

GEOSCIENCE CHALLENGE

This Geoscience Challenge is taken in part from U.S. Geological Survey Open-File Report 98-507-A, *Science Challenge Questions and Answers*, by Carol Lawson and Mary Ellen Lazarus. The *Science Challenge* is a collection of 196 questions and answers about earth and planetary science. The Mars images are found on the Jet Propulsion Laboratory/Nasa website <http://jpl.nasa.gov/pictures/>

1. What is the age of earth?

A. Earth is over 4 1/2 billion years old. This age was determined by radiometric dating that uses the decay of elements with long half-life isotopes, like uranium-lead and potassium-argon.

2. When two full moons occur in any calendar month, what is the second full moon called?

A. A blue moon. Blue moons occur in approximately 30 percent of all years, with two blue moons occurring in nearly 4 percent of these years.

3. What is the largest planet in our solar system?

A. Jupiter. It is not only the largest planet, but is also heavier than all the other planets and

satellite moons in our solar system combined.

4. What phenomenon formed the Grand Canyon in Arizona?

A. The 277 mile-long Grand Canyon is a product of water erosion over the last 5 to 7 million years.

5. Are the rock formations in the Grand Canyon older at the top or bottom of the canyon?

A. At the bottom. On average, the rocks at the bottom of the canyon are 570 million years old, whereas those near the top are 245 million years old. However, some crystalline rocks at the bottom are nearly 1.8 billion years old.

6. What is the distance from the surface of earth to its center?

A. 3,700 miles. The thickness of the ocean lithosphere or the relatively solid skin of the earth under oceans is only 41 miles, which in relative terms is much thinner than the skin of an apple.

7. From how many states does the Mississippi River system drain?

A. The Mississippi River system drains water from 31 states and is the source of 23 percent of the public surface water supply for the United States.

8. What is the highest point above sea level in the United States?

A. Mt. McKinley, Alaska, at 20,320 feet above sea level.

9. Where is the lowest point in the United States?

A. Badwater in Death Valley, California, at 282 feet below sea level.

10. Can rocks float?

A. Some volcanic rocks can float. The explosive separation of gas from lava produces a "frothy" rock called pumice. Some pumice is so light, because of the many bubbles, that it floats on water.



11. If the total world supply of water were poured on the land surface of the 50 U.S. states, to what average depth would the land surface be submerged?

A. 90 miles.

12. What is the deepest lake in the U.S.?

A. Crater Lake, Oregon. Its deep blue waters extend to 1,932 feet below the surface.

13. Where is the world's highest waterfall?

A. Angel Falls in Venezuela at 3,212 feet.

14. What is the world's largest desert?

A. Sahara Desert in northern Africa. It is more than $23 \frac{1}{3}$ times the size of southern California's Mojave Desert where Death Valley is located.

15. Which of the earth's oceans is the largest?

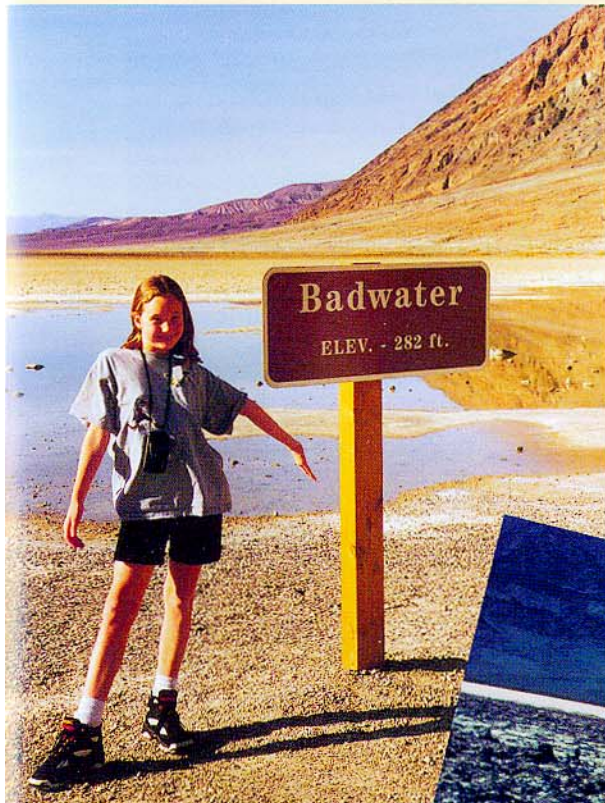
A. The Pacific Ocean is the largest ocean at 64,186,000 square miles. It's more than two times the size of the Atlantic Ocean. It has an average depth of 12,925 feet. The greatest known depth is 36,198 feet at the Mariana Trench.

16. What is the longest mountain chain on earth?

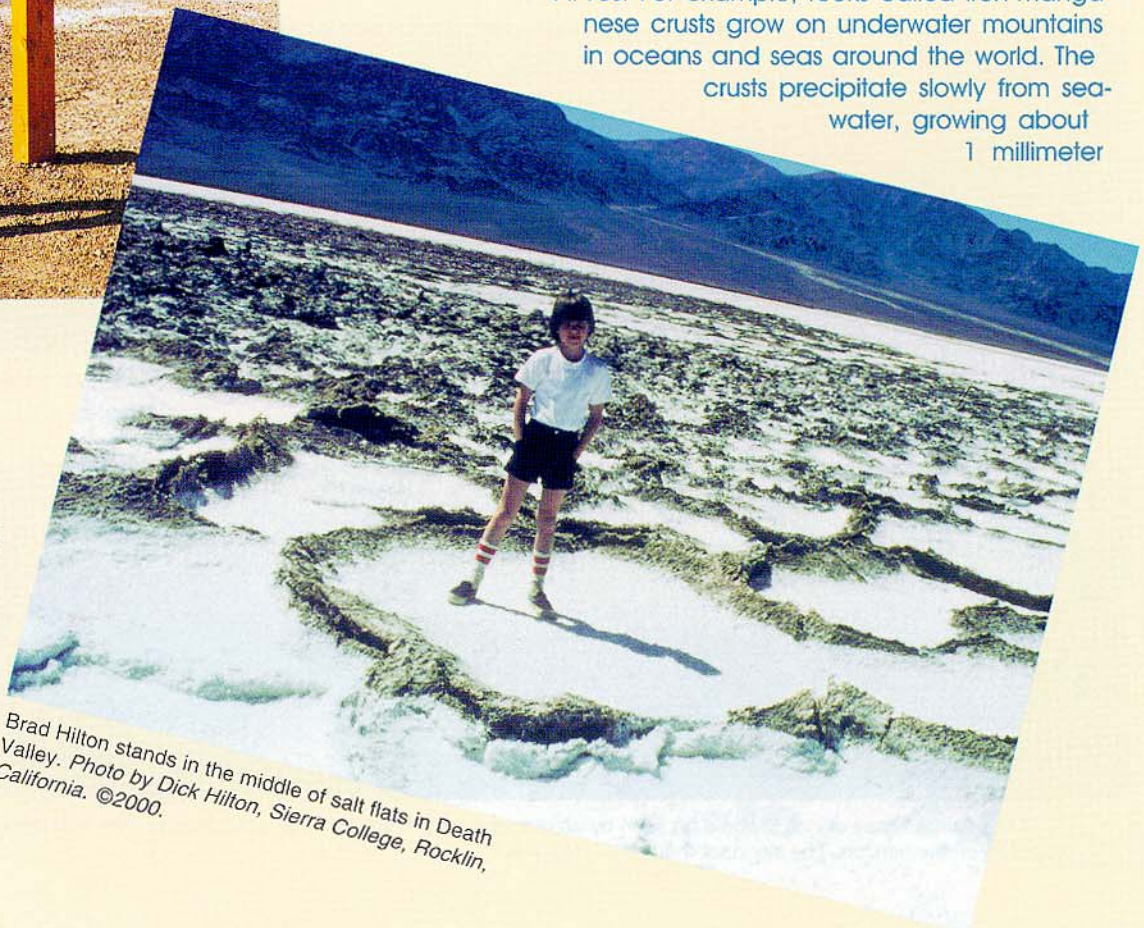
A. The Mid-Atlantic Ridge, which splits nearly the entire Atlantic Ocean north to south. Iceland is one place where this submarine mountain chain rises above the sea surface.

17. Can rocks grow?

A. Yes. For example, rocks called iron-manganese crusts grow on underwater mountains in oceans and seas around the world. The crusts precipitate slowly from seawater, growing about 1 millimeter



Alaina Taylor points to Badwater in Death Valley. Elevation is 282 feet below sea level. Photo by C.L. Pridmore, DMG.



Brad Hilton stands in the middle of salt flats in Death Valley. Photo by Dick Hilton, Sierra College, Rocklin, California. ©2000.

in thickness every million years. Your fingernails grow much faster, about 1 millimeter every 2 weeks.

18. On average, how many gallons of water does each American use daily?

A. About 80-200 gallons of water. Most is used to flush toilets.

19. On average, how much water is used worldwide each day?

A. About 400 billion gallons.

20. What is the largest marine sanctuary in the U.S.?

A. The Monterey Bay National Marine Sanctuary. It encompasses more than 5,000 square miles and has a 400-mile-long coastline, stretching from north of San Francisco to south of the Big Sur coast. Its

protected resources include the nation's most expansive kelp forests and one of North America's largest underwater canyons.

21. Who was Inge Lehmann and what did she do?

A. Inge Lehmann was a famous Danish seismologist and the only woman to win the Medal of the Seismological Society of America. Her most famous achievement was the discovery of the inner and outer cores of the earth through the reflection of seismic waves off those features. She died in 1993 at the age of 105.

22. How long is a Martian year in equivalent days on earth?

A. A Martian year is 687 days long, compared to 365 days on earth.

23. How long is the average Martian day?

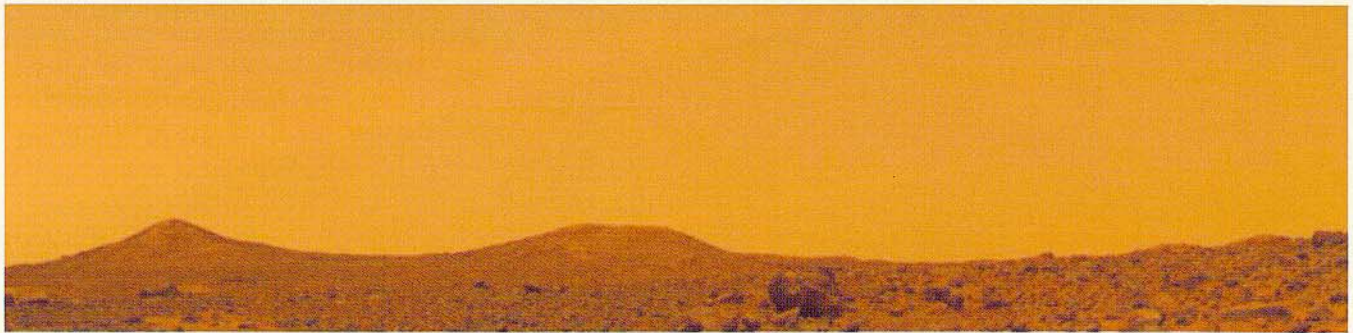
A. The average day on Mars is 24 hours and 37 minutes, compared to 23 hours, 56 minutes on earth.

24. How many minerals are known to exist?

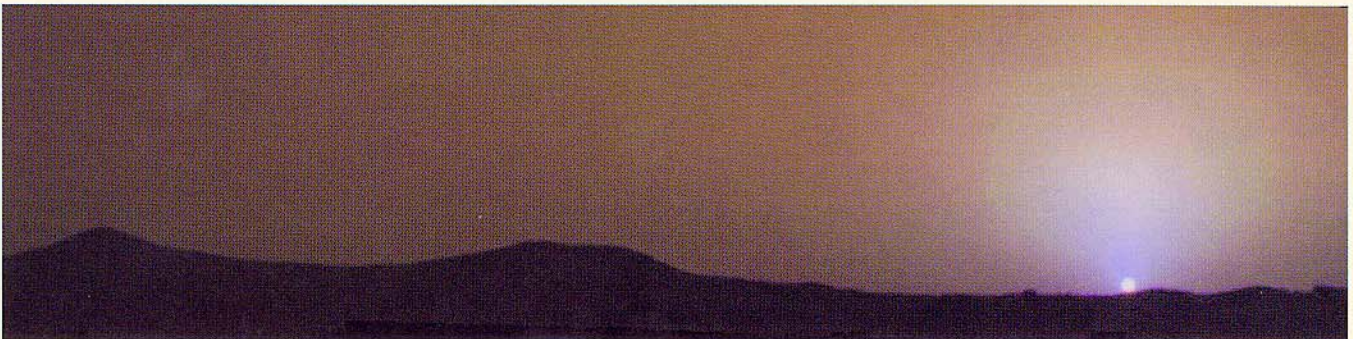
A. There are approximately 4,000 known minerals, although only a couple hundred are of major importance. Approximately 50-100 new minerals are described each year.

25. What was Pangaea?

A. It was the supercontinent that began to break up about 225 million years ago, eventually fragmenting into the continents we know today.



The true color of Mars based on three filters. The color of the Pathfinder landing site is yellowish brown with only subtle variations.



The brownish gray sky as it would be seen by an observer on Mars in this true color mosaic. The twin peaks can be seen on the horizon. The sky near the sun is pale blue.



Mars landscape. The twin peaks are modest-size hills to the southwest of the Mars Pathfinder landing site. They're approximately 100 feet tall.

26. What system is used to perform modern-day topographic surveys used in U.S. Geological Survey map production?

A. Global position system (GPS) satellites, receivers, and related computer support systems allow modern surveyors to perform field topographic surveys in minutes. These tasks took 19th century USGS surveyors many months to complete.

27. Is ice considered a mineral?

A. Yes, ice is a mineral and is formally described as such in *Dana's System of Mineralogy*.

28. What is the softest mineral?

A. Talc. It is commonly used to make talcum powder.

29. What is the hardest mineral?

A. Diamond.

30. What mineral is composed of flexible, hair-like crystals that you can "pet"?

A. Okenite.

31. What is the major use of mined phosphate worldwide?

A. Approximately 90 percent of the phosphate mined in the world today goes into fertilizer for production of food.

32. What types of features may be found on a topographic map?

A. A large-scale topographic map (1:24,000 scale) depicts elevation and natural and cultural features such as streams, highways and railroads, forests, schools, churches, cemeteries, campgrounds, ski lifts, and even fence lines.

33. Can ice burn?

A. Special types of ice called gas hydrates can burn. Gas hydrate is a frozen mixture of natural gases and water that forms naturally on some deep-water parts of the world's seafloor.

34. How is gold used in energy conservation?

A. A microcoating of gold on glass reflects solar energy and reduces the electrical demand for air conditioning.

