任务作业 6

Massive projectiles striking much larger bodies create various kinds of craters, including multi-ring basins–the largest geologic features observed on planets and moons. In such collisions, the impactor is completely destroyed and its material is incorporated into the larger body. Collison's between bodies of comparable size, on the other hand, have very different consequences: one or both bodies might be entirely smashed, with mass from one or both the bodies redistributed among new objects formed from the fragments. Such a titanic collision between Earth and a Mars-size impactor may have given rise to Earth's Moon.

The Earth-Moon system has always been perplexing. Earth is the only one of the inner planets with a large satellite, the orbit of which is neither in the equatorial plane of Earth nor in the plane in which the other planets lie. The Moon's mean density is much lower than that of Earth but is about the same as that of Earth's mantle. This similarity in density has long prompted speculation that the Moon split away from a rapidly rotating Earth, but this idea founders on two observations. In order to spin off the Moon, Earth would have had to rotate so fast that a day would have lasted less than three hours. Science offers no plausible explanation of how it could have slowed to its current rotational rate from that speed. Moreover, the Moon's composition, though similar to that of Earth's mantle, is not a precise match. Theorizing a titanic collision eliminates postulating a too-rapidly spinning Earth and accounts for the Moon's peculiar composition. In a titanic collision model, the bulk of the Moon would have formed from a combination of material from the impactor and Earth's mantle. Most of the earthly component would have been in the form of melted or vaporized matter. The difficulty in recondensing this vapor in Earth's orbit, and its subsequent loss to the vacuum of outer space, might account for the observed absence in lunar rocks of certain readily vaporized compounds and elements.

Unusual features of some other planets might also be explained by such impacts. Mercury is known to have a high density in comparison with other rocky planets. A titanic impact could have stripped away a portion of its rocky mantle, leaving behind a metallic core whose density is out of proportion with the original ratio of rock to metal. A massive, glancing blow to Venus might have given it its anomalously slow spin and reversed direction of rotation. Such conjectures are tempting, but, since no early planet was immune to titanic impacts, they could be used indiscriminately to explain away in a cavalier fashion every unusual planetary characteristic; still, we may now be beginning to discern the true role of titanic impacts in planetary history.

1. According to the passage, which of the following is **true of** the collisions mentioned **in the highlighted sentence**?

A. They occur less frequently than do titanic collisions.
B. They occur between bodies of comparable size.
C. They occur primarily between planet-sized bodies.
D. They result in the complete destruction of the impacting body.
E. They result in mass being redistributed among newly formed objects.

2. The author of the passage asserts which of the following about titanic collision models?

A. Such models are conclusive with respect to certain anomalies within the solar system, but leave numerous other anomalies unexplained.
B. Such models are more likely than are earlier models to account for the formation of multi-ring basins.
C. Such models may be particularly useful in explaining what happens when the impacting bodies involved are of highly dissimilar mean densities.
D. Such models have been tested to such a degree that they are quickly reaching the point where they can be considered definitive.
E. Such models are so tempting that they run the risk of being used indiscriminately to explain unusual planetary features.

3. The passage **suggests** that which of the following is true of the cited compounds and elements?

A. They were created by reactions that took place during a titanic collision.
B. They were supplied by an impactor that collided with Earth.
C. They were once present on the Moon but were subsequently vaporized.
D. They are rarely found on planet-size bodies in our solar system.
E. They are present on Earth but not on the Moon.

4. In the second paragraph, the author is **primarily concerned with**

A. arguing in favor of a particular theory about the formation of the Earth-Moon system.
B. summarizing conventional theories about the formation of the earth-Moon system.
C. anticipating and responding to criticisms of a particular theory about the formation of the Earth-Moon system.
D. explaining why the Earth-Moon system is considered scientifically perplexing.
E. questioning an assumption underlying one theory about the formation of the Earth-Moon system.

Passage2:

In 1995 the Galileo spacecraft captured data about Jupiter's atmosphere—namely, the absence of most of the predicted atmospheric water—that challenged prevailing theories about Jupiter's structure. The unexpectedness of this finding fits a larger pattern in which theories about planetary composition and dynamics have failed to predict the realities discovered through space exploration. Instead of normal planets whose composition could be predicted by theory, the planets populating our solar system are unique individuals whose chemical and tectonic identities were created through numerous contingent events. One implication of this is that although the universe undoubtedly holds other planetary systems, the duplication of the sequence that produced our solar system and the development of life on Earth is highly unlikely.

Recently planetary scientists have suggested that the external preconditions for the development of Earth's biosphere probably included four paramount contingencies. First, a climate conducive to life on Earth depends upon the extraordinarily narrow orbital parameters that define a continuously habitable zone where water can exist in a liquid state. If Earth's orbit were only 5 percent smaller than it is, temperatures during the early stages of Earth's history would have been high enough to vaporize the oceans. If the Earth-Sun distance were as little as 1 percent larger, runaway glaciation on Earth about 2 billion years ago would have caused the oceans to freeze and remain frozen to this day. Second, Jupiter's enormous mass prevents most Sun-bound comets from penetrating the inner solar system. It has been estimated that without this shield, Earth would have experienced bombardment by comet-sized impactors a thousand times more frequently than has actually been recorded during geological time. Even if Earth's surface were not actually sterilized by this bombardment, it is unlikely that any but the most primitive life-forms could have survived. This suggests that only planetary systems containing both terrestrial planets like Earth and gas giants like Jupiter might be capable of sustaining complex life-forms.

Third, the gravitational shield of the giant outer planets, while highly efficient, must occasionally fail to protect Earth. Paradoxically, while the temperatures required for liquid water exist only in the inner solar system, the key building blocks of life, including water itself, occur primarily beyond the asteroid belt. Thus the evolution of life has depended on a frequency of cometary impacts sufficient to convey water, as well as carbon and nitrogen, from these distant regions of the solar system to Earth while stopping short of an impact magnitude that would destroy the atmosphere and oceans.

Finally, Earth's unique and massive satellite, the Moon, plays a crucial role in stabilizing the obliquity of Earth's rotational axis, this obliquity creates the terrestrial seasonality so important to the evolution and diversity of life. Mars, in contrast, has a wildly oscillating tilt and chaotic seasonality, while Venus, rotating slowly backward, has virtually no seasonality at all.

1. The passage is **primarily concerned with**

A. enumerating conditions that may have been necessary for a particular development
B. outlining the conditions under which scientists may be able to predict certain events
C. explaining how a particular finding affected scientists understanding of a phenomenon
D. suggesting reasons why a particular outcome was more likely to occur than other possible outcomes
E. assessing the relative significance of factors that contributed to a particular occurrence

2. It can be **inferred** from the passage that the planetary scientists would be most likely to agree with which of the following statements concerning the development of complex life forms on Earth?

A. It might have occurred earlier in Earth's history if cometary impacts had been less frequent than they were.
B. It could have occurred if Earth's orbit were 1 percent larger than it is but not if Earth's orbit were 5 percent smaller
C. It probably follows a pattern common on other terrestrial planets that occupy planetary systems containing gas giants.
D. Its dependence on the effect that Jupiter's gravitational shield has on Earth was difficult to recognize prior to 1995.
E. It has been contingent on conditions elsewhere in Earth's solar system as well as on conditions on Earth itself.

3. The author of the passage most likely mentions Mars oscillating tilt primarily **in order to**

A. provide evidence for a proposition about the potential effects of cometary impacts
B. emphasize the absence from our solar system of normal planets
C. contrast the rotational axis of Mars with that of Venus
D. characterize the role of other planets in the solar system in earths development
E. emphasize the importance of the Moon to the development of life on Earth

4. The passage suggests each of the following about water on Earth **EXCEPT**:

A. It was conveyed to Earth by comets.
B. It appeared on Earth earlier than did carbon and nitrogen.
C. Its existence in a liquid state is contingent on Earths orbital parameters.
D. Much of it came from a part of the solar system where water cannot exist in a liquid state.
E. It is unlikely that there would be much of it available to support life if the gravitational shield of the outer planets did not limit the frequency with which comets strike Earth.