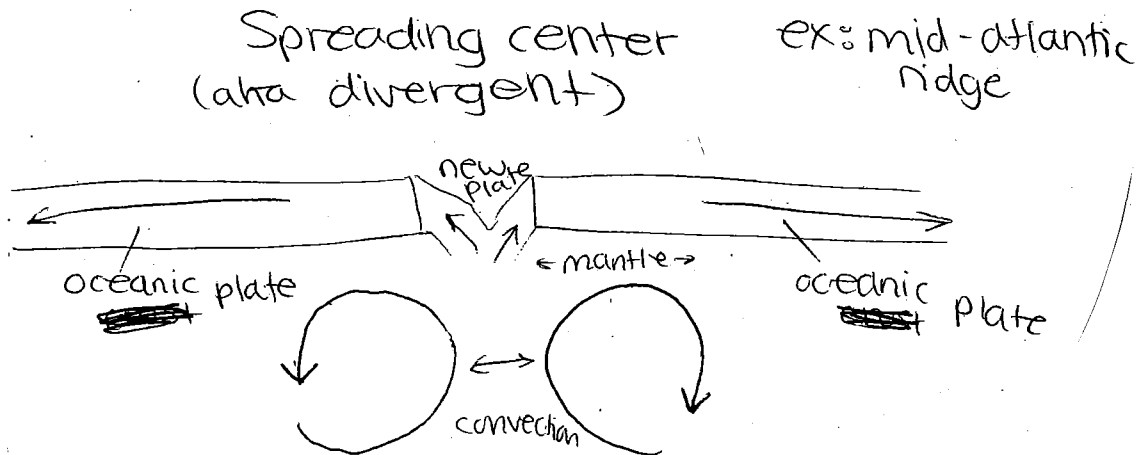
Why was there so much volcanic activity at this time? [5 points]

Pangaea was present at the time and with a large mass like a super-continent, heat was not able to escape through the crust. Heat from the core of the earth kept building up under the supercontinent and eventually it broke through, spewing molten rock out of volcanoes.

How can volcanic eruptions warm the atmosphere? [5 points]

Volcanic eruptions first create global cooling due to ash and other materials which temporarily block the sun. However, after this brief period, global warming occurs for a significantly longer amount of time. This is due to the greenhouse effect. Volcanoes release massive amounts of  $\text{CO}_2$  (and other greenhouse gases) which warm the Earth. The Earth would get heat from the sun, and when it bounces back as long infrared waves, more of it is absorbed rather than reflected. Additionally, the Siberian Trap set coal on fire which burns for a very long time, intensifying the greenhouse effect.

5. Please draw below a labeled cross-section through a **spreading center** showing with arrows which directions the plates move and the *convection cells* in the *mantle* beneath them. [10 points]



6. What is our evidence that predatory dinosaurs had a high rate of food consumption comparable to that of mammals? [10 points]

Typical predatory mammals have a high level of prey compared to a predator in an ecosystem. This ratio for lions is about 1 predator to 60 prey. There is evidence for a similar pattern in dinosaurs. This ratio is estimated to be about 1 predatory dinosaur to about 30 prey. This suggests they have a high rate of food consumption.

7. Please briefly describe below three lines of evidence that support the hypothesis that dinosaurs showed considerable care for their young. Be sure to give me the fossil evidence and not just the interpretations. [9 points]

First Line of Evidence

nests / eggs:

there ~~are~~<sup>is</sup> fossil evidence of nests ✓ w/ dinosaur eggs and youth. The eggs are crushed, meaning young didn't just hatch and leave; they stayed in the nests and were cared for.

Second Line of Evidence

regurgitation:

there is fossil evidence of ~~regurgitation~~  
herding / protection via footprints:

There is fossil evidence of young & adult footprints together, meaning the adults stayed w/ young and cared for / protected them. Namely, there is evidence of young Triceratops circled by adults who were protecting them from the T-Rex outside the circle.

Third Line of Evidence

brooding / incubation:

There is fossil evidence of an ✓ adult dinosaur sitting over the eggs in a "brooding" position, meaning they were ~~also~~ perched over the nest & incubating the eggs. This shows that dinosaurs didn't just lay their eggs & leave.

8. Fill in the blanks! All time terms must be spelled and capitalized correctly. [10 points total]

Period during which the first fish appeared: Cambrian

Period during which the first amphibians appeared: Devonian

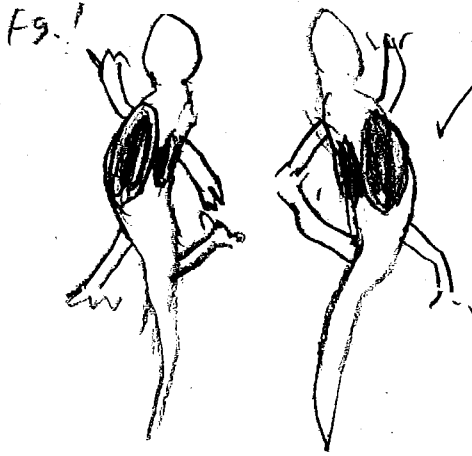
Period during which the trilobites went extinct: Permian

Period during which the first dinosaur appeared: Triassic

Period during which the first pterosaur appeared: Triassic

9. One reason dinosaurs survived the disruption of the Triassic Extinctions may have been that they did not have Carrier's Constraint. What is Carrier's Constraint and how did the early dinosaurs overcome it? [8 points]

amphibians and some reptiles have legs that sprawl to the side. When they walk, their bodies move, see Fig. 1. This forces the air out



of one lung, so they don't get as much oxygen while moving, and can't run for long distances as they get out of breath quickly. dinosaurs legs are underneath them, and so running doesn't force air out of their lungs. ✓



10. Birds and other theropod dinosaurs have air sacs as part of their respiratory systems. What use are these air sacs to their respiration? How does this system affect the structure of their bones? [8 points]

Birds and other theropod dinosaurs need lots of oxygen for the strenuous activity of running / flying, but their lungs are very small for such oxygen absorption. So, to solve this, theropod dinosaurs have air sacs which hold air that the dinosaurs breathe in. This allows theropods to have an airflow through the lungs which moves only in one direction and this allows them to absorb much more oxygen with their small lungs. ✓

In order to fit the air sacs in their bodies, theropods must store the sacs in their hollow bones. The bones are hollow in part to accommodate the air sacs.