Homework 4

SABIC: Physics

Due February 29, 2016

Reading:

Read Chapters 6 and 7.

Problem 1: practice with estimation

(a) The gravitational potential of the sun on the Earth is given by $GM_{sun}M_{Earth}/x$, where $G = 6.67 \times 10^{-11}\text{Nm}^2/\text{kg}^2$ is Newton's gravitational constant and $x = 1.49 \times 10^1 1m$ is the distance from the Earth to the Sun. (i) Estimate the gravitatational force the Earth exerts on the sun. (ii) Estimate the speed at which the Earth rotates about the sun, and find the period of rotation.

(b) A bullet from a .50 caliber rifle (bullet weight of 50 grams) can be used to hit a target over 2 km away. Estimate the potential energy in the gunpowder. (Hint: find the velocity of the bullet as it leaves the gun, and use conservation of energy.)

Problem 2: Kinetic Energy and Work

(a) Book problem 6.21

(b) Book problem 6.25

Problem 3: Conservation of Energy

(a) Book problem 7.37. Hint: the friction force does some work $W = F_{\text{friction}} \cdot \Delta x$, so $\Delta E = W$.

(b) Book problem 7.42. Hint: the total acceleration at the top of the loop is due to gravity, pointing downwards (at the minimum speed the normal force, which also points downwards, is zero). What must this acceleration be equal to for the motion to be in a circle? Reviewing the equations for circular motion may help.