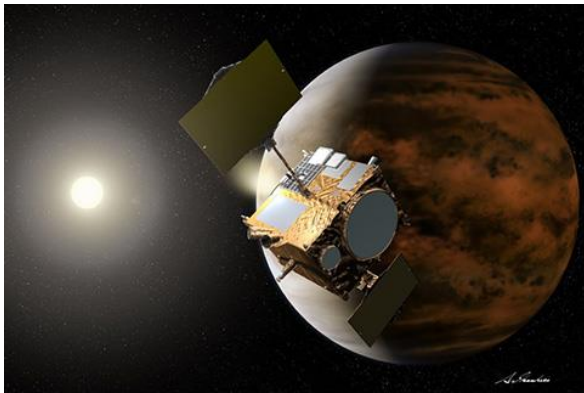


CENTRIPETAL FORCE FROM GRAVITY

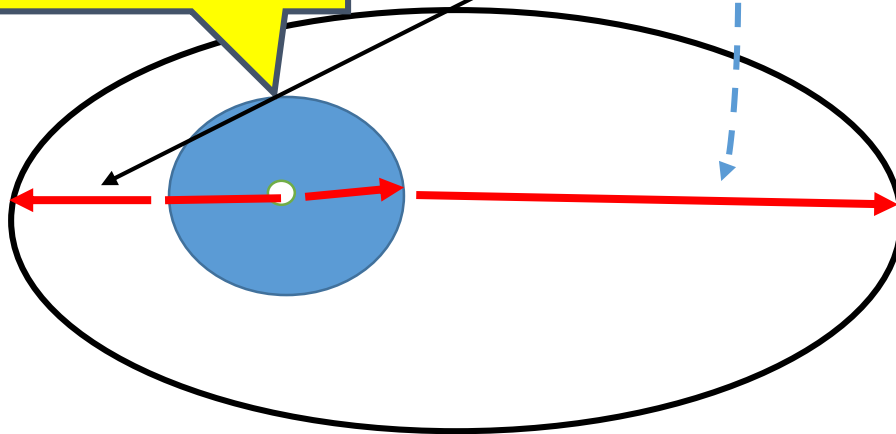
Unit 14 Dr. John P. Cise

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Japan: On Second Try, Space Probe Enters Orbit Around Venus



Venus : radius of 6.052×10^6 meters



From Japan Space Agency(JAXA):

"The orbit **(((period of Akatsuki probe is 13 days and 14 hours.)))** Also found the orbiter is flying in the same direction as that of Venus's rotation," JAXA officials **wrote in a statement** today. "The Akatsuki is in good health."**(((Akatsuki's current path takes it as close as 250 miles (400 kilometers) to Venus, and as far away as 273,000 miles (440,000 km).)))** officials added. This orbit is much more elliptical than the one Akatsuki was supposed to achieve five years ago,

INTRODUCTION: Purpose here is to find mass of Venus with Kepler's 3rd law which came from Newton's 4th law of gravity and Centripetal force $F = m v^2 / R$.

$$M = [4\pi^2 / G] (R^3 / T^2)$$

QUESTIONS: (a) Find maximum distance from center of Venus? (b) Find minimum distance from Center of Venus? (c) Find R which is mean distance ([min. + max.]/2) (d) Convert the period into seconds?, (e) Find mass of Venus? (f) Compare result to NASA stated Venus mass of 4.867×10^{24} kg.?

Japan's space agency said Wednesday that its **Akatsuki probe had successfully entered orbit around Venus** after an initial attempt failed five years ago. It is the first time a Japanese space probe has entered the orbit of another planet, according to the Japan Aerospace Exploration Agency, or JAXA. An agency project manager, Masato Nakamura, said the probe would shift to full observation of Venus in April. Akatsuki, meaning dawn, blasted off in 2010 on a mission to observe the toxic atmosphere and superhot volcanic surface of Venus. But it failed to enter the planet's gravitational pull and shot past it, forcing JAXA technicians to make the second attempt.

HINTS: $G =$ gravitational constant = $6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$, $3600 \text{ s} = 1 \text{ hour}$,

ANSWERS: (a) 446,051 Km. , (b) 6452 km. , (c) $2.2625 \times 10^8 \text{ m}$, (d) $1.377 \times 10^{12} \text{ s}$, (e) $4.978 \times 10^{24} \text{ kg}$.

(f) Computed Venus mass comes very close to NASA stated mass. Thus, Kepler's 3rd Law derived from equating gravitational force $G Mm/R^2$ to supplying the centripetal force $m v^2/R$ does produce

$$R^3/T^2 = G M / 4\pi^2 \quad \text{Kepler's 3}^{\text{rd}} \text{ Law} \quad \text{Note: } v = R \omega = R 2\pi/T$$