

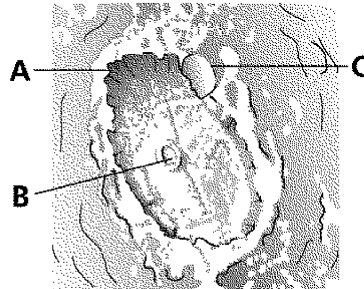
Short Answer

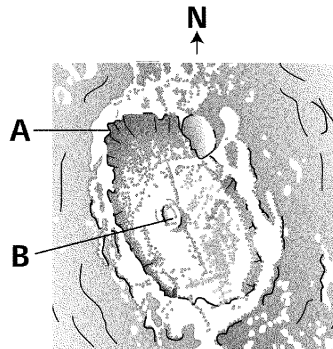
11. Which theory of the Moon's formation is based on Earth's gravity? What is the problem with this theory?
12. What is the commonly accepted theory regarding the Moon's formation? How does it explain the absence of water in the rocks that make up the Moon?
13. List the phases of the Moon, beginning with a full moon.

Study the photograph of the Moon. Then answer the questions.



14. What is feature D and how did it form?
15. Which feature is a mountain range?
16. Compare and contrast the type, appearance, and formation of features A and C.
17. Why is the Moon's surface so heavily pitted with craters, while Earth's is not?
18. How would conditions on Earth be different if Earth were not tilted on its axis? Explain your answer.
19. How would conditions on Earth be different if Earth were tilted on its axis at an angle of 60° ? Explain your answer.
20. The drawing below shows several impact craters on the Moon. Which of the three labeled craters is the oldest? Explain your answer.



Problem

21. Referring to the illustration above, from which direction is the sunlight shining? How can you tell?
22. Of craters A and B in the illustration above, which is older? How do you know?

In its orbit around the Moon, the *Lunar Prospector* spacecraft spent 19 months collecting data. From January, 1998, to July 31, 1999, the craft—about the size of an oil drum—performed at a high level of efficiency, according to Alan Binder, mission researcher.

One device on *Lunar Prospector* was a neutron spectrometer. When cosmic rays from space hit the surface of the Moon, sprays of neutrons and other particles result. When the neutrons mix with the soil layers on the Moon, they lose various amounts of energy depending on what elements make up the soil. Hydrogen, one of the elements needed to form water, takes away more energy than other elements.

Lunar Prospector flew over the Moon's north and south poles many times. These regions are cold and shadowed, receiving only a small amount of the sun's light or heat. The spacecraft's neutron spectrometer measurements showed large amounts of hydrogen in the surface soil at the poles. More studies are needed to confirm what this might or might not mean in terms of a possible water supply existing on the Moon. The spacecraft also gathered data that suggest the Moon has a small iron-rich core. It is much smaller than the iron core of Earth.

23. Did *Lunar Prospector* prove there is water on the Moon? Why or why not?
24. If there is water near the poles on the Moon, in what form do you think it would be found—liquid, gas, or ice? Why?
25. In terms of the data on the Moon's core, which theory of the Moon's origin seems to be supported by *Lunar Prospector's* findings? Explain.

Earth-Moon System Short Study Guide Answer Section

MULTIPLE CHOICE

1. B
2. C
3. B
4. C
5. D

MATCHING

6. M
7. K
8. O
9. E
10. L

SHORT ANSWER

11. The capture theory suggests that the object that became the Moon passed so close to Earth that Earth's gravity captured it. The object remained in Earth's orbit and became the Moon. The problem with this theory is that the object would have had to somehow slow down in order to be captured by Earth's gravity.
12. The accepted theory today is that Earth collided with a Mars-sized body billions of years ago. Materials from both bodies were ejected into space by the explosion. Some of these materials were captured by Earth's gravity, merged, then began to orbit Earth. This theory explains the absence of water in the Moon's rocks because heat produced by the impact would have evaporated any water. Consequently, the materials that ultimately formed the Moon would have been almost completely dry.
13. The phases, in order from full moon would be: full moon, waning gibbous, third quarter, waning crescent, new moon, waxing crescent, first quarter, waxing gibbous.
14. It is an impact crater that formed when an object from space crashed into the Moon's surface.
15. B
16. A is a mare, which is a dark, smooth plain and lower in elevation than a highland. The maria formed after a period of bombardment when lava welled up and filled in some of the impact basins. C is a highland, which is light in color, mountainous, and heavily covered with craters. Highlands are slightly older than maria, and formed after intense bombardment by space objects.
17. On Earth, the craters caused by bombardment by space objects have been worn away by erosion. The Moon, lacking an atmosphere and flowing waters, does not experience erosion except by surface creep. As a result, the craters are preserved.

18. If Earth were not tilted on its axis, there would be no seasonal changes. The climate at any given location would be much the same year-round because neither hemisphere would lean more or less toward the Sun any time of the year.
19. If Earth's axis were tilted at an angle of 60° , the seasonal changes would be more severe. Each hemisphere would lean more toward the Sun in summer and farther from the Sun in winter. As a result, summers would be warmer and winters would be colder.
20. Crater A must be the oldest because it is covered by craters B and C. On the Moon, impact craters are preserved until later craters cover them.

PROBLEM

21. The sun is shining from the west. The east side of the craters are lit and the west side craters are in shadow.
22. Crater A is older than crater B. The impact of crater B is on top of crater A. Because of its larger size, if crater A was younger, it would cover up crater B.
23. No, it did not prove the existence of water. It showed only that there is much hydrogen in the soil located around the poles. This only suggests the possibility of the existence of water on the Moon.
24. Because of the temperature at the lunar poles, any water in those areas would have to be in the form of ice. The poles receive only a small amount of sunlight, which means the temperature is at or below freezing all the time. Liquid water cannot flow in freezing temperatures and in order to exist as gas, water would need to be very hot.
25. The theory of the collision between Earth and a Mars-sized body seems to be supported. Earth has a large iron core while the Moon has a small iron core. If the Moon is made up of material from Earth, some of that would have to be iron.