

HOUR EXAMINATION #1
 Geology 100: History of Life
 February 17, 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 chart 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 meteorite crystal contains 10 μg of ^{40}K and 70 μg . of ^{40}Ar . How old is this meteorite? [8 points]

Age of the meteorite:

3.9 billion years ✓

(Show your work – or reasoning -- below)

H.L.	Parent	Daughter	
0	80	0	=80
1	40	40	=80
2	20	60	=80
3	10	70	=80

$$\begin{array}{r} 1.3 \\ 1.3 \\ +1.3 \\ \hline 3.9 \end{array}$$

2. A fossil mammoth bone has 10 μg of ^{14}C inside. When the mammoth was alive it had 40 μg of ^{14}C in that same bone. How old is this fossil bone? [8 points]

Age of the mammoth bone:

11460 years

(Show your work – or reasoning -- below)

HL	P	D
0	40	0
1	20	20
2	10	30

$2 \text{ h.l.} \times \frac{5730 \text{ years}}{2} =$

11460 years


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]

isotope

An isotope is a variation of an element. This means that while the number of protons will remain the same, there can be a varying number of neutrons. For example: ^{12}C , ^{13}C , and ^{14}C . This is important to H.O.L. because it gives us a way to date things → like carbon dating we get from the unstable ^{14}C isotope.

lipids - AKA fats. These molecules consist of a polar (hydrophilic) head group and a non-polar (hydrophobic) tail. Like this:

Lipids are important to the H.O.L. because they make up cell membranes. A lipid bilayer forms in a spherical shape around the cell to protect it & help the cell maintain homeostasis.

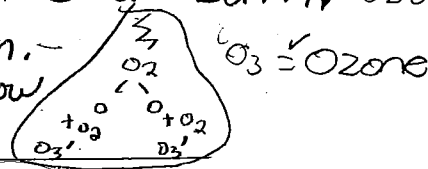


Oort Cloud

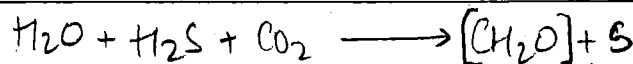
The Oort Cloud is the outermost ring of our Solar System composed of icy rocks, dust, and other particles, which is a remnant of the nebula long ago. Its significance is that comets often fly into the solar system and the Melchison Meteorite, which landed on Earth, was found to have organic compounds - providing evidence for a new theory on the origin of life.

ozone

Ozone is a protective layer of the atmosphere that is important to the H.O.L. because of the fact that organisms needed UV protection to sustain life on Earth. Ozone is formed from this diagram. Ozone formed over time, and allowed animals to develop.



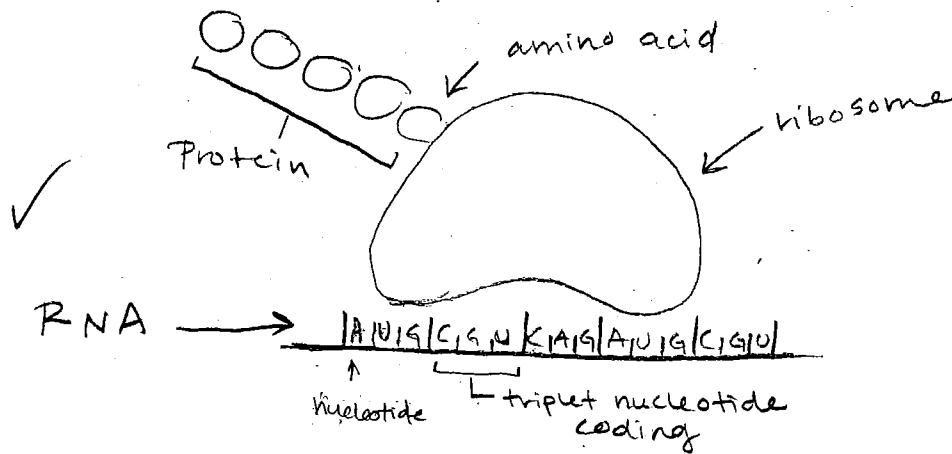
chemosynthesis



Chemosynthesis is a process developed by organisms that live in the bottom of the ocean near craters and cracks that emit acid and magma. These organisms receive no sunlight yet adapted to be able to create carbohydrates for their consumption.

4. How does a ribosome make proteins? Please use the following terms in your answer: *triplet nucleotide coding, RNA, DNA, protein, amino acids*. A labeled diagram is required. [10 points]

RNA makes a copy of DNA and then delivers this to the ribosome. The ribosome reads the triplet nucleotide coding from the RNA and selects amino acids according to this code, the amino acids are put together to make proteins.



5. Darwin and Wallace had four basic observations of nature that led to their concept of Natural Selection. Please list these below and briefly describe each with a sentence. Please use the boxes below. [10 points]

1 Overproduction of offspring

Organisms often produce many more offspring than could ever be expected to survive.

2 Variation in Population

Within a population of organisms there are many variations in the traits organisms display.

3 Variations often lead to selective advantages

Some variations within a population ~~lead~~ give an organism a selective advantage, allowing them to live + reproduce.

4 Variations are often inherited

Variations seen in parents are often passed to their offspring.

6. **Cyanobacteria** are the first recognizable organisms (or at least the stromatolites they construct) in the fossil record. Please describe below the characteristics of cyanobacteria, including how they managed to survive the harsh conditions on the early Earth's surface. [10 points]

Cyanobacteria are simple, unicellular, photosynthetic bacteria which were the earliest life, and remain the simplest life today. They construct stromatolites when they rise to the top of sediment that has washed down from above so that they can reach the sunlight again. This creates layers seen in fossilized stromatolites. Cyanobacteria survived the lack of ozone and oxygen in early Earth because they are anaerobic and UV resistant, though they do produce O_2 from photosynthesis which built up oxygen and ozone levels making other life possible.

7. What are three advantages of multicellularity in life? In other words, what are the benefits of having many cells in an organism instead of just one? Please list these below and describe each with a sentence. [9 points]

1 The organism can be larger.

One cell cannot become too large, because it would not be able to produce enough energy to support itself. However, many cells together can work together + create a large organism.

2 Cells become specialized + more efficient.

When there are many cells together, they can become specialized + perform specific tasks. This is more efficient + allows the organism to become more advanced.

3 Cells can be worn out + replaced.

In a single celled organism, once the cell is worn out, it is dead. But a multicellular organism lives longer because its cells are replaced + it has many

8. Your choice: Describe either a **sponge**, **cnidarian** or **flatworm**. Choose only one and tell me about its body and life habits. Diagrams are always helpful. [10 points]

The sponge is the first known animal, and is believed to be 635 million years old. Although Earth is 4.6 billion years old, it took so much time because animals need 6-10% of the PAL of oxygen to survive. Sponges filter feed, or absorb water and then filter out the waste through the top. Sponges have no organs and no tissues so if you were to put a sponge in a blender, it could still reassemble afterwards.

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

Second most common element in the universe today: Helium

Cellular structures that contain the DNA in animals and plants: Chromosomes

Two-word term for chance (or random) factors in evolution: Genetic Drift

Minimum level of oxygen required for eucaryotes: 2-3% PAL O₂

Term for a fertilized egg cell: Zygote

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	
	Neocene	Pliocene	
		Miocene	
	Paleocene	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. (For goodness sakes – don't lose points for not capitalizing!)

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