Geology
Lancaster High School

Name
Date
Block

Chapter 1 Questions for Review

Questions for Review

1. Geology is traditionally divided into two broad areas. Name and describe these two subdivisions.

2. List at least three phenomena that could be regarded as geologic hazards.

3. Briefly describe Aristotle's influence on the science of geology.

4. How did the proponents of catastrophism perceive the age of the Earth?

5. Describe the doctrine of uniformitarianism. How did the advocates of this idea iew the age of the Earth?

6. About how old is Earth?

7. The geologic time scale was established without the aid of radiometric dating. What principles were used to develop the time scale?

8. How is a scientific hypothesis different from a scientific theory?

9. List and briefly describe the four spheres that constitute our natural environment.

10. How is an open system different from a closed system?

11. Contrast positive feedback mechanisms and negative feedback mechanisms.

12. What are the two sources of energy for the Earth system?

13. Using the rock cycle, explain the statement "One rock is the raw material for another."

14. Briefly describe the events that led to the formation of our solar system.

15. List and briefly describe Earth's compositional layers.

16. Contrast the lithosphere and asthenosphere.

17. Describe the general distribution of Earth's youngest mountains.

18. Distinguish between shields and stable platforms.

19. List the three basic types of plate boundaries, and describe the relative movement each exhibits.

20. With witch type of plate boundary is each of the following associated: subduction zone, San Andreas Fault, seafloor spreading, and Mount St. Helens?

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Answers to the Review Questions

1. The science of geology is traditionally divided into two broad areas: physical and historical. Physical geology examines Earth's rocks and minerals and seeks to understand the processes that operate beneath and upon its surface. On the other hand, the aim of historical geology is to understand Earth's origin and how the planet changed through time. Historical geology strives to establish the chronology of physical and biological changes of the past 4.6 billion years.

2. Volcanoes, floods, earthquakes, and landslides are all examples of potential geologic hazards.

3. Aristotle's explanations of the natural world were not based on keen observations and experimentation, as modern science is. Instead, they were his opinions, based on the limited knowledge of his day. Unfortunately, many of his wrong interpretations continued to be believed for many centuries, thus thwarting the acceptance of better ideas based on observations.
4. Catastrophists believed that Earth was a young planet and that its landscape was shaped by great catastrophes.

5. Uniformitarianism, a fundamental concept in modern geology, states that the physical, chemical, and biological laws that operate today have also operated in the geologic past. The uniformitarian view is one of a very old Earth, modified by processes that have been at work for a very long time.

6. The currently accepted age of the Earth is 4.5 to 4.6 billion years, based on meticulous experimental measurements of lead isotopes on meteoritic and terrestrial samples. The basic assumptions and results are supported by rubidium-strontium isotopic age determinations on meteorite samples. The oldest rocks yet dated formed about 4 billion years ago. Because Earth is a dynamic planet, most rocks we see formed much later during Earth's history and thus are much younger than the age of the Earth.

7. The principles used to establish the geologic timescale include the law of superposition—which establishes the sequence of rock layers, and the principle of fossil succession—fossil organisms succeed one another in a definite and determinable order, and, therefore, any time period can be recognized by its fossil content. These concepts enable geologists to correlate similar-age rocks anywhere in the world and to place them in their proper chronological order and position in the timescale.

8. A scientific hypothesis is a preliminary, untested explanation. On the other hand, a scientific theory is a well tested and widely accepted view that scientists agree best explains observable facts.

9. The four major spheres of our living environment are: (1) the atmosphere—the gaseous envelope surrounding our planet; (2) the hydrosphere—those environments (oceans, rivers, lakes, ice, groundwater, and water vapor in the atmosphere) involved in the hydrologic cycle; (3) the biosphere—the diverse, surficial, and near-surface environments that include all living organisms and their habitats; and (4) the solid earth—the soils, regolith, and crustal bedrock layers of Earth; it hosts most of the hydrosphere, forms the inorganic substrate for the biosphere, and interacts extensively with the atmosphere.

10. In an open system both energy and matter flow into and out of the system. Closed systems, however, are self-contained with regard to matter.

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11. Positive-feedback mechanisms tend to enhance or drive changes in a system. By contrast, negative-feedback mechanisms work to maintain a system as it is (e.g., maintain the status quo).

12. The Earth system is driven by energy from two sources. The Sun provides the energy that drives the external processes that occur in the atmosphere and on Earth's surface. Internal processes, such as plate tectonics and volcanism, are driven by energy from Earth's interior. This internal energy is the result of leftover heat from the origin of Earth and also heat from the decay of radioactive elements.

13. Sedimentary rocks are composed of constituents derived from the disintegration and decomposition of other rocks (igneous, metamorphic, or sedimentary). Metamorphic rocks were once igneous, sedimentary, or metamorphic rocks that have since changed in texture and/or mineral composition in response to elevated temperatures, or elevated temperatures and pressures (deep burial). Igneous rocks form by cooling and crystallization of magmas; magmas form by melting of other igneous, sedimentary, or metamorphic rocks. Therefore, all rocks are the result of various processes acting upon preexisting rocks.

14. About 5 billion years ago, a huge cloud of gases and minute rocky fragments began to contract under its own gravitational influence. As it contracted, the rotation of this nebular cloud caused it to assume a disk-like shape, with the protosun located at the center. Within the rotating disk, small eddy-like contractions formed the nuclei from which the planets would eventually develop. As the temperature began to drop, materials in the disk began to condense into small rocky and icy fragments. These fragments in turn were swept up by the protoplanets. Because of higher temperatures in the inner solar system, the innermost planets are made mostly of rocky material and lack the gases and ices, which are the main constituents of the outer planets.

15. Earth's compositional layers include (1) the crust, Earth's comparatively thin outer skin; (2) the mantle, a solid rocky shell that extends to a depth of about 2900 kilometers (1800 miles); and (3) the core, which can be further divided into the outer core, a molten metallic layer, and inner core, a solid iron-rich sphere.

16. The lithosphere, which averages about 100 kilometers in thickness, is the rigid outer layer of Earth, which includes the crust and part of the upper mantle. Beneath the lithosphere (to a depth of about 660 kilometers) lies a soft, relatively weak layer located in the upper mantle known as the asthenosphere.

17. Earth's youngest mountains tend to occur in two major zones. The first zone is the circum-Pacific belt, which includes the mountains of the western Americas and volcanic island arcs of the western Pacific. The second zone extends eastward from the Alps through Iran into the Himalayas. Note that the younger mountain belts on Earth generally occur as long, topographic features at the margins of continents.

18. Shields are relatively flat expanses of metamorphic rocks and associated igneous plutons found near the center or cores of the continents. The crystalline rocks in shields are typically Precambrian in age and highly deformed. Stable platforms are areas of the stable interior where the highly deformed rocks of the shield are covered by a thin veneer of sedimentary rocks. The sedimentary rocks are nearly horizontal except where they have been deformed to form large basins or domes.

19. Divergent boundaries: where plates are moving apart.

Convergent boundaries: where plates are moving together.
Transform boundaries: where plates slide past one another along faults.

20. Subduction zone—convergent boundary; San Andreas Fault—transform fault boundary; seafloor spreading—divergent boundary; Mount St. Helens—convergent boundary