WORK-ENERGY

Unit 10 & 11 Dr. John P. Cise, Professor of Physics, Austin Com. College, 1212 Rio Grande St., Austin Tx. 78701 jpcise@austincc.edu **& New York Times , September 6, 2016 by Kenneth Chang**

NASA Aims at an Asteroid Holding Clues to the Solar System's Roots

INTRODUCTION: **This asteroid Bennu could hit the earth(mass =~ 7.75 X10^{10} kg at NASA website) at 27,000 mph(see article below) in years 2175 – 2196. The article below claims the energy is equivalent to 1,459 X 10^6 Tons TNT.**

QUESTIONS: **(a) Convert 27,000 mph to m./s. ? (b)Find kinetic energy of Nennu Asteroid?, (c) Convert 1,450 X 10^6 Tons TNT to Jouls of energy?, (d) Compare how?**

HINTS: **0.447 m./s. = mph , KE = ½ m v^2 , 4.184 X 10^{12} J/ KTon TNT**

ANSWERS: **(a) v = ~ 1.23 X 10^4 m./s. ,(b)~ 5.9 X 10^{18} J, (c) ~ 6.1 X 10^{18} J,(d) Close!**

For the next two years, NASA's latest robotic spacecraft will be chasing down an asteroid near Earth in the hopes of scooping up some of the most primordial bits of the solar system. **The premise of the mission for the spacecraft, Osiris-Rex, is simple: Fly to an asteroid, grab some of the rock and bring it back to Earth, where scientists will study some of the pristine ingredients that went into the making of the solar system, including possibly the building blocks of life.** The spacecraft is sitting on top of an Atlas 5 rocket at Cape Canaveral, Fla., ready for launching on Thursday on a seven-year mission. Once off the ground, Osiris-Rex — a shortening of Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer — **will be aiming to get close to the asteroid Bennu. "It's 500 meters or so in size, about the height of the Empire State Building," Dr. Green said. Discovered in 1999, Bennu is a carbon-rich, almost black asteroid.** Data from NASA's Spitzer Space Telescope and radar measurements by ground-based radio telescopes suggest it is a "rubble pile" with pebbles about half an inch wide on the surface. Scientists believe that it is a conglomeration of leftovers, largely unchanged over the last 4.5 billion years. **Studying this asteroid could also come in handy if it is ever on a collision course with Earth. With about a 14-month orbit, Bennu passes fairly close once every six years. In 2035, it will make a particularly close approach, passing within the orbit of the moon, and Earth will give enough of a gravitational kick that astronomers cannot precisely predict where the asteroid will go after that.**

There **is a small chance — one in 2,700 — that Bennu will smack into Earth sometime from 2175 to 2196.** Bennu is not large enough to wreak planetwide extinctions — **the asteroid that is thought to have killed off the dinosaurs 66 million years ago was about six miles wide — but a collision would be devastating. Impact would occur at more than 27,000 miles per hour, unleashing energy equivalent to 1,450 million tons of TNT and carving a crater almost three miles wide and 1,500 feet deep, Dr. Lauretta calculated.** **On Bennu's surface, the pull of gravity may be somewhere from one-hundred-thousandth to one-millionth as that of Earth's, depending on the location. That means the spacecraft, about 3,000 pounds while awaiting launch, will probably weigh less than an ounce as it nudges Bennu to collect the rock.**

PART B INTRODUCTIOIN: **The function of this part is to verify the last two sentences above: The 3000 lb.(on earth) on Bennu would have a weight of less than an ounce?**

QUESTIONS: **(a) Find mass of spacecraft?, (b) If(as said) gravity on Bennu is one millionth of earth gravity, what is gravitational acceleration on Bennu?, (c) Find weight in pounds of spacecraft on Bennu?, (d) Find weight of spacecraft in ounces on Bennu?, (e) How well does computed weight in ounces compare to article stated?**

HINTS: **Weight = mg , g_{EARTH} = 32 FT./S.^{2} , 16 ounces/pound ,**

ANSWERS: **(a) m = ~ 93.75 slugs , (b) ~ 32 X 10^{-6} ft./s.^{2} , (c) $(Weight)_{BENNU}$ = ~ 0.03 LB., (d) $(Weight)_{BENNU}$ = ~ 0.5 ounces**
(e) Article states 3000 lb. on earth spacecraft would weigh < ounce on Bennu. Computed = ~ 0.5 oz….close!