PHYSICS 180

"Choose a job you love and you'll never have to work a day in your life."
--Confucius

1) i) A 0.04 *kg* gecko is subjected to a total force $\vec{F} = .05\hat{i} - .06\hat{j}$ *(N)* . Starting from rest at $(1,1)m$ it attains a speed of 11 *m/s* at (20, y) *m*. What is y?

   ii) Show that any central force between two objects, *i. e.*, one that acts along the displacement of centres, $\vec{r}$, with a strength that depends only on *r* is a conservative force.

2) A smooth, frictionless hemisphere of radius 0.2 *m* is fixed to the top of a table. A tiny bead starting from rest at a position very near the top of the hemisphere slides under gravity as shown in the figure. Where does the bead leave the hemisphere and how far from the outer edge of the hemisphere is it when it hits the table?
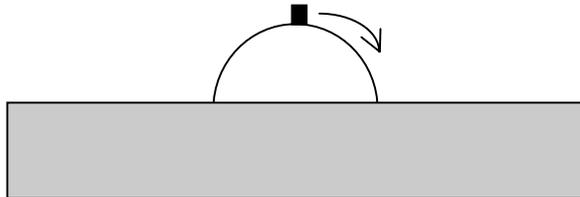
3) One of the hydrogen atoms in a $C_6 H_{12} O_6$ molecule (a sugar molecule) has a potential energy as a function of distance, *r*, from a particular position given by $U(r) = U_0 \left[(\frac{\sigma}{r})^4 - (\frac{\sigma}{r})^2 \right]$ where $U_0 = 2x10^{-20} J$ and $\sigma = 3x10^{-10} m$. If the speed of the hydrogen atom is $8x10^2$ m/s when it passes through its equilibrium position, what is its maximum distance from the equilibrium position?

4) A 10 cm long brass coil with spring constant 2 *N/m*, mass 0.1 *kg* and uniform density is pulled and released. With what frequency does it oscillate?
        Hint: Consider the end of the spring to be moving at a certain speed and calculate the total kinetic energy by integrating the kinetic energy of all infinitesmal segments.

Practice Problems:
Ch. 7: 31, 34,38,39, 41,44,49, 51,53
Ch. 8: 3, 6, 11, 16, 18, 21,27,32