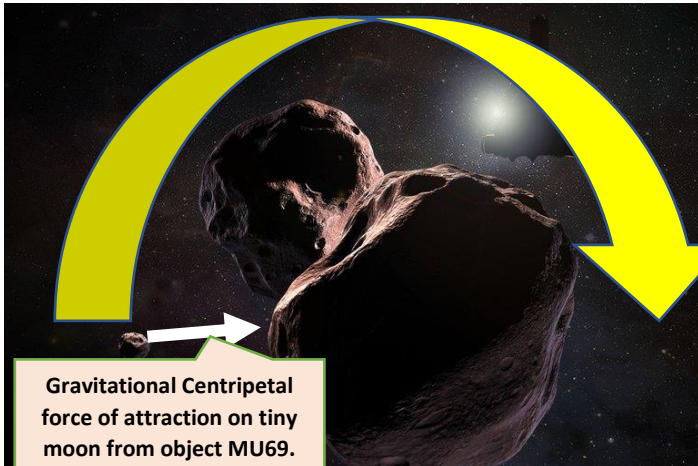


GRAVITATIONAL CENTRIPETAL FORCE

Units 8 & 14

Dr. John P. Cise, Professor of Physics, Austin Com. College, Austin Tx., jpcise@Austincc.edu & NYTimes 12/12/18 by Kenneth Chang

Tiny Moon May Orbit Distant Object That NASA's New Horizons Probe Will Visit



INTRODUCTION: Goal of this application is to find mass of object MU69 from knowing distance from MU69 the tiny moon is from MU69 (see article below = 120 miles = R) and average period (T) of orbit of tiny moon (T = 2 to 4 weeks {see below}, thus average T = 3 weeks or 21 days).

QUESTIONS: (a) Convert 120 miles to meters?, (b) Convert 3 weeks of time to seconds?, (c) Find Mass of MU69 object knowing T & R?

HINTS: $G Mm/R^2 = m V^2/R$, where $V = R \omega = R 2\pi f = 2\pi R/T$, thus $M = [4\pi^2/G][R^3/T^2]$

An artist's rendering shows a flyby of the New Horizons spacecraft of 2014 MU69, a distant object in the solar system's Kuiper belt. MU69 is no more than 20 miles wide, and it's possible, **scientists say, it has an even smaller moon.** Credit NASA/JHUAPL/SwRI

In just over a year, a NASA spacecraft will visit a tiny world at the edge of the solar system. Now that tiny object appears to have an even tinier moon, scientists announced on Tuesday. The object, known as 2014 MU69, is small, no more than 20 miles wide, but planetary scientists hope that it will turn out to be an ancient and pristine fragment from the earliest days of the solar system. The moon, if it exists, might be about three miles wide, **(((circling at a distance of about 120 miles from MU69, completing an orbit every two to four weeks, (for purpose of this application we will take period to be 3 weeks)))** estimated Marc W. Buie, an astronomer at the Southwest Research Institute in Boulder, Colo. He cautioned that the findings were tentative. "The story could change next week," he said. Dr. Buie and others working on NASA's New Horizons mission provided an update on Tuesday at a meeting of the American Geophysical Union meeting here. New Horizons flew past Pluto two years ago, sending back spectacular views that revealed a world with soaring mountains of ice, smooth plains and maybe even an subsurface ocean of liquid water.

New Horizons will zip past MU69 on Jan. 1, 2019. MU69 is so small that it can be seen only by the Hubble Space Telescope and then only as a faint point of light. But by happenstance, it passed in front of three stars within a few weeks this summer.

HINTS CONTINUED: 1609 meters = 1 mile, 7 days/week, 24 hrs./day, 3600 s./hr., $G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$

ANSWERS: (a) $R = 1.93 \times 10^5$ meters, (b) $T = 1.814 \times 10^6$ s., (c) $M_{\text{MU69}} = 1.3 \times 10^{15}$ kg.