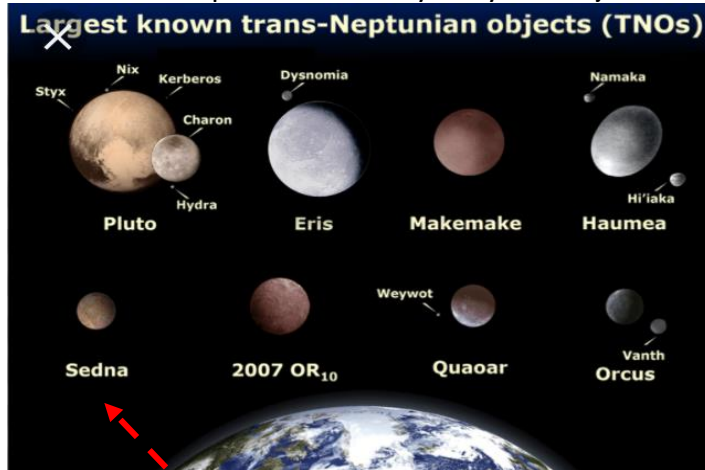


GRAVITY PROVIDES CENTRIPETAL FORCE ON SEDNA: A TRANS-NEPTUNIAN OBJECT

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A Journey Into the Solar System's Outer Reaches, Seeking New Worlds to Explore

NASA's New Horizons spacecraft will visit a tiny and mysterious object in the Kuiper belt on Tuesday, seeking clues to the formation of our cosmic neighborhood.



INTRODUCTION: Gravity provides centripetal force to keep Trans-Neptune Object Sedna in a 11,408 yr. period orbit of our sun(see NASA table below). $G m M_{\text{EARTH}}/R^2 = mv^2/R$ where $V = R\omega = R 2\pi f = 2\pi R/T$, Thus solving for $M_{\text{EARTH}} = (4\pi^2/G)(R^3/T^2)$. This Kepler's 3rd. Law. **Goal of this application is to confirm SUN Mass(1.989×10^{30} kg,** from NASA/Wikipedia) using Sedna parameters of T(in seconds) & R(semi-major axis ($R_{\text{APPOGEE}} + R_{\text{PERGEE}})/2$).

QUESTIONS (a) Find R(semi-major axis) in miles with data in article's bottom below R in miles?, (b) Convert R in miles to meters?, (c) Convert period in years to seconds?, (d) Find mass of our sun with T & R of Sedona?

HINTS: 1609 m./mile, 365 days/yr., 24 hrs./dat, 3600 s./hr. G = gravitational constant = 6.67×10^{-11} N m.²/kg.²

ANSWERS: (a) $R = 47 \times 10^9$ mi., (b) $R = 7.5623 \times 10^{13}$ m., (c) $T = 3.5976 \times 10^{11}$ s., (d) $M_{\text{SUN}} = \sim 1.976 \times 10^{30}$ kg.

COMMENT: Commuted M_{SUN} is close to NASA's number above.

90377 Sedna is a large minor planet in the outer reaches of the Solar System that was, as of 2015, at a distance of about 86 astronomical units from the Sun, about three times as far as Neptune. [Wikipedia](#)

Orbital period: 11,408 years

Orbits: Sun

Did you know: The name "Sedna" comes from the Inuit goddess of the sea, thought to live at the bottom of the Arctic Ocean.

Universe Today

The Dwarf Planet Sedna - Universe Today

Comparison of Sedna with the other largest TNOs and with Earth (all to scale)

In 2015, a NASA spacecraft snapped [spectacular photographs of Pluto](#), forever changing humanity's view of that world. On Tuesday that same probe, New Horizons, will provide a closeup of the farthest object ever visited. [New Horizons](#) will speed past an object nicknamed [Ultima Thule](#) at 31,500 miles per hour and pass within 2,200 miles of the surface, seeking clues to the earliest days of the solar system. Ultima Thule is four billion miles from the sun, in an area where many astronomers within recent memory believed there wouldn't be much that was worthy of study. It was once a common view that all of the solar system's big, interesting things — the sun and the nine planets — had been found. When NASA's Pioneer 10 spacecraft crossed the orbit of Neptune in June 1983, some newspaper headlines declared that it had left the solar system. (Pluto was still a planet then, but it was at the innermost part of its orbit and closer to the sun than Neptune.) Thirty-five years later, the Kuiper belt — the region Pioneer 10 was just entering and that New Horizons continues to explore — and the spaces beyond are perhaps the most fascinating parts of the solar system. In their vast, icy reaches are clues about how the sun and planets, including ours, coalesced out of gas and dust 4.5 billion years ago. **Farther out, beyond the Kuiper belt, are another group of objects that are even more puzzling. The first, Sedna, was discovered in 2003. At its closest approach to the inner solar system, it is seven billion miles from the sun, or more than twice as far out as Neptune, and too far away to ever have been gravitationally kicked by any of the giant planets. At its farthest orbit, Sedna is some 87 billion miles from the sun.**