ENERGY

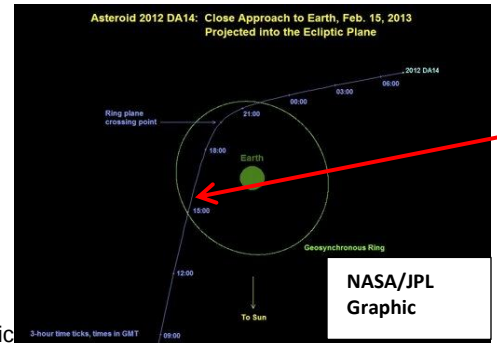
Units 10 & 11 Dr John P. Cise, Professor of Physics, Austin Community College, 1212 Rio Grande St. Austin Tx 78701 jpcise@austincc.edu & NYTimes February 9, 2013 by Donald K. Yeomans

Beware of Errant Asteroids.

Multimedia

Click at left to view more graphics

Graphic



INTRODUCTION A: **NASA.gov has answered the question below ….Q: How fast will the asteroid be traveling at closest approach? A:** Asteroid 2012 DA 14 is traveling at about 17,450 miles per hour (28,100 kilometers per hour), or 4.8 miles per second **(((7.82 kilometers per second)))** relative to Earth. Below the weight 2012DA14 is listed at 143,000 tons. This is English weight. Metric tons conversion is 0.907 Metric tons/English ton. Thus, 143,000 x 0.907 = 129,701 metric tonns(in kg.). **With 2000 kg /ton the mass of 2012DA14 is (((2.594 X 10^8 kg))).**

Getting Closer

INTRODUCTION B: **2012dA14 feels effects of gravitational force at 22,300 miles above earth. 22,300 miles x 1.62 Km/mile = 3.6126 X 10^7 m. Earth radius is 0.6384 X 10^7 m . Thus, distance from center of earth to where gravitational effects exist is approximately R=~ 4.251 X 10^7 m. At that distance gravitational potential energy can not be determined using mgh. Mgh is only good near earth's surface. To find gravitational potential energy(U) at 22,300 miles our models show we must use U=GmM/R where G = gravitational constant= 6.67 X 10^{-11} Nm^2/kg^2 , m = mass of 2012DA14 = 2.594 X 10^8 kg(see above) M = earth mass = 5.97 X 10^{24} kg. Kinetic energy(K) = ½ mv^2 . Thus, at 22,300 miles above earth and traveling at 7.82 X 10^3 m/s 2012DA14 has kinetic(K) and gravitational potential energy(U) which could be released "if" it collided with earth.**

QUESTIONS: **(a) Find gravitational potential energy(U) of 2012DA14? (b) Find kinetic energy(K) of 2012DA14? (c) Find total energy (K+U) of 2012DA14 at 22,300 miles? (d) Convert 2.4 megatons of TNT to Joules of energy? (e) How well does (c) total energy compare with (d) energy of blast if 2012DA14 hit earth?**

HINTS: **4.184 x 10^9 Joules/Ton TNT , other hints are in introduction A & B.**

ANSWERS: **(a) 2.43 X 10^{15} joules , (b) 7.930 X 10^{15} joules , (c) ~10.36 X 10^{15} joules , (d) ~ 10.04 X 10^{15} joules , (e) close (-:**

ON Feb. 15, an asteroid designated 2012 DA14 will (((pass safely within about *17,200 miles of Earth's surface*))) — closer than the communication satellites that will be broadcasting the news of its arrival. The asteroid is about 150 feet in diameter and has (((a mass estimated at about *143,000 tons*.))) Should an object of that (((size hit Earth, it would cause a blast with the energy equivalent of about 2.4 million tons — or *2.4 megatons — of TNT explosives*))), more than 180 times the power of the atomic blast that leveled Hiroshima. It's almost as if nature is firing a shot across our bow to direct our attention to the vast number of nearby rocky asteroids and a few icy comets that make up what we call the near-Earth object population. We should take the warning seriously. While no known asteroids or comets represent a worrisome impact threat now, NASA's Jet Propulsion Laboratory shows **more than two dozen asteroids have better than a one in a million chance of smacking into Earth within the next 100 years.** That may sound reassuring, but we estimate that less than 10 percent of all near-Earth objects have been discovered. And while we are keeping a vigilant eye out for these objects in the Northern Hemisphere, we are considerably less watchful in the Southern Hemisphere.. Objects larger than about 100 feet in diameter, the size of a large house, strike Earth with an average interval of a few hundred years. The last one of about this size to hit was on June 30, 1908, in a sparsely populated region of Siberia called Tunguska. The Tunguska blast released about four megatons of energy and leveled millions of trees across 825 square miles. A much larger asteroid or comet, six miles in diameter, collided with Earth some 65 million years ago, killing most of the large vertebrates, including the dinosaurs. Fortunately, Earth collisions with objects so big happen only at average intervals of 100 million years.