PC1221 Fundamentals of Physics 1

Semester-1, AY10/11

Tutorial 4

Week-9: T6, T7, T8, T9, T10.
Week-10: T1, T2, T3, T4, T5.

1.   Can static friction do work? If no, explain why. If yes, give an example.

2.   In the design of a roller coaster, is it possible for any hill of the ride to be higher than the first one? If it is not possible, give the reason. If it is possible, how is it done?

3.   In a bungee jumping attempt, a daring student jumps from a hot-air balloon with a specially designed elastic cord attached to his waist. The unstretched length of the cord is 25.0 m, the student weighs 700 N, and the balloon is 36.0 m above the surface of a river below. By considering the student as a point mass, calculate the required force constant of the cord if the student is to stop safely 4.00 m above the river.

4.   A 0.400-kg particle slides around a horizontal track. The track has a smooth vertical outer wall forming a circle with a radius of 1.50 m.   The particle is given an initial speed of 8.00 m/s. After one revolution, its speed has dropped to 6.00 m/s because of friction with the rough floor of the track. (a) Find the energy converted from mechanical to internal in the system due to friction in one revolution. (b) Calculate the coefficient of kinetic friction. (c) What is the total number of revolutions the particle makes before stopping?

5.   A child slides without friction from a height h along a curved water slide.   She is launched from a height h/5 into the pool.   Determine her maximum airborne height y in terms of h and θ.
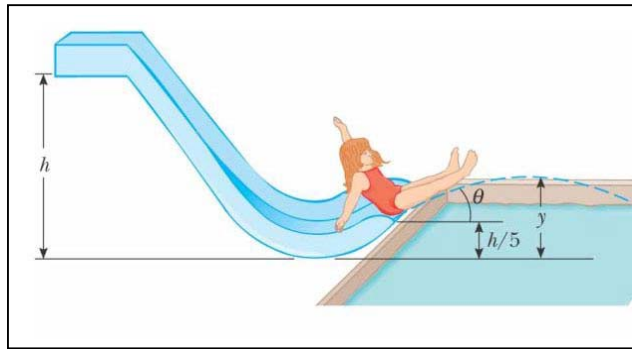
6.   A pendulum, comprising a string of length L and a small sphere, swings in the vertical plane. The string hits a peg located a distance d below the point of suspension. (a) Show that if the sphere is released from a height below that of the peg, it will return to this height after striking the peg. (b) Show that if the pendulum is released from the horizontal position (θ = 90°) and is to swing in a complete circle centered on the peg, then the minimum value of d must be 3L/5.