EARTH AND SPACE SCIENCE

2005 – 2007

Benchmarks (hyperlinked)

A. Explain how evidence from stars and other celestial objects provide information about the processes that cause changes in the composition and scale of the physical universe. **(Items 1 -2)**

B. Explain that many processes occur in patterns within the Earth's systems. **(Items 3 – 12, 27)**

C. Explain the 4.5 billion-year-history of Earth and the 4 billion-year-history of life on Earth based on observable scientific evidence in the geologic record. **(Items 13 – 14)**

D. Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. **(Items 15 – 17, 28 - 29)**

E. Explain the processes that move and shape Earth's surface. **(Items 18 – 22)**

F. Summarize the historical development of scientific theories and ideas, and describe emerging issues in the study of Earth and space sciences. **(Items 23 – 26)**

EARTH AND SPACE SCIENCE

Multiple Choice
Identify the choice that best completes the statement or answers the question.

<u>**Benchmark A**</u>   <u>**(items 1 -2)**</u>

1. When examining the red shift of galaxies outside our own, every galaxy appears to be moving away from the observer. This observation supports the Big Bang Theory because it indicates that
   A. our galaxy is not moving.
   B. the universe is expanding.
   C. most galaxies have the same mass.
   D. Earth is at the center of the universe.

2. Which property of a star can be determined most directly from its color?
   A. mass
   B. diameter
   C. precise age
   D. surface temperature

<u>**Benchmark B**</u>   <u>**(items 3 – 12)**</u>

Use the information and graph to answer questions 3 - 10.
<div align="center">Biomes</div>
The following graph shows the ranges of temperature and precipitation for six American biomes, two of which are identified by name.

Selected North American Biomes
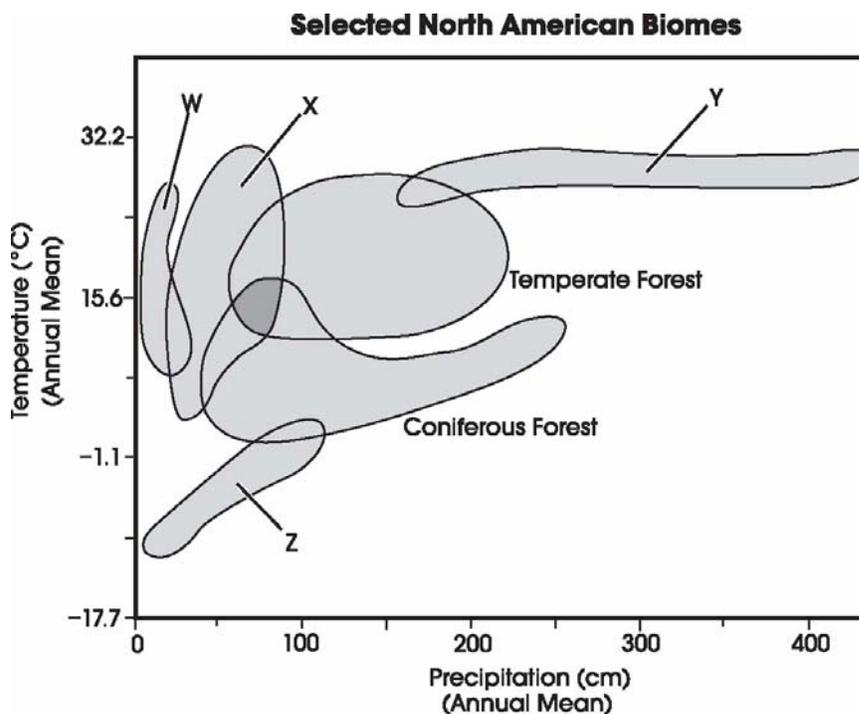
3. Deserts are consistently the driest biomes in North America. They typically receive very little precipitation but have a wide variation in the mean annual temperature.
   Which biome likely represents the deserts?
   A. W
   B. X
   C. Y
   D. Z

4. Based on the graph, what is the primary difference between biomes W and X?
   A. mean number of species
   B. mean annual temperature
   C. mean annual precipitation
   D. mean number of days with sunshine

5. Biome Z would likely be found in which of these locations?
   A. in a valley along the Pacific coast
   B. along a rocky shore in New England
   C. in the middle of the Midwestern plains
   D. above the tree line in the Rocky Mountains

6. The tundra is the coldest of the biomes, having extremely low temperatures and little precipitation.
   What other characteristics would be expected for this biome?
   A. low biotic diversity and sparse vegetation
   B. nutrient rich soil and a long growing season
   C. stable population numbers and high biotic diversity
   D. dense vegetation and large daily temperature fluctuations

7. Tropical forests typically have a narrow range of temperatures but a wide variation in the amount of rain that falls per year. Additionally, some tropical forests receive nearly twice as much precipitation as other wet biomes.
   Which biome represents the tropical forests?
   A. W
   B. X
   C. Y
   D. Z

8. Which two biomes share the most similar precipitation ranges?
   A. biome W and biome X
   B. the temperate forest and biome Y
   C. biome Z and the coniferous forest
   D. the coniferous forest and temperate forest

9. What type of energy from the oceans is responsible for weather patterns?
   A. electrical
   B. magnetic
   C. mechanical
   D. thermal

10. A driver traveling from the coniferous region to the tundra region would most likely observe
    A. a decrease in air quality.
    B. a decrease in biodiversity.
    C. an increase in deciduous tree species.
    D. an increase in nighttime temperatures.

11. Climatographs are often used to represent a location's temperature and precipitation patterns. (Precipitation is represented by the bar graph because it is cumulative.)

Which climatograph most likely represents a tropical rainforest?
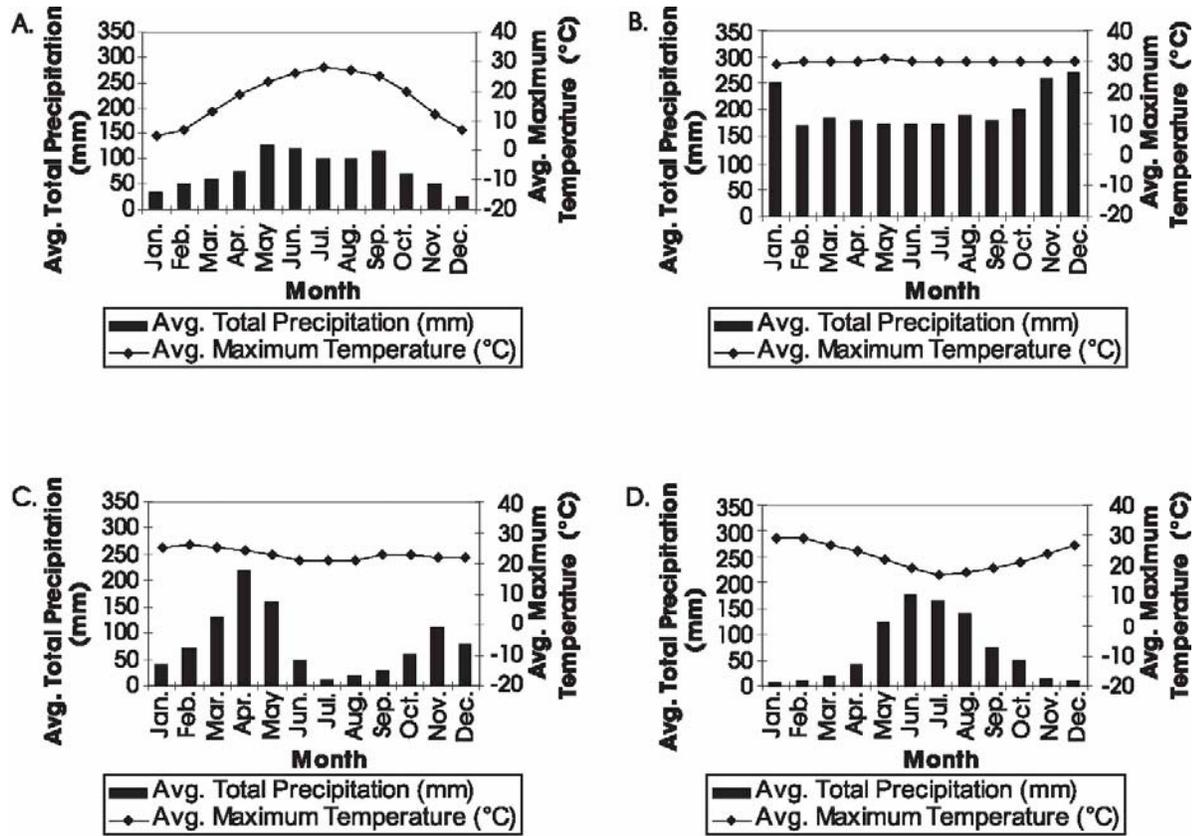
A. A
B. B
C. C
D. D

12. The Arctic tundra has an annual temperature range of –34°C to 12°C. Annual precipitation ranges from 15 cm to 25 cm.
Based on these conditions, what characteristic does the Arctic tundra exhibit?
A. high nutrients
B. low biodiversity
C. long growing season
D. small population changes

13. Our solar system is thought to have formed from a nebula of dust and gas. Most of this nebula condensed to form the sun.
     What is primarily responsible for causing these materials to condense?
     A.   electrical attraction between charged dust particles
     B.   gravitational pull of nebula materials on each other
     C.   heat released by nuclear fusion at the center of the nebula
     D.   chemical reactions between hydrogen and other nebula gases

14. Use the table below to answer the question that follows.

Data on Select Organisms

Organism	Date of First Appearance in Fossil Record	Method of Obtaining Energy
purple sulfur bacteria	3.6 billion years ago	ingestion of particles/anaerobic respiration
cyanobacteria	3.3 billion years ago	photosynthesis/cellular respiration
bony fish	341 million years ago	consumption of other organisms/aerobic respiration
mammals	229 million years ago	consumption of other organisms/aerobic respiration

The appearance of which organism contributed the most to making it possible for humans and other organisms to breathe Earth's current atmosphere?
A.   bony fish
B.   mammals
C.   cyanobacteria
D.   purple sulfur bacteria

Use the information and tables to answer questions 15 - 16.

Peppered Moths

The British peppered moth, Biston betularia, occurs in two colorations: light (mixed black and white) and black. Black coloration was first seen in 18th-century moth collections as a rare, highly prized mutant. Black coloration is controlled primarily by a single, dominant gene.

Before 1850, the overwhelming majority of peppered moths in northern England were light. As the Industrial Revolution swept through northern England, however, light moth populations dwindled as black moth populations grew. Overall, the total peppered moth numbers remained steady.

Peppered Moths in England

Year	Black Moths (%)	Light Moths (%)
1850	10	90
1900	90	10
1996	Fewer than 10	90+

In the same time period, the less industrialized rural England saw no such changes in moth populations. The only predators observed to prey on the moths were local birds. No migratory or population changes of birds occurred during that time.

British naturalist H.B.D. Kettlewell captured, marked and released known numbers of black and light-peppered moths in an unpolluted woodland and two similar groups in a polluted woodland. He later recaptured as many moths as possible. The following are some of Kettlewell's mark-and-recapture data.

Dorset, England
(Unpolluted Woodland)

	Black Moths	Light Moths
Marked and Released	473	496
Recaptured	30	62
Percentage Recaptured	6.3%	12.5%

Birmingham, England
(Soot-blackened Woodland)

	Black Moths	Light Moths
Marked and Released	447	137
Recaptured	123	18
Percentage Recaptured	27.5%	13.1%

15. What 20th-century event most likely had the greatest impact on the recovery of light moth populations?
    A. higher taxes imposed on oil imports
    B. invention of the silicon solar cell in 1941
    C. clean air legislation passed in the 1950s
   D. reduced fuel efficiency in new automobiles

16. The change in population numbers of black and light moths from 1850 and 1900 is most likely a result of the increased use of
    A. fossil fuels.
    B. solar energy.
    C. geothermal energy.
    D. pollution control technologies.

17. Methane (CH_4) from Ohio's Rose Valley coal mine has successfully been used to power fuel cells.
    Since the fuel used in these cells is not burned, using methane from the mine will help to
    A. increase the concentration of atmospheric ozone.
    B. reduce public demand for alternative fuel sources.
    C. increase public awareness of global warming issues.
    D. reduce pollutants commonly associated with fossil fuel combustion.

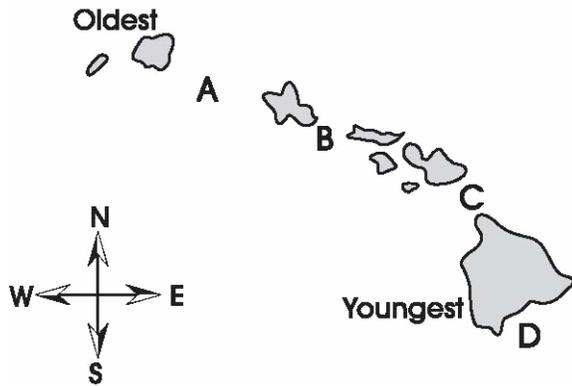18. Use the diagram to answer the question that follows.

Earth's Cross Section
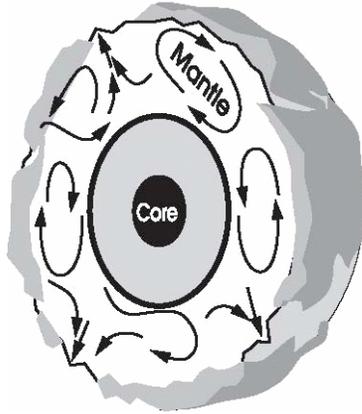
Scientists believe that forces in Earth's mantle move Earth's crustal plates. What do the arrows in the diagram represent?
A. ocean currents
B. gravity
C. convection currents
D. wind patterns

19. Use the map to answer the question that follows.
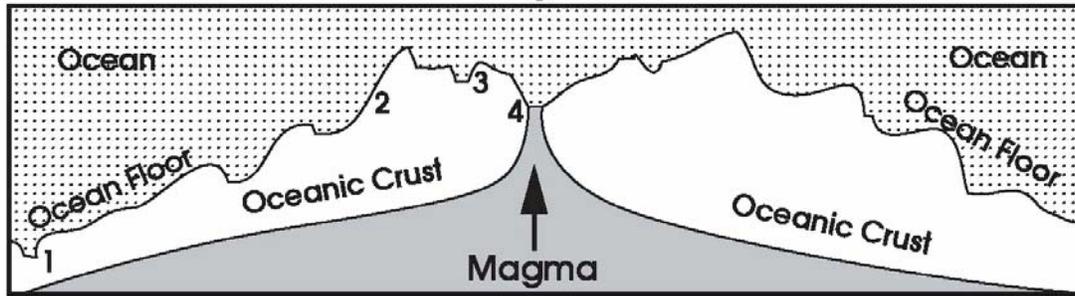
Map of the Hawaiian Island Chain

The Hawaiian Islands are riding on the Pacific Plate as it moves northwestward. They are being formed as the plate moves over a hot spot in the mantle.

Where is the next volcano likely to form?
A. A
B. B
C. C
D. D

20. The following diagram shows a cross-section of the mid-Atlantic Ridge.

**Mid-Atlantic Ridge Cross Section**

Which area is likely the oldest crust?
A. 1
B. 2
C. 3
D. 4

21. What evidence has been used to support the theory of plate tectonics?
A. The Grand Canyon runs in the same direction as the mid-Atlantic ridge.
B. There are deserts in the western parts of North and South America.
C. The same fossil species are found in South America and Africa.
D. Glacial till covers parts of the northern United States and Asia.

22. The cross-section below shows the orientation of rock layers in a given area.

Geologic Cross-section
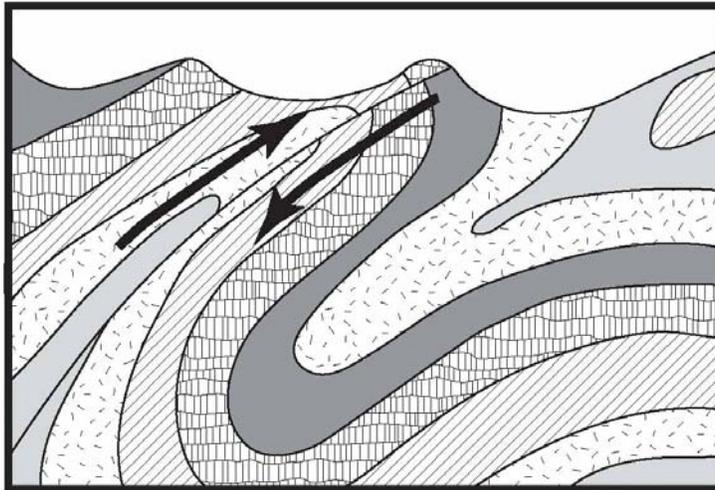
What geologic event most likely caused the folding and faulting of these layers?
A. tectonic activity
B. glacial advance
C. magnetic reversal
D. seafloor spreading

Benchmark F   (items 23 – 26)

23. The early development of the theory of plate tectonics was supported by which of these observations?
A. matching fossils on the continents of Africa and South America
B. glacier deposits far from existing continental glaciers
C. thick sediment layers at the mouths of rivers
D. sudden volcanic activity of long-dormant volcanoes

24. In Aristotle's treatise On Meteorology, he stated that:
    "The same parts of the Earth are not always moist or dry, but they change accordingly as rivers come into existence and dry up. And so the relation of land to sea changes too and a place does not always remain land or sea throughout all time, but where there was dry land there comes to be sea, and where there is now sea, there one day comes to be dry land. …"
    Aristotle was referring to the
    A. depletion of natural resources.
    B. cyclic nature of Earth processes.
    C. relationship between latitude and climate.
    D. effects of humans on biogeochemical cycles.

25. Astronomers have formulated many models of the solar system over time. Ptolemy's early geocentric model gave way to Copernicus' heliocentric model on which the modern solar system model is based.
    Which statement best describes why models of the early Ptolemy solar system were replaced by the Copernican model?
    A. Computers are better able to develop scientific models than humans are.
    B. A more precise age has been established for the formation of the solar system.
    C. More direct observations have enabled scientists to change solar system models.
    D. Scientists established that a different set of laws govern the motion of our solar system than govern the motion of other solar systems.

26. The cross-section below shows a series of rock layers that have been found in all of these landmasses: South America, Africa, India, Australia, and Antarctica.
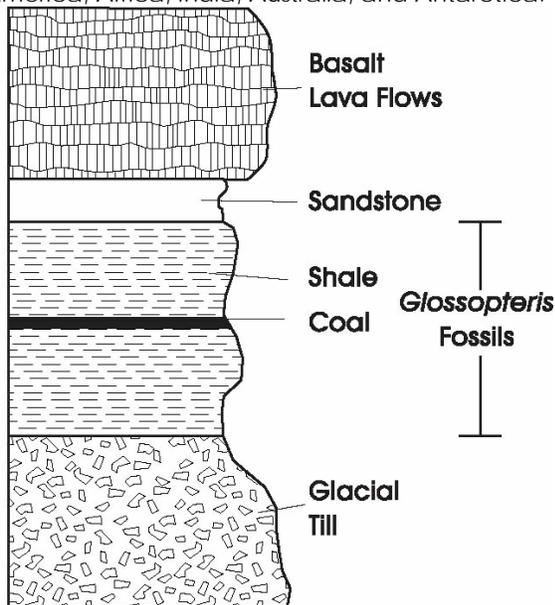
Alfred Wegener's analysis of the similarities in these layers led to the conclusion that
    A. continental plates float on top of a molten mantle.
    B. in undisturbed rock sequences, the oldest fossils will be on the bottom.
    C. these five landmasses were once joined together in a single landmass.
    D. magnetic anomalies are preserved in rocks formed at mid-oceanic spreading centers.
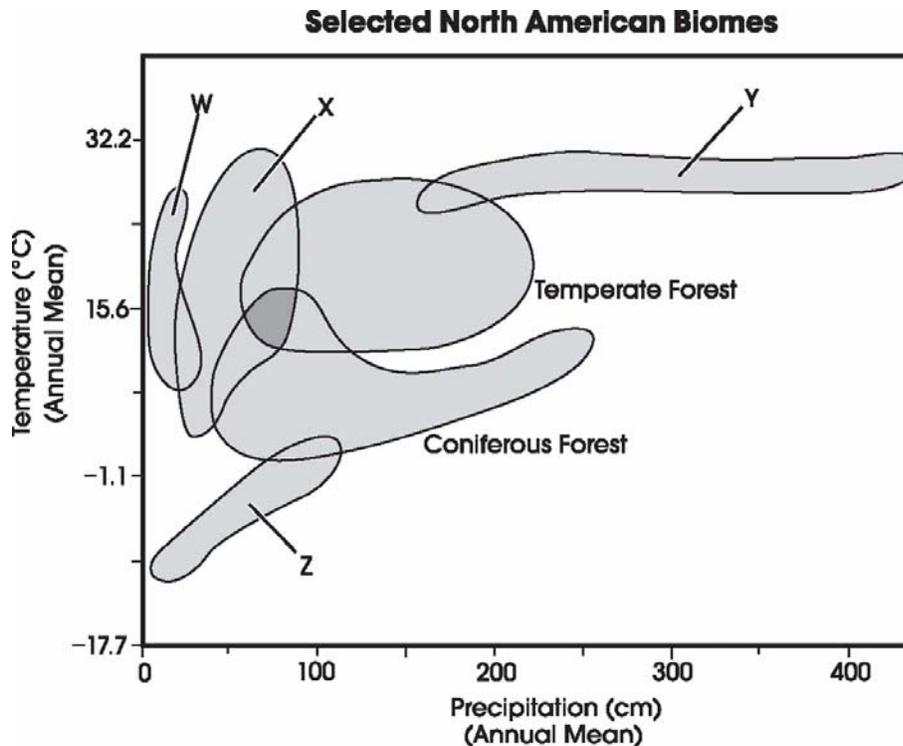
Short Answer

<u>Benchmark B</u>　　　　(item 27)

Use the information and graph to answer the following questions.

Biomes

The following graph shows the ranges of temperature and precipitation for six American biomes, two of which are identified by name.

Selected North American Biomes

27. Locate biome W and the temperate forest on the graph. Based on the information provided, describe one similarity and one difference between the climates of these two biomes. Respond in the space provided in your Answer Document. (2 points)

<u>Benchmark D</u>　　　　(items 28 – 29)

28. Identify two savings that result from recycling aluminum cans and explain one ecological benefit of each. Respond in the space provided in your Answer Document. (4 points)

29. A study is planned to investigate the potential environmental impact of storing animal wastes in large, open lagoons on commercially owned farms. These lagoons sometimes rupture or overflow, spilling their contents into lakes and waterways.
Identify one negative consequence of increased animal waste in lakes and waterways and describe how the increased animal waste results in this consequence.
Then identify a second negative consequence of increased animal waste in lakes and waterways and describe how the increased animal waste results in this consequence. Respond in the space provided in your Answer Document. (4 points)

EARTH AND SPACE SCIENCE
Answer Section

MULTIPLE CHOICE

1.	ANS:	B	REF:	2005 - No. 23
2.	ANS:	D	REF:	2005 - No. 6
3.	ANS:	A	REF:	2005 - No. 15
4.	ANS:	C	REF:	2005 - No. 16
5.	ANS:	D	REF:	2005 - No. 17
6.	ANS:	A	REF:	2005 - No. 18
7.	ANS:	C	REF:	2006 - No. 29
8.	ANS:	D	REF:	2006 - No.30
9.	ANS:	D	REF:	2005 - No. 20
10.	ANS:	B	REF:	2006 - No.24
11.	ANS:	B	REF:	2007 - No.6
12.	ANS:	B	REF:	2007 - No24
13.	ANS:	B	REF:	2005 - No.26
14.	ANS:	C	REF:	2006 - No.28
15.	ANS:	C	REF:	2007 - No.29
16.	ANS:	A	REF:	2007 - No.31
17.	ANS:	D	REF:	2007 - No.32
18.	ANS:	C	REF:	2005 – No.1
19.	ANS:	D	REF:	2005 - No.22
20.	ANS:	A	REF:	2006 - No.1
21.	ANS:	C	REF:	2006 - No.39
22.	ANS:	A	REF:	2007 - No.35
23.	ANS:	A	REF:	2005 - No.8
24.	ANS:	B	REF:	2006 - No. 34
25.	ANS:	C	REF:	2007 - No.18
26.	ANS:	C	REF:	2007 - No.38

SHORT ANSWER

27. ANS:
    See OGT 2005 No. 18
    REF: 2005 - No.18

28. ANS:
    See OGT 2006 No. 31
    REF: 2006 - No.31

29. ANS:
    See OGT 2007 No.19
    REF: 2007 - No.19