Name: _____ Date: _____

Ceres Was a Planet Once

Reading level 14 · 1269 words

Pluto was not the first planet to lose its title. On January 1, 1801, the astronomer Giuseppe Piazzi found a faint object circling the Sun between Mars and Jupiter, and astronomers welcomed it as the planet they had long expected in that gap. They named it Ceres. A year later Heinrich Olbers found a second object, Pallas, in almost the same orbit, and William Herschel, studying the pair, judged them much too small to be true planets. He proposed a new word for them: asteroids. The textbooks did not take it up. By 1807 two more had turned up, and for the next forty years or so the astronomy books counted all four among the planets, giving each a symbol of its own, just as Mars and Saturn had.

Then the list ran away from them. In just six years, from 1845 to 1851, the number of these small bodies reached fifteen, giving the solar system twenty-three planets, and it was obvious that hundreds more were waiting. Astronomers did not hold a vote. Instead they changed how they filed them: each newcomer got a number in the order it was found, while the planets were still listed by their distance from the Sun. That quiet change in bookkeeping was the demotion. Ceres was not reclassified because it had shrunk or moved. It was reclassified because astronomers discovered it had company. Keep that pattern in mind, because the story of Pluto repeats it almost step for step, about a century and a half later.

When Clyde Tombaugh found Pluto in 1930, it was welcomed as Planet X, the world that Percival Lowell had predicted from small irregularities in the orbits of the outer planets. The pull Lowell had calculated was never real: his figures for Neptune's mass were slightly off, and Pluto was found because Tombaugh searched so thoroughly, not because the prediction was right. Pluto also kept proving smaller than anyone expected. Once its moon Charon was found in 1978, its mass could be measured: about two tenths of one percent of Earth's. Pluto turned out to be smaller than seven moons in the solar system, including our own Moon, Jupiter's Ganymede and Neptune's Triton. For sixty years it sat alone at the edge of the map, an object that fit no family.

The oddity got company in 1992, when David Jewitt and Jane Luu found a small icy body beyond Neptune, the first since Pluto and Charon. By 2018 about 2,400 more had been catalogued, and Pluto turned out to be one member of a crowd, the Kuiper Belt, rather than a lone ninth world. Some institutions moved early. In 2000 the Hayden Planetarium in New York opened a solar system model with only eight planets, which made headlines almost a year later. Then, in 2005, Mike Brown, Chad Trujillo and David Rabinowitz announced Eris, about the same size as Pluto and slightly more massive. If Pluto counted as a planet, nothing about Eris itself could keep it off the list, and the same went for dozens of other big, round icy

bodies, and for Ceres.

The International Astronomical Union met in Prague in August 2006 intending to settle the matter, and its first draft did the opposite of what eventually passed. It would have kept Pluto, added Ceres and Eris, counted Pluto and Charon as a double planet, and left a dozen more candidates waiting to join. On August 22, after two open meetings, the plan swung round sharply toward a definition with only eight planets. Two days later members raised yellow cards to vote. Resolution 5A, the definition, was not counted but passed by a great majority. Resolution 6A, which made Pluto a dwarf planet and the prototype of a new class, passed 237 to 157, with 17 abstentions according to the Union's own release.

The definition has three parts. A planet orbits the Sun, has enough gravity to pull itself into a nearly round shape, and has cleared the neighborhood around its orbit. The first two are physical properties of the object; the third is a relationship between the object and everything near it. That third clause is where the argument lives. Only 424 astronomers were present for the final votes, fewer than five percent of the profession, because many had already gone home at the end of a ten-day meeting. Critics called the result unrepresentative. Defenders replied that if those four hundred were a representative slice of a membership of nine thousand, statistics says their vote is quite a good estimate of what the whole membership thinks.

The resolution attaches no numbers to "cleared the neighborhood," but others have supplied them. The astronomer Steven Soter proposed dividing a body's mass by the combined mass of everything else that shares its orbital zone. By that measure Earth outweighs the rest of its zone about 1.7 million to one. Mars, the weakest of the eight planets, still manages about 5,100 to one. Ceres comes out at about one third, since it holds only a quarter of the asteroid belt's mass, and Pluto at less than a tenth, since it holds only about seven percent of the Kuiper Belt's. Between Mars and Ceres lies a gap of four orders of magnitude, a factor of ten thousand. Every one of the eight planets sits above it, and everything else sits below.

The sharpest critic has been Alan Stern, who led NASA's New Horizons mission to Pluto. He points out that no planet has truly emptied its lane: Earth travels with thousands of near-Earth asteroids and Jupiter with about a hundred thousand Trojan asteroids. "If Neptune had cleared its zone," he has said, "Pluto wouldn't be there." The usual reply is that clearing means control, not emptiness. Neptune locked Pluto long ago into a pattern in which Pluto circles the Sun twice for every three of Neptune's orbits, so the two never collide, and Jupiter's Trojans stay where Jupiter's gravity holds them. There is an irony here. The phrase about clearing a neighborhood comes from a 2000 paper by Stern himself, with Harold Levison.

Stern's deeper objection is about what kind of fact should decide the question. He prefers properties the body has on its own, such as size and roundness, over its relationship with its neighbors. Many planetary scientists agree and still call Pluto, Charon and Eris planets, which

amounts to trusting only the test of roundness. New Horizons gave them a strong example in 2015. The western lobe of Pluto's bright heart, Sputnik Planitia, is a basin about a thousand kilometers wide, flooded with nitrogen ice that churns slowly in cells like a simmering pot. New Horizons saw no craters on it, so the surface must be less than ten million years old. A world that resurfaces itself behaves, to a geologist, very much like a planet.

There is one more complication, and it may be the most interesting. The astronomer Jean-Luc Margot built a test from a body's mass, its distance from its star and the star's mass, and calculated the distance at which each object would switch from dwarf planet to planet. For Pluto that distance is about 1.7 times Earth's distance from the Sun, a little beyond the orbit of Mars. Inside that distance it would count as a planet: set the same icy world down where Mars orbits, and by Margot's test it would pass. Under the 2006 rule, then, whether Pluto counts depends partly on where it lives. Ceres lost the title in the 1850s for the same reason Pluto lost it in 2006. Should a definition care about an object's address?

Questions

1. Why was Ceres reclassified in the 1800s?

A. It shrank
B. Astronomers found many similar bodies near it
C. It moved closer to the Sun

2. What does the author suggest by saying Pluto's story repeats Ceres's almost step for step?

A. Pluto was demoted when astronomers found it had company
B. Pluto and Ceres share an orbit
C. Both were found by Clyde Tombaugh

3. By Soter's measure, how does Earth compare with everything else in its orbital zone?

A. It is about one third of the mass
B. It is about equal
C. It outweighs the rest about 1.7 million to one

4. In the book, what does "abstentions" mean?

A. Votes against
B. People who chose not to vote either way
C. Votes that were lost

5. Why do some planetary scientists point to Sputnik Planitia?

A. It shows Pluto is geologically active, like a planet
B. It proves Pluto has cleared its orbit
C. It is the largest crater in the solar system

6. What does Margot's test suggest about Pluto?

A. It could never be a planet anywhere

B. Near the orbit of Mars it would probably count as a planet

C. It is really a moon of Neptune

Words to know

asteroids: small rocky bodies

prototype: first example

abstentions: votes not cast

magnitude: power of ten

resurfaces: renews its surface

Answer key: Ceres Was a Planet Once

1. B. Astronomers found many similar bodies near it
2. A. Pluto was demoted when astronomers found it had company
3. C. It outweighs the rest about 1.7 million to one
4. B. People who chose not to vote either way
5. A. It shows Pluto is geologically active, like a planet
6. B. Near the orbit of Mars it would probably count as a planet