ENERGY MOSTLY + GRAVITY+

CENTRIPETAL FORCE

Units 10,11,8,14, Dr. John P. Cise, Prof. of Physics, 1212 Rio Grande St., Austin Tx. 78701
jpcise@austincc.edu & NYTimes Dec. 14,2012 by Thee Kenneth Chang {Dedicated to my friend/wife of 22 years Gertrude Cabacungan}

Two Space Probes to Crash, Intentionally, on Dark Side of Moon

NASA's latest Moon mission will end on Monday — not with a whimper, but a splat.

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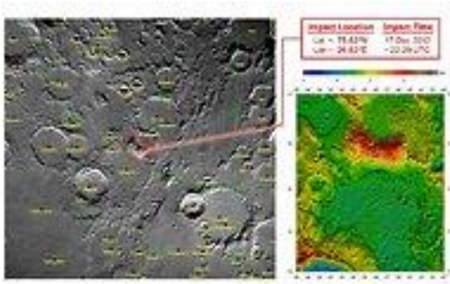
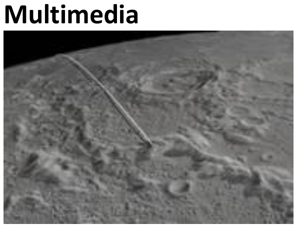


This map of the Moon shows the area where Ebb and Flow, two NASA probes, are set to crash.

Multimedia



The End of 'Ebb' and 'Flow'

INTRODUCTION: The purpose of this great application of: Gravity, Centripetal force, and Energy is to confirm Ebb & Flow satellites will crash into moon at ~ 3760 mph from 6.6 miles above moon surface.

QUESTIONS: (a) Using Gravitation & Centripetal force concepts find needed orbital speed for satellites to stay in orbit 6.6 miles above moon surface? (b)Using energy conservation concepts show Ebb/Flow satellites crash into moon at 1.6848 X 10^3 m/s or ~ 3760 mph = v_{final} ? Assume friction forces are minimal.

HINTS: Gravitation from Sir Isaac Newton's 4^{th} law is: $F = G\ mM/r^2$,This gravitational force provides needed centripetal force(mv^2/r)to keep Ebb/Flow in orbit 6.6 miles above lunar surface. Thus, $GmM/r^2 = mv^2/r$ giving needed orbital speed to be $(GM/r)^{1/2} = v$, where M = mass of moon= 7.3477 X 10^{22} kg , r = radius of moon+ 6.6 miles(in km) = 1737.1 km. + 10.56 km. = 1747.66 km., G= gravitational constant = 6.673 X 10^{-11} $m^3/kg\ s^2$. To solve for speed of crash you will need to use energy conservation concept: total initial energy at 6.6 miles(10.56 km. up{h}, initial kinetic energy(K) ½ mv_i^2 + gravitational potential energy U=mgh) equals total final energy at crash(h =0, so $U_{final} = mgh_{surface}=0$,$K_{final} = 1/2mv_f^2$). Thus: $1/2mv_i^2 + mgh = 1/2mv_{final}^2$, Even though the Gravitational potential at 6.6 miles up is so little, your solution will be closer to the 3760 mph stated in the article when used. 2.236 mph= 1 m/s , use max. sig. figures, g_{moon} =1.6 m/s^2 , 1000 m = 1 km.

ANSWERS: (a) 1.6748 X 10^3 m/s, (b) 1.6848 X 10^3 m/s or ~ 3767.2 mph , close to article 3760

The End of 'Ebb' and 'Flow'Ebb and Flow, two space probes the size of washing machines that have been orbiting the Moon and measuring its gravity field, will perform an orchestrated death plunge on Monday, crashing into the body's dark side. The exercise will not be for the advance of science, but rather something of a garbage-disposal operation, to make sure that the probes — which are running out of fuel — do not come to rest in a historically significant place, like on Neil Armstrong's footprints. The Moon has been affronted this way many times before, especially during the space race of the 1960s, but NASA is now trying to dispose of its litter more carefully. This time, the first impact will come 40 seconds past 5:38 p.m. Eastern Standard Time on Dec. 17 **when Ebb slams into a mountain near the Moon's north pole at (((3,760 miles per hour** For the primary mission, the **two spacecraft orbited at an altitude of 34 miles. Wobbles in the distance between them told of variations in the Moon's gravitational field**. For example, the gravity would be stronger when the spacecraft passed over a mountain field or a clump of dense minerals. After the primary mission was completed, the **two spacecraft were (((nudged to a lower altitude of 14 miles — for more precise measurements — and then, on Dec. 6, even lower to 6.6 miles))).**