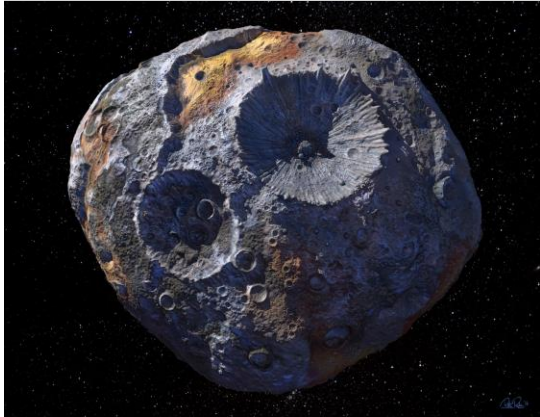


GRAVITY CAUSING ACCELERATION

Units 8 & 4,5 Dr. Dr. John P. Cise , Professor of Physics, Austin Com. College, 1212 Rio Grande St., Austin Tx., 78701
jpcise@austincc.edu & New York Times , January 6, 2016 by Kenneth Chang

A Metal Ball the Size of Massachusetts That NASA Wants to Explore



An artist's rendition of Psyche, the asteroid that is the target of a NASA mission in the next decade. Planetary scientists speculate it was once the nickel-iron core of a small [NASA](#) will be heading to a metal world. The space agency announced on Wednesday

that **a spacecraft**

named Psyche would visit an

asteroid named Psyche, one of two

new missions it will be launching into the solar system in the 2020s. From radar

observations, Psyche the asteroid appears ellipsoid in shape, about as **(((wide as Massachusetts.**

It is also quite dense, with estimates of 200 to 450 pounds per cubic foot, which is much denser than most asteroids. (By comparison, the average density of Earth is 344))) pounds per cubic foot.) Psyche is also very bright, adding to suspicions that it is made of metal.

“Humankind has visited rocky worlds and icy worlds and worlds made of gas, but we have never seen

a metal world,” Dr. Elkins-Tanton said. **“It’s the only roundish, fairly spherical metal body in our solar system. Not only is it unique, it’s improbable.”**

INTRODUCTION: At NASA website & Wikipedia gravity at surface of Asteroid Psyche is $\sim 0.11 \text{ m./s.}^2$. This is quite low considering on earth gravity is 32 ft./s.^2 . From Newton's 2nd law

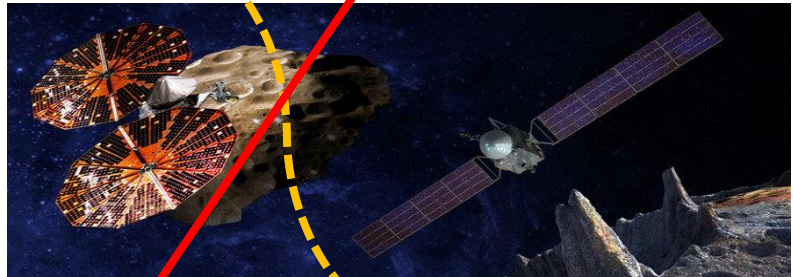
$mg = GmM/r^2$ where m = mass of object on surface & M = mass of object causing gravity, r = radius of gravity causer, G = gravitational constant = $6.67 \times 10^{-11} \text{ N m}^2/\text{kg.}^2$, Thus....

$$g = G M/r^2 \quad \text{eq. 1}$$

density = $\rho = M/V$, volume of sphere = $V = 4/3 \pi r^3$, thus

$M = [4/3 \pi r^3] \rho$, $r = [\text{width of Massachusetts(Wikipedia)}]/2$

$\sim 250 \text{ km.}/2 = \sim 125 \text{ km.}$, $\rho = 200 \text{ lb./ft.}^3$ (as seen in article below)



QUESTIONS: (a) Convert density of Psyche asteroid of 200 lb./ft.^3 to kg./m.^3 ?, (b) Write eq. 1 in terms of: G, ρ, π, r ?, (c) Find g on surface of Asteroid Psyche?, (d) Compare ans. (c) to NASA stated value of Psyche gravitational acceleration g ?

HINTS: $16.02 \text{ kg./m}^3 = 1 \text{ lb./ft.}^3$

ANSWERS: (a) $3.205 \times 10^3 \text{ kg./m.}^3$, (b) $g = 4/3 G \rho \pi r$, (c) $g = \sim 0.113 \text{ m./s.}^2$

(d) NASA stated $g_{\text{PSYCHE}} = 0.11 \text{ m./s.}^2$. Computed value of g at asteroid Psyche surface is quite close to NASA stated. Success!