

TEST 3

Version 1

EARTH, LIFE, AND TIME *GEOLOGY 102*

FALL 2002

NAME _____

I.D.# _____

LAB TEACHER _____

PART 1 _____ (40 POINTS TOTAL)

PART 2 _____ (30 POINTS TOTAL)

PART 3 _____ (30 POINTS TOTAL)

BONUS _____ (10 POINTS TOTAL)

PART I – MATCHING AND MULTIPLE CHOICE

MATCH THE TERM WITH ITS DEFINITION (2 POINTS EACH)

- | | |
|------------------------|---------------------------------------------------------------------------|
| (1) _____ heterotroph | (a) organism that is tolerant of, and prefers, high temperatures |
| (2) _____ phylogeny | (b) organ within a eukaryotic cell that aids in metabolism |
| (3) _____ thermophile | (c) primitive organisms without nuclei; bacteria |
| (4) _____ mitochondria | (d) organism that eats organic material to receive nutrients |
| (5) _____ RNA | (e) building blocks used to construct genetic material |
| (6) _____ amino acids | (f) distinctive biota, maybe the worlds first multicellular animals |
| (7) _____ Ordovician | (g) time period marked by exploitation of marine environments |
| (8) _____ eukaryote | (h) organism made of a cell, or cells, each containing a nucleus |
| (9) _____ prokaryote | (i) representation of relationship based on total number of shared traits |
| (10) _____ ediacara | (j) genetic material capable of self-replication |

CHOOSE THE ANSWER THAT BEST COMPLETES THE STATEMENT (2 POINTS EACH).

- (11) Evolutionary advantages of skeletonization include:
- (a) increased reproductive ability
 - (b) increased efficiency of gas exchange
 - (c) increased muscularity
 - (d) all of the above
- (12) Biomineralization utilizes which of the following mineral forms:
- (a) CaPO_4 (calcium phosphate)
 - (b) SiO_2 (silica)
 - (c) CaCO_3 (calcium carbonate)
 - (d) all of the above
- (13) A primary line of evidence that the earth has retained a stable temperature throughout its history is:
- (a) the Earth has supported 4.5 billion years of eukaryotic life
 - (b) the Earth has retained liquid water on its surface for nearly its entire history
 - (c) the Earth currently has ice in its polar latitudes
 - (d) all of the above
- (14) Plate tectonic activity was vital to the oxygenation of the Earth's biosphere because:
- (a) weathering of soils releases oxygen
 - (b) volcanic activity releases oxygen to the atmosphere and oceans
 - (c) mountain building provides sediment to bury organic matter in the oceans
 - (d) all of the above
- (15) The earliest multicellular life:
- (a) first appear in the Archean (4.5-2.5 billion years ago)
 - (b) required more available oxygen than unicellular life
 - (c) were composed of prokaryotes
 - (d) all of the above
- (16) Evidence that the earliest life on Earth was thermophilic comes from:
- (a) phylogenetic analysis of organisms RNA
 - (b) carbon isotope fractionation
 - (c) permineralized fossil bacteria
 - (d) all of the above

- (17) Oxygenation of the Earth's biosphere:
- (a) coincides with major mountain building events
 - (b) is dependent upon photosynthesis by prokaryotic bacteria
 - (c) resulted in the evolution of increasingly complex life on Earth
 - (d) all of the above
- (18) Bioturbation of late Precambrian and early Cambrian sediments was inhibited by:
- (a) rapid cementation of the substrate
 - (b) low concentrations of dissolved oxygen in marine substrates
 - (c) rarity of organisms capable of boring/burrowing
 - (d) all of the above
- (19) Early life on Earth most likely evolved near deep sea hydrothermal vents because:
- (a) sunlight was abundant
 - (b) plate tectonics was particularly active in the Archean
 - (c) nutrients, water, and energy were abundant
 - (d) all of the above
- (20) Early atmospheres contained all of the following gasses, except:
- (a) NH₃ (ammonia)
 - (b) CO₂ (carbon dioxide)
 - (c) O₂ (oxygen)
 - (d) CH₄ (methane)

PART 2 – SHORT ANSWER

PLEASE ANSWER THE FOLLOWING QUESTIONS IN A FEW WORDS OR A SHORT SENTENCE

- (1) What would be the significance of finding evidence for eukaryotic life if you were trying to decipher the chemical composition of a planet's early atmosphere? (5 points)
- (2) Briefly describe the process of planetary differentiation in the formation of the Earth. (5 points)
- (3) Provide three lines of evidence that indicate the existence of multicellular animal life in the oceans before the Cambrian explosion. (6 points)
- (a)
 - (b)
 - (c)

(4) Provide two lines of evidence that suggests that Ediacara fossils were indeed animals. (4 points)

(5) What were primary sources of water and dissolved chemicals in the Earth's earliest oceans? (6 points)

(a) *sources* of water:

(b) *sources* of dissolved chemicals (nutrients)

(6) Describe two ways in which biomineralization (the construction of hard parts) may have influenced what environments were exploited by Ordovician marine organisms. (4 points)

(a)

(b)

PART 3 – LONG ANSWER

PLEASE ANSWER **TWO** OF THE FOLLOWING QUESTIONS (15 POINTS EACH). YOUR ANSWER MAY BE IN A PARAGRAPH, A FEW SENTENCES, A BULLETED LIST, OR AN ANNOTATED DIAGRAM.

(1) Describe the process, product, importance, and any unresolved issues regarding Miller-Urey's early life experiments.

(2) Describe, in detail, the lines of evidence that support an interpretation that the Archean biosphere was largely anoxic (that is, contained little of any free oxygen in the oceans and atmospheres).

(3) Describe, in as much detail as possible, the relationship between photosynthesis, atmospheric O₂, atmospheric CO₂, and the increased complexity of life on Earth.

(4) Describe, in detail, the process by which prokaryotic life evolved into three distinct forms of eukaryotic life (primitive eukaryotes with no intracellular organs; eukaryotic animal cells containing mitochondria; and eukaryotic plant cells containing both mitochondria and chloroplasts).

(5) Describe, in as much detail as possible, why scientists believe that the advent of biomineralization resulted from changes in ocean/atmospheric chemistry.

EXTRA CREDIT QUESTIONS

(1) Match the following events to their approximate time (5 points, maximum):

- | | |
|--------------------------------------------|-----------------------------|
| (a) advent of biomineralization | _____ 2.7 billion years ago |
| (b) first evidence for multicellular life | _____ 2.0 billion years ago |
| (c) origin of multicellular animal life | _____ 1.3 billion years ago |
| (d) first major rise in atmospheric oxygen | _____ 600 million years ago |
| (e) chemical evidence for eukaryotic life | _____ 550 million years ago |

(2) Do you think that it is likely that life has occurred (or does occur) on other planets? Support your answer with information from class regarding the requirements for all life. (5 points maximum)