GEOL 1122 Section 13799 - Final Exam - December 12, 2019
Professor: L.B. Railsback
For all matching questions, any letter may be used any number of times.

Key
_____
Name as it appears in UGA documents

Part I

1. The current scientifically accepted notion of the origin of the Earth is . . . (choose one) [3]

   A. Accretion of gases and molten materials from the solar nebula, with subsequent flow of those liquids and gases to form the core and mantle before solidification of the entire planet.

   B. Ejection of the proto-Earth from a massive sunspot and subsequent magnetic attraction of metallic meteorites to give Earth's present core rich in iron and nickel beneath the sialic mantle.

   D C. Earth formed around a distant star and was ejected from that star's planetary system, and was later trapped in the gravitational field of our sun and settled into an orbit around the sun.

   D. Accretion of mostly solid materials from the solar nebula, and subsequent heating by radioactivity and other sources to cause melting that allowed differentiation of core and mantle.

2. The history of Earth's geography for the last 2 or 3 billion years can be summarized best as . . .

   A. From Earth's formation until about 300 million years ago, Earth's geography consisted of a large ocean Panthalassa surrounding a supercontinent Pangaea, until the latter broke apart.

   B B. Earth's continental crust has repeatedly broken into separate continents and then agglomerated into one or two supercontinents, and then broken apart again, and so on.

   C. Earth was entirely covered with oceans until a large meteorite impact delivered the silica-rich materials of the continental crust about 800 million years ago.

   D. Earth was entirely covered with continents until condensation from the atmosphere formed the oceans about 1.5 billion years ago. [3]

3. Earth's atmosphere in the early Archean probably consisted of [3]

   A. CH_4 (methane), NH_3 (ammonia), N_2 (nitrogen), O_2 (oxygen), and CO_2 (carbon dioxide).

   C B. N_2 (nitrogen), O_2 (oxygen), Ar (Argon), He (helium) and CO_2 (carbon dioxide).

   C. CO_2 (carbon dioxide), CO (carbon monoxide), H_2 (hydrogen), CH_4 (methane), NH_3 (ammonia) and HCl (hydrochloric acid)

4. Our current understanding of the history of O_2 in Earth's atmosphere is that [3]

   A. there was little O_2 in the atmosphere until about 3.8 billion years ago, when the first photosynthesizers appeared.

   B B. there was little O_2 in the atmosphere until ~2.1 billion years ago, as suggested by the presence of banded iron formations and increase in redbeds thenceforth.

   C. there was little O_2 in the atmosphere until the Cretaceous, when the first grasses increased the extent of photosynthesis.

   D. there was little O_2 in the atmosphere until the Cenozoic, explaining why mammals now dominate Earth's ecosystems but did not in the Mesozoic.

5. Our best approximation of how sea level has varied through time is [4]

   A. High in the Cambrian, low in the Ordovician, and high thereafter.

   B. Low in the Ordovician and Silurian, high in the Permian and Triassic, low in the Cretaceous, and rising in the Cenozoic to a high in the Quaternary.

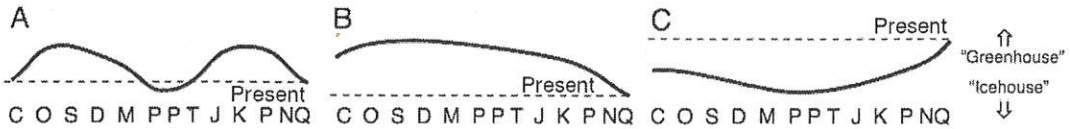
   D C. Rising throughout the Phanerozoic to a high level today.

   D. High in the Ordovician and Silurian, low in the Permian and Triassic, high in the Cretaceous, and dropping in the Cenozoic to a low in the Quaternary.

   E. Dropping throughout the Phanerozoic to a low level today.

6. The best graphic summary of global-scale climate change in the Phanerozoic is [4]

A



7. Measurements of proxies and geochemical modeling of the carbon cycle suggest that CO_2 concentrations were [4]

A. Very high in the Ordovician to Devonian, low in the Mississippian to Permian, high in the Mesozoic, and then low in the Cenozoic.
B. Low in the Paleozoic, moderate in the Mesozoic, and high in the Cenozoic.
A ___ C. Low in the Ordovician to Devonian, highest in the Mississippian to Jurassic, low in the Cretaceous, and high in the Cenozoic.

4

8. The evidence presently available suggests that the best characterization of Cretaceous global climate is A. Generally cooler than today. [4]

C ___ B. Polar regions similar to today, but equatorial regions cooler than today.
C. Equatorial regions similar to today, but warmer at the poles than today.
D. Equatorial regions similar to today, but much colder at the poles than today.
E. Polar regions like today, but equatorial regions much warmer than today.

4

9. The time in which we think the genera *Australopithecus* and *Homo* lived coincides with

A. The long period of warm global climate that began in the early Cretaceous. [3]
B ___ B. the relatively cool global climate of the last five million years.
C. The warm and comparatively stable Holocene interglacial.

3

10. We used a fossil breadfruit leaf from the Cretaceous of Greenland as an example of

A. How plant and animal remains can be transported by ocean currents.
B. How plate tectonic reconstructions are made. [3]
D ___ C. The evidence for glaciation in Northern Hemisphere before the Cenozoic.
D. How paleobiogeography is used to understand ancient climate.

3

11. A distinct climatic event occurred about 50 million years ago, in the latest Paleocene and/or earliest Eocene (both of which are epochs of the Paleogene period). It . . . (check all that apply)

___ was caused by a meteorite impact ___ was caused by perturbations of Earth's orbit

✓ was caused by an exceptional release of methane ___ was a distinctly cold event [3]

✓ was a distinctly hot event ___ was a period of glaciation ✓ caused an extinction event

3

12. Which of the following are evidence that glaciers moved across North America in the Quaternary? Check all that are correct. [4]

___ Elephant bones in Michigan.
___ Fossils of Devonian snails found in Illinois.
✓ Striations on bedrock surfaces in the Midwest.
✓ Erratics (exotic blocks of rock) scattered across the landscape.
✓ Tills covering much of the landscape north of the Ohio and Missouri Rivers.
✓ The positions of end moraines at the southern end of Lake Michigan and the southwest end of Lake Erie.

4

13. Dropstones are anomalously large sediment particles in the otherwise fine-grained sediments of the deep oceans. We used dropstones and their locations as evidence

A. for meteorite impacts that caused mass extinctions. [4]
B. for times of very low sea level. C. for times of colder global climate.
C ___ D. for use of anchors by prehistoric mariners. E. for trans-oceanic flight by early birds.

4

14. The main point of our "Holocene VII – Why I to V happened" lecture (the lecture with snarling wolves, clever squirrels, happy gazelles and wildebeests, and far too many dead deer) was that . . .

A. North American wildlife has suffered greatly from lead poisoning [3]
B ___ B. Agriculture and industry, combined with currency, lead to a totalitarian view of ecology.
C. Americans use energy, metals, and food at a far greater rate than other people.
D. Application of CFCs has caused widespread environmental devastation and extinction.

3

15. The timing of glaciation over the past 500,000 years, as revealed by isotopic analyses of fossils of benthic marine forams, can best be described as [3]

3 A ___ A. 100,000-year cycles of glacial advances and interglacial periods, with the present being an interglacial period.
B. Increasing degree and extent of glaciation throughout this period.
C. 100,000-year cycles of glacial advances and interglacial periods, with the present being a period of maximum glacial advance.
D. 1,000-year cycles of glacial advances and interglacial periods, with the former now.
E. 1,000-year cycles of glacial advances and interglacial periods, with the latter now.

16. There was a time lag between the scientific recognition of problems with lead in gasoline and CFCs in Earth's atmosphere and the banning of leaded gasoline and CFCs 11 & 12 because . . .

3 B ___ A. because time was needed to developed technologically workable alternatives.
B. because industry and/or government used a stalling campaign of denial.
C. because time was needed to gather confirmatory scientific evidence. [3]

17. The cold part of the last glacial cycle (the time of Wisconsinan glaciation, or MIS 4 to 2, 60,000 to 18,000 years ago), was punctuated by . . . [3]

3 Don't just think! ~~A~~ ___ A. episodes of Northern Hemisphere cooling and Antarctic warming, and then abrupt (decades-scale) warming of much of the planet as Antarctica cooled.
B. episodes in which all of Earth's land was covered with glacial ice.
C. episodes in which almost all of Earth's glacial ice melted away for a few decades before abruptly returning.

18. The timing of Quaternary glacial cycles seems to have been linked to

4 A/B ___ A. Periodic changes in Earth's orbit
B. Periodic fluctuations in ocean circulation
C. Regular near-misses by a large comet
D. Periodic changes in solar luminosity
E. Periodic variation in solar flaring and sunspots
F. Regular meteorite impacts [4]
G. Clockwork-like volcanic eruptions
J. B and D
M. D and E
Q. B and G

19. Humans have increased the concentration of CO_2 in Earth's atmosphere by . . .

4 J ___ A. Mining various metal ores
B. Converting forests and grassland to farmland
C. Burning fossil fuels
D. Using nuclear energy
E. A and B [4]
H. A and C
J. B and C
K. C and D

20. What was the significance of the graph on the screen to our understanding of global change?

3 B ___ A. It demonstrates that Americans pay more than they should for petroleum [3]
B. It demonstrates that we have depleted all easily-accessed deposits of petroleum.
C. It demonstrates that humans have generated much CO_2 with their use of petroleum.
D. It demonstrates that photosynthesis quickly replenishes petroleum.

21. Earth is presently . . . (choose one; they are in a sequence to facilitate your decision) [3]

3 D ___ A. warmer than the coldest parts of the Little Ice Age but cooler than the warmest parts.
B. warmer than any time in the Little Ice Age, but cooler than the Medieval Warm Period.
C. Warmer than the Medieval Warm period but cooler than the Holocene Thermal Maximum.
D. Warmer than the Holocene Thermal Maximum, but not its warmest in all of geologic time.
E. Warmer than it ever has been, in all of geologic time.

22. Match the named climatic periods with the appropriate times. [4]

4

N ___ Little Ice Age	Q. 1930-1960 AD or CE	C. ~8,200 years ago
C ___ 8.2 ka event	B. 1880-1920 AD or CE	X. ~5,100 years ago
G ___ Medieval Warm Period	N. 1400s to 1800s AD or CE	J. 6,000 years ago
T ___ Holocene Thermal Maximum	G. ~ 900 to 1300 AD	T. 8,000 to 6,000 years ago
A ___ Last Glacial Maximum	E. ~400 BC to 300 AD	A. ~20,000 years ago
	F. ~1800 BC to 700 BC	K. 230,000 years ago

26. Global change caused by humans [3]

3 B ___ A. has taken place at about the same rate as natural global change.
B. has been much faster than natural global change.
C. has been much slower than natural global change.

27. For each of the questions or objections on the left posed by skeptics of global climate change, fill the blank or blanks with the letter or letters representing the appropriate response from the list on the right.

B ___ I live in the southeastern United States, and I don't think the climate has warmed.

A. This is denialism – the southeastern US has in fact warmed. [3]
B. You're right, the southeastern United States is one of the two places on Earth that have cooled, both of them because of failure of the AMOC caused by global-scale warming.
C. You're right, and in fact much of North America has cooled as winds from Greenland have strengthened, bringing cool air.

C ___ There's no consensus among scientists about climate change.

A. You're right: most climate scientists think there is no anthropogenic global warming. [3]
B. You're right: most climate scientists think there is global warming, but they don't think that it has been caused by humans.
C. 97% of climate scientists think global climate has warmed as the result of human activity.

A D ___ ___ Hasn't the increase in global temperature just been a continuation of natural trends and cycles?

A. Extrapolation of past trends and cycles yields nothing like the observed warming – in fact, it indicates that cooling would have happened. [4]
B. You're right: climate changed lots in the past, and today's warming is part of that pattern.
C. Global-scale experiments show that the warming can only be anthropogenic.
D. Modeling (i.e., computer simulation) of climate shows that natural inputs cannot explain the observed warming, but the combination of natural and human inputs can.

C ___ If Earth was going into another ice age, isn't it a good thing that we have warmed the Earth with CO_2 ?

A. Yes, in fact we need to add more CO_2 to avoid the coming ice age. [3]
B. Yes, we have just about balanced the natural cooling trend with our injection of CO_2 into the atmosphere.
C. We have already far over-corrected relative to the Holocene Thermal Maximum, the *warmest* point of the glacial-interglacial cycle.

A ___ How would we know if the concentration of CO_2 in air had increased?

A. Direct sampling of air for the last sixty years, and sampling of air trapped in glacial ice, show that the CO_2 concentration today is far greater than at any time over the last 800,000 years. [3]
B. You're right – air isn't preserved the way sediments and fossils are, because it's a gas.
C. You're right – scientists have been sampling air, but they have done so in cities where there were lots of automobiles, so the data say nothing about the bigger picture.

28. The presentation called "The Holocene VI – an alternate Late Holocene" examined European life-styles and suggested that some of the features that allow Europeans to live comfortably with lesser energy and environmental costs than those of Americans include . . . .(check all that apply)

✓ _____ More fuel-efficient vehicles.
_____ Monarchies like those in Britain and Spain.
✓ _____ More useful public transportation. [3]
✓ _____ Laws and infrastructure facilitating travel on foot and by bicycle.
_____ Socialist governments like those in Italy, France, Germany, and Denmark.

29. Lecture 26 on resource issues argued that patterns of mining and petroleum extraction suggest that

A ____

A. We have in decades used up all of the easily available deposits of those resources, which required hundreds of millions of years to accumulate. [3]
B. Use of solar-based technologies would enhance production of metals and petroleum.
C. Hiring of more geologists would lead to more discoveries and lower prices for consumers.

30. Our reading on Aldo Leopold's essay "The Land Ethic" argued that there are practical arguments for an ethics of treatment of land parallel to that for treatment of animals and treatment of humans. Those arguments had to do with [3]

A ____

A. Water supplies, agricultural productivity, and local- to global-scale climate change.
B. Transportation, land ownership, and interstate- to international-scale relations.
C. Sports and recreation, tourism, and regional- to international-scale migration.

31. The "Changing the World" lecture accessed online examined satellite and space-shuttle images of Earth's surface and concluded that [3]

C ____

A. Humans have changed the Earth surface greatly and with no chance of remediation.
B. Humans have done little to change the Earth surface, but we need to do so in order to geo-engineer solutions to global warming.
C. Humans have changed the ecosystems at the Earth surface greatly, but those ecosystems can be restored across broad areas if we want them to be restored.
D. Much of Earth's surface remains under-utilized and, if converted to farmland, could feed billions more humans as Earth's population increases.

Part II. Write an essay of 400 to 700 words summarizing the current scientific understanding of the history of the Earth and its life, from Earth's origin to the present. Your answer should include the current scientific understanding of the origin and present context of humans in Earth history. Your answer should be a summary that is both (a) factually correct and complete and (b) coherent and well-organized. It should contain at least five quantitative references to ages or times of events in Earth history.

[50]

Part III [50]

For the story and cultural group indicated, write an essay on this page (using the back of this page if necessary) that accomplishes the following.

(a) give the time the story was written or the context in which was written, if such information is provided in *Creation Stories From Around the World* or in an updated class handout,

(b) recount the story, in no more than 250 words, as told in *Creation Stories From Around the World*,

(c) indicate whether or not you think the story is a literal account of the origin of the earth and/or its life and/or its peoples. If your answer is "yes", indicate why you pick this story rather than one of the others. If your answer is "no", indicate why you reject this story.

(d) comment on the story in terms of how it portrays the human relationship to nature or in terms of its implications for the society from which it comes.

Whether you answer "yes" or "no" to part C will have no effect on your grade, so long as you justify your response as indicated above.