

HOUR EXAMINATION #1
Geology 100: History of Life
September 22, 2017
(All tests are due at 8:50 a.m.)

| Parent → Daughter | Half-Life |
|--|-------------------|
| $^{40}\text{K} \rightarrow ^{40}\text{Ar}$ | 1.3 billion years |
| $^{14}\text{C} \rightarrow ^{14}\text{N}$ | 5730 years |

The table above contains the information you need for these questions. Always show your work and make certain your answers are clearly written in the boxes. These are not designed to be difficult!

1. A crystal in an igneous rock contains 5 μg of ^{40}K and 15 μg of daughter isotopes, including ^{40}Ar . How old is this rock? [7 points]

Age of the rock:
2.6 billion years old

(Show your work – or reasoning -- below)

| HL | P | D |
|----|----|-----|
| 0 | 20 | 0 |
| 1 | 10 | 5 |
| 2 | 5 | 2.5 |
| ? | | |

$$\begin{array}{r} 1.3 \\ + 1.3 \\ \hline 2.6 \end{array}$$

2. A horse bone that is 11460 years old has 10 μg of ^{14}C inside. How much ^{14}C did this bone have when the horse was alive? [8 points]

Amount of ^{14}C in the living horse bone:
40 μg

$$\begin{array}{r} 5730 \\ \times 2 \\ \hline 11460 \end{array} \quad \frac{11460}{5730} = 2$$

(Show your work – or reasoning -- below)

| P | $\frac{1}{2}L$ | |
|----|----------------|---|
| 40 | 0 | |
| 20 | 1 | |
| 10 | 2 | X |

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 will be graded.) [15 points]

biological species

A biological species can be defined as a group of organisms that ~~reproduce together~~ have independent sexual reproduction from other distinct organisms. Thus, an organism from one species cannot mate with an organism from another species and produce viable offspring. Its importance in the H.O.L involves evolutionary distinction ~~is~~ between organisms; special variation denotes evolutionary factors at work.

vestigial structure

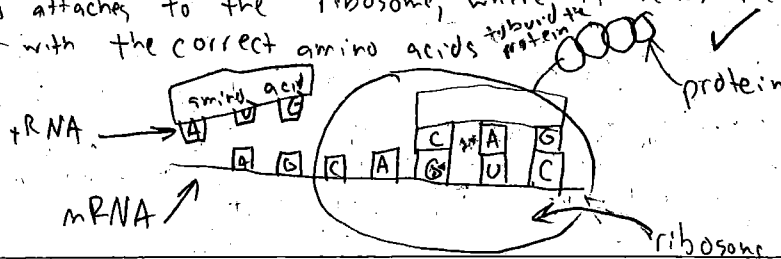
A structure in an organism body that used to serve a function, but is now virtually useless or not in use. Vestigial structures are evidences of evolution. Whales have vestigial hipbones, they must have evolved from some type of mammal that was capable of walking to have hipbones or else the hipbone wouldn't exist.

evolutionary convergence

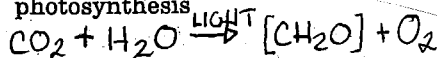
Evolutionary convergence is when two ^{genetically} different and unrelated species emerge with similar traits that help them deal with the environment. For example the similarities in body type between a Shark and a Dolphin. This is important because it shows the validity of Natural Selection in response to the environment.

ribosome

the ribosome is the protein factory of the cell, this is important to the history of life because it acts as a catalyst for creating proteins from amino acids. the mRNA attaches to the ribosome, where it reads the codon triplet of nucleotides and matches it with the correct amino acids.



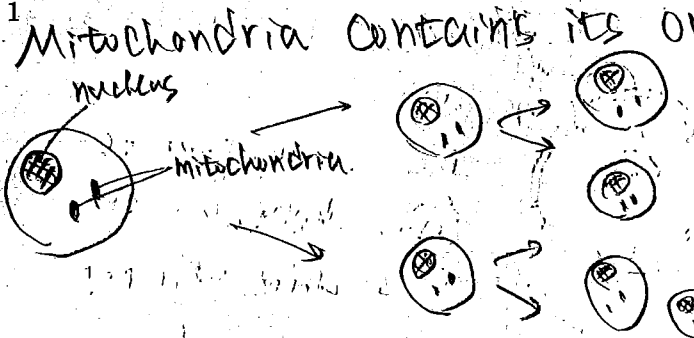
photosynthesis



PHOTOSYNTHESIS IS THE CONVERGENCE of CO_2 TO O_2 . THIS FUNCTION IS PERFORMED BY PLANTS & CYANOBACTERIA. THIS PROCESS IS IMPORTANT TO THE H.O.L BECAUSE W/O IT NO THING COULD LIVE ON THE SURFACE OF THE EARTH. THIS PROCESS IS ALSO TAKING OUT THE CO_2 WE DON'T NEED.

4. Briefly describe (don't just list) two lines of evidence supporting the Endosymbiotic Hypothesis for the origin of eukaryote cells. Please use the boxes below. The evidence can be in any order. [10 points]

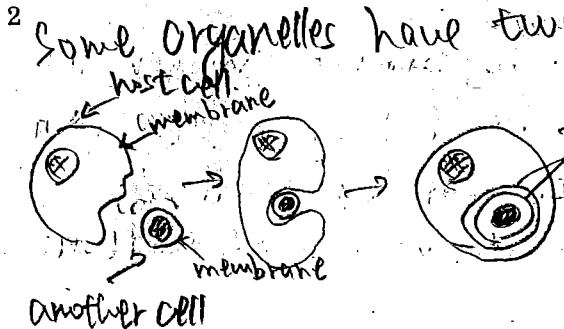
1 Mitochondria contains its own DNA ✓



nucleus
mitochondria

Mitochondrial DNA is separated from that in nucleus. And mitochondria replicates itself separately.

2 Some organelles have two membranes ✓



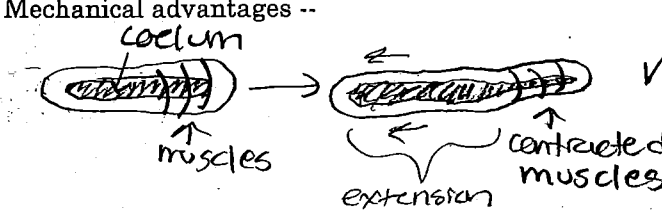
host cell membrane
another cell membrane

two membranes. During the process, the cell from outside gained another membrane from the host cell.

Good

5. What are the mechanical and respiratory advantages of a coelom in a simple worm? Please use the boxes below. [10 points]

Mechanical advantages --



coelom
muscles
extension
contracted muscles

when the worm contracts the muscles around the coelom, the body expands on the other end as water is incompressible. This allowed early worms to burrow under the mud for food. Their burrowing also provided protection and camouflage under the mud. ✓

Respiratory advantages --

The coelom - being a liquid filled cavity - could transport oxygen throughout the body, which made absorbing oxygen directly through the skin unnecessary. This allowed for organisms to be larger with more complex parts. ✓

6. How did the homogeneous **Protoearth** change into the layered **Earth** we know today? When you describe the primary sources of heat, indicate which was the most prominent. (Familiar question!) [10 points]

The homogeneous Protoearth was a mix of three main materials - ice, rock, and metal (specifically, iron). Protoearth heats up from three main causes - friction (gravity pulling the particles closer together), impacts (from objects in space), and radioactivity (which is the most important source). As Protoearth heats up, its materials begin to melt. The ice turns into water and sinks to the surface, while the iron liquifies and, in the moment of the iron Catastrophe, rushes to the core. Thus the Earth differentiates, with molten iron at its center, water rapidly evaporating on its surface, and rock creating a mantle and crust.

7. The **Cambrian Explosion** was one of the most extraordinary events in the history of life. What are the suggested *intrinsic* and *extrinsic* reasons for this diversification? [10 points]

Intrinsic reasons:

- **Coelom** - the fluid filled cavity allowed for a respiratory system to develop and created a mechanical advantage of being able to propel forward. organisms became less dependent on the environment for movement
- **Skeleton** - a skeleton allowed muscles and other tissue to latch on to it. It is now able to provide leverage for movement and organisms can have more complex body structures.

Extrinsic reasons:

- **Rise of atmospheric oxygen** and decrease of CO_2 - photosynthetic organisms used CO_2 and added O_2 to the atmosphere. Also, the oceans absorb a lot of CO_2 . This was important because larger organisms need 6-10% of PAL O_2
- **Ozone layer** - ozone provides protection from UV rays. Very few organisms are resistant to UV light so now that there is a "shield" many more organisms can survive

8. What is a **supernova**? How do they form? How have supernovae influenced the composition of our planet? [10 points]

A supernova is the explosion of a star, they are 4-8 times bigger than our sun. Through the heavy element synthesis the supernova produced every element past iron, such as gold. When the supernova ~~exploded~~ exploded the elements dispersed throughout the universe, providing our earth with many of the elements we have today.

9. Fill in the blanks! [10 points total]

Principle summarized as "the present is the key to the past": Uniformitarianism

Total number of protons and neutrons in an atomic nucleus is that element's Atomic Mass

Proteins are chains of Amino Acids

Single point of space, time and matter in the Big Bang: Singularity

Prokaryotes consist of two domains: Bacteria and Archaea

10. No surprise here. Fill in the appropriate blanks below (all the eras, periods and the Cenozoic epochs). Correct spelling and capitalization is required. [10 points]

| ERA | PERIOD | EPOCH | |
|-------------|---------------|-------------|--|
| Cenozoic | Quaternary | Holocene | |
| | | Pleistocene | |
| | Neogene | Pliocene | |
| | | Miocene | |
| | Paleogene | Oligocene | |
| | | Eocene | |
| | | Paleocene | |
| | Mesozoic | Cretaceous | |
| | | Jurassic | |
| Triassic | | | |
| Paleozoic | Permian | ✓ | |
| | Carboniferous | | |
| | Devonian | | |
| | Silurian | | |
| | Ordovician | | |
| | Cambrian | | |
| Proterozoic | Ediacaran | | |
| Archean | | | |
| Hadean | | | |

A half-point will be deducted from the total of 10 for each slot that is filled incorrectly or the name is not properly spelled or capitalized. (A clue: Capitalize them all.)

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