

Fold front page forward so name does not show.

Name _____

Part I

1. The two most widely accepted scientific explanations of how the oceans formed is/are [3]
- i. a huge rain event deposited all the ocean's water in the early Archean.
 - ii. the ocean's water has accumulated from water vapor from volcanic outgassing.
 - iii. melting of glaciers in the Pleistocene provided all the water of the present oceans.
 - iv. comets have gradually delivered water from space to generate the oceans.
- _____ A. i and ii B. i and iii C. i and iv D. ii and iii E. ii and iv F. iii and iv

2. Geologic evidence indicates that North America originated in the Archean [3]
- A. as one the fragments resulting when the huge sheet of continental crust that covered the entire Earth surface in the Hadean broke up.
 - B. through sequential accretion of many small island arcs and fragments of continental crust.
 - C. when glaciers delivered boulders and till from the north.
 - D. as the remnants of a huge meteorite impact.
- _____ E. A and B H. A and C. J. B and C K. C and D L. A and D M. B and D

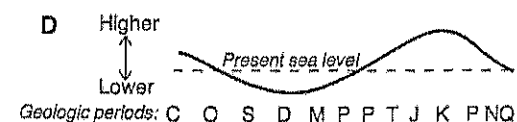
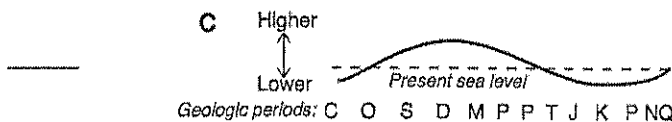
3. In the Mesozoic, Earth's geography consisted of [3]
- A. Continents moving apart as the Atlantic Ocean opened.
 - B. Several small continents scattered along the equator and to the south, and a huge northern ocean.
 - C. Continents in one huge mass from north to south, and one huge ocean.
 - D. Pangaea splitting apart and the opening of the Atlantic.
 - E. Continents clumped over North Pole and a huge southern ocean.
- _____

4. The evidence available suggests that Earth's atmosphere originated [3]
- A. from emission of gases from Earth's volcanoes.
 - B. in condensation of residual gas after the formation of the Earth
 - C. from condensation or settling of heavier materials to form the solid Earth.
 - D. with collisions of comets with the earth and their subsequent evaporation.
- _____

5. Match the times at left with the characterization of the CO₂ content of Earth's atmosphere at right, as understood by Bob Berner's modeling of atmospheric CO₂ and from other evidence. [3]
- | | |
|-------------------------------|--|
| _____ Cretaceous | A. About the same as today. |
| _____ Ordovician and Silurian | B. Much higher (10 to 20 times higher) than today. |
| _____ Pennsylvanian | C. Decreasing from very high to very low. |
| | D. Much lower (one-tenth?) than today. |
| | E. Increasing from very low to very high. |
| | F. Somewhat higher (2 to 8 times higher) than today. |

6. The composition of Earth's atmosphere underwent a significant change in the Proterozoic. What was that change, and what probably caused the change? [3]
- A. Addition of O₂ as the result of photosynthesis.
 - B. Addition of CO₂ because the first animals evolved.
 - C. Addition of ozone to protect animals from ultraviolet radiation.
 - D. Addition of N₂ with the evolution of the first denitrifying bacteria.
- _____ E. B and C F. C and D

7. Which of the following is the best graphic summary of how we think global sea level has changed during the Phanerozoic? (The dashed lines indicate present sea level, and higher on each plot represents higher sea level). [3]



8. Times when the continental crust has been separated into many continents, rather than agglomerated into one or two supercontinents, have typically been times of
A. Higher sea level than average. B. Lower sea level than average. [3]
C. Average sea level.
9. What evidence did we use in class to construct our record of Phanerozoic sea level change? Check all that are correct. [4]
____ The geographic extent to which marine sediments of any given age are found on the North America continent.
____ The stratigraphic record in Australia.
____ The extent of marine sediments on the Siberian craton.
____ The hydrostatic pressure to which deep-sea organisms of different ages were subjected.
____ The presence of marine sediments in stratigraphic sections from the continental interior (Oklahoma, Kansas, Iowa, and Nebraska).
10. The significance of the three fossils shown on the projection screen at the front of the room was
A. They are Cretaceous and early Paleogene fossils that are evidence of warmer climate at higher latitudes during those times. [3]
B. They are components of the coal deposits that have been burned, generating CO_2 .
____ C. They are examples of invasive species transported by humans.
D. They are fossils of plants now extinct as the result of human-induced climate change.
11. Dansgaard-Oeschger cycles, or the changes from Greenland stadials to Greenland interstadials, are evidence that [3]
A. Early humans modified global climate repeatedly as they developed agriculture.
B. Climate can warm dramatically over decades.
____ C. Now-extinct large vertebrates like mastodons fluctuated in abundance through time.
D. Greenland was repeatedly connected to northern Europe as sea-level fluctuated.
12. The Last Glacial Maximum was [4]
A. 3000 years ago B. 10,000 years ago C. 20,000 years ago D. 100,000 years ago
____ E. 400,000 years ago J. 1,000,000 years ago M. 1,400,000 years ago
13. The Younger Dryas was [3]
A. A major cooling event or anomaly within the warming transition from the Last Glacial Maximum to the Holocene interglacial stage.
B. Elizabeth G. Dryas, paleoclimatologist and daughter of Elena Dryas, early glaciologist.
____ C. The interglacial stage prior to the present one.
D. One of the coldest periods of the Little Ice Age.
14. Our lecture comparing the ecology of modern humans with that of non-humans and human hunter-gatherers concluded that [3]
A. Hunter-gatherers caused surprisingly large environmental impact compared to the more efficient modern human lifestyle.
____ B. The modern human lifestyle that developed over the last century involves far greater ecological impact than did hunter-gatherer lifestyles that had existed for tens of thousands of years.
C. Modern humans should revert to the hunter-gatherer lifestyle.
15. A major step in global climatic change took place in the Oligocene (about 34 million years ago, in the Paleogene, or in the early middle Tertiary). What was that step? [3]
A. The first glaciation of land in the Northern Hemisphere.
B. The first formation of sea ice around Antarctica and/or glaciers on Antarctica.
____ C. The first deserts formed in Africa. E. Central America closed the former seaway between the Americas
D. Global climate abruptly warmed.
16. What is the feature shown in the images on the screen? Your answer should be as short as one or two words but must be accurate rather than very general. The feature's location is irrelevant. [4]

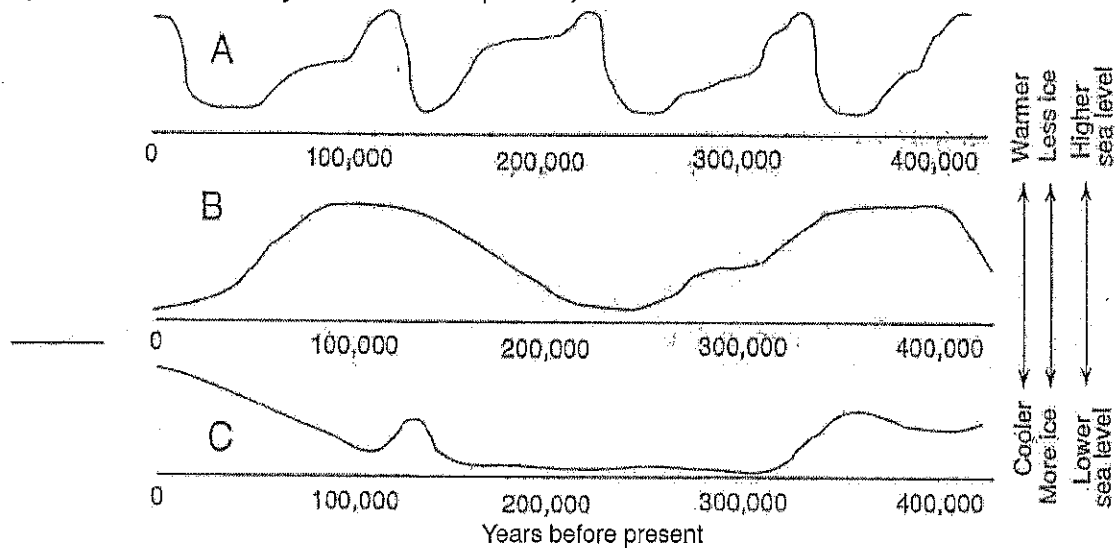
17. The development of glaciers requires [4]
 A. abundant snowfall D. abundant sleet G. A and B K. A and F
 B. exceptionally cold winters E. sleet and snow H. B and C M. D and F
 C. exceptionally cold summers F. high mountains J. A and C P. C and D

18. The best estimate of the thickness of the North American (Laurentide) ice sheet at its center during the Last Glacial Maximum is [3]
 A. 10 meters B. 50 meters C. 200 meters D. 500 meters
 E. 1000 meters J. 3000 meters (2 miles)

19. Which of the following best characterizes the variability of Holocene climate (climate during the last ten thousand years)? ("ka" means "thousands of years ago") [4]
 A. Repeated changes from glacial to interglacial periods.
 B. Relatively constant conditions, but with colder and drier events across much of the Northern Hemisphere at 8.2 ka, 5.9 ka, and 4.2 ka.
 C. Relatively constant conditions, but with hotter events at 8.2 ka, 5.3 ka, and 3.8 ka.
 D. The entire Holocene is also called "The Little Ice" because it was consistently cold.
 E. Consistently much warmer, except for the glacial maximum at 4.7 ka.

20. Our "Changing the World" on-line lecture showing satellite images of the earth surface, mostly from the U.S., concluded that [4]
 A. Deforestation has been incredibly extensive but is reversible.
 B. Deforestation has been incredibly extensive and, once done, is permanent.
 C. Landfills now occupy a remarkable proportion of the land surface & are visible from space.
 D. PCBs (polychlorinated biphenyls) are remarkably widespread across the earth surface.
 E. PCBs are concentrated in lakes and rivers and thus enter human water supplies.

21. We devoted considerable attention to the record of Quaternary (late Neogene) glaciation. Which of the following is the most accurate graphic representation of that record? [4]
 (The horizontal axis is years before the present).



22. The beginning of human agriculture, and thus the beginning of the progression toward civilization (and the beginning of human alteration of Earth), roughly coincided with [3]
 A. The beginning of our present interglacial. B. The present glacial maximum
 C. The last glacial maximum. D. The interglacial prior to our present interglacial.
 E. The beginning of the oscillations between glacials and interglacials.

23. Two ways that humans have added CO₂ to the atmosphere are [4]
 A. use of chlorofluorocarbons. B. burning of fossil fuels. C. mining of copper
 D. use of DDT E. deforestation and plowing of soils
 and F. Paving of parking lots and highways G. Use of lead in paint

24. CFC11 and CFC 12 (two chlorofluorocarbons) . . . [4]
 A. were first used in the 1930s, production of them ended in 1996, but they will still be in the atmosphere in 2100 and thus still depleting atmospheric ozone.
 ____ B. are produced by burning of fossil fuels and have been released into the atmosphere since the 1700s and depleting ozone since that time.
 C. have been dumped into groundwater for the last four decades, contributing to spread of cancer, but were never in groundwater before the 1920s.
25. As the United States' response to concerns about CFCs was debated in the 1980s, U.S. Secretary of the Interior Donald Hodel proposed that [3]
 A. CFCs be removed from the atmosphere by chemical scrubbers hung from high-altitude balloons.
 B. Production of CFC's be phased out, with chlorine-free refrigerants replacing them.
 ____ C. Americans should wear hats and sunglasses to shield themselves from UV radiation.
 D. Americans should forgo use of refrigerators, freezers, and air conditioners.
26. Given the following data from earlier Time 1 and later Time 2 in the Quaternary, which of the four lettered choices is the most reasonable inference? (planktic = sea surface; benthic = seafloor) [3]
- | | Time 1 | Time 2 |
|--|--------|--------|
| $\delta^{18}\text{O}$ (‰ relative to the PDB standard) of marine planktic forams | -1.5 | -3.1 |
| $\delta^{18}\text{O}$ (‰ relative to the PDB standard) of marine benthic forams | +4.5 | +2.3 |
| $\delta^{18}\text{O}$ (‰ relative to the SMOW standard) of high-latitude glacial ice | -45.0 | -34.0 |
- ____ A. Global climate became colder, and sea level dropped. (The information in parentheses above is given only for completeness and can be ignored with no effect on the answer.)
 B. Global climate became colder, and sea level rose.
 C. Global climate became warmer, and sea level rose.
 D. Global climate became warmer, and sea level dropped.
27. The effort in the early 1960s to end atmospheric testing by the USA, the UK and the USSR, and thus to end the dispersal of radionuclides across the United States, was opposed by [3]
 A. Soviet leader Nikita Khrushchev. B. Eleanor Roosevelt.
 C. American political leaders of the party that did not hold the Presidency.
 D. Rev. Carl McIntire, the President of the International Council of Christian Churches.
 ____ E. Madalyn Murray O'Hair, founder of American Atheists. F. Claire Patterson
 G. Queen Elizabeth II of the United Kingdom of Great Britain and Northern Ireland.
 F. A and B G. B and C H. C and D J. D and E K. A and C L. A and D M. All of the above
28. Our lecture on environmental problems generalized that the usual pattern of our dealing with a reported environmental problem with a pollutant is [3]
 A. The problem gets worse and worse, regardless what we do to solve it.
 B. Scientists identify a problem, they are attacked by industrial and political leaders, citizen advocacy leads to laws or treaties, and the concentration of the pollutant begins to diminish.
 ____ C. Scientists identify a problem, political leaders endorse their findings and soon legislate or negotiate to enact a solution, and the pollutant soon disappears from the environment.
 D. The reported problem commonly turns out to not be a problem at all.
29. Rachel Carson's book *Silent Spring* publicized the scientific understanding of the environmental impact of DDT. She was . . . [3]
 A. immediately praised by all for her contribution to an important question about public policy.
 ____ B. within months awarded the Presidential Medal of Freedom. D. imprisoned.
 C. immediately vilified as a communist and "a hysterical woman". E. A and B
30. Aldo Leopold's essay on *The Land Ethic* argued that . . . [4]
 A. an ethical approach to nature would require reducing world population significantly.
 B. an ethical approach to nature and land use would require reducing the amount of land under cultivation in the U.S. by 60%.
 ____ C. the development of ethics regarding treatment of land has lagged far behind development of ethics regarding social behavior.
 D. policies designed to reduce CO₂ emissions would also favor reduction of soil erosion.

