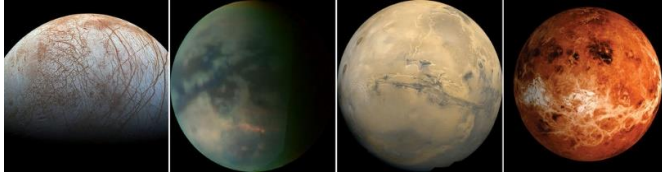


CENTRIPETAL FORCE & GRAVITY

Unit 10 & 11

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& New York Times, August 28, 2015 by Michael Roston

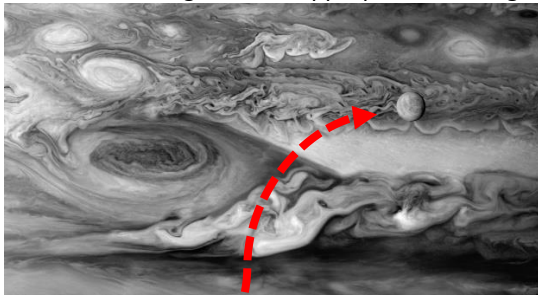
NASA's Next Horizon in Space



INTRODUCTION: This application's goal is to find mass of Jupiter using period (T) and distance (R) of Jupiter's moon Europa is from Jupiter. NASA states period of Europa is 3.551 days(T) around Jupiter and distance (R) about Jupiter is 670,900 km. Europa stays in orbit Jupiter due to Gravitational pull of Jupiter. $G Mm/R^2 = mv^2/R$

From left: Europa, the moon of Jupiter; Titan, the moon of Saturn; a composite image of the Valles Marineris across Mars; a mosaic of Venus's surface. Credit NASA Most of us have come down from the highs of [seeing Pluto up close](#) for the first time. Ever since New Horizons beamed back those photos, the question has loomed: [What's next?](#)

We asked a few experts and Times readers what NASA's exploratory priority should be in the years ahead. More than 1,600 readers shared their imaginative ideas. Some responses were serious and technical. Others were more whimsical, like that of Carter Read of Brooklyn, who proposed that we "send a record player bumping the sounds of Chuck Berry's 'golden decade' into deep space," because "he's the best communicator the human race has." (Mr. Berry already has one song in space, aboard [the Voyager spacecraft](#).) Below are some of the best responses, starting with the most popular. Perhaps NASA — and the members of Congress who appropriate its budget — will listen up.



Europa, right, crosses near Jupiter's Great Red Spot in a multiframe mosaic captured by Voyager 1 in March 1979.

where $v = R 2\pi/T$, thus $G M/R^2 = R^2 4\pi^2/T^2 R$, or $M = [4\pi^2/G][R^3/T^2]$
This last equation is called kepler's 3rd. law. $G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$

HINTS: 24 hrs. = 1 day, 3600 s. = 1 hr., 1000 m. = 1 km.

QUESTIONS: (a) Convert 3.551 days to seconds?, (b) Find R in meters?, (c) Find mass M of Jupiter?, (d) How does the computed mass of Jupiter compare to NASA stated value of $M = 1.9 \times 10^{27} \text{ kg}$.

ANSWERS: (a) $3.06806 \times 10^5 \text{ s}$., (b) $6.709 \times 10^8 \text{ m}$., (c) $1.9 \times 10^{27} \text{ kg}$., (d) same

Europa, Jupiter's Moon

The right ingredients for life? The astrophysicist Neil deGrasse Tyson has been vocal about his choice for future space travel. "I want to go ice fishing on these icy moons of Jupiter, especially Europa," he said, [soon after the Pluto flyby](#). Nearly one-third of all the responses indicated a readiness for a mission to Europa. Dr. Tyson and other scientists have [long flirted](#) with the idea that Jupiter's moons could harbor the ingredients necessary for life, and this seemed to be the strongest factor motivating readers for a trip to Europa. J. Gradie of Kailua, Hawaii, wrote: Europa has the right combination: (a) lots and lots of water, (b) a cosmochemical abundance of other essential elements in its large rocky core, (c) a liquid water ocean (covered by an icy crust) and (d) a constant source of energy (tidal heating) operating over billions of years. All this implies a "sea floor" environment analogous to, if not identical to, Earth's mid-ocean ridges. And, we know what's going on down there! Similar sentiments were offered by other readers: All our chips should be pooled to answer the question of whether there is life beyond Earth, and Europa is the best place to look. — Peter Dermody, Center Moriches, N.Y. Readers were also energized by the prospect of doing more than orbiting Europa, with Vivek Vankayalapati of India giving voice to the hope of a submersible vehicle plumbing the moon's watery depths. Such a mission "would spark wonder and awe as well as immense scientific data," he said. These readers are in luck, sort of. NASA is working on a mission to Europa and already budgeting tens of millions of dollars to [plan multiple flybys](#) of the moon with a scientific instrument-packed spacecraft. The agency may not be able to send a submarine beneath Europa's ice in that mission, planned for the 2020s, but it's a start.