PHY 107

HW 2

Due dates

SECTION 4 and SECTION 5 : July 29, 2018

SECTION 6 and SECTION 7 : July 30, 2018

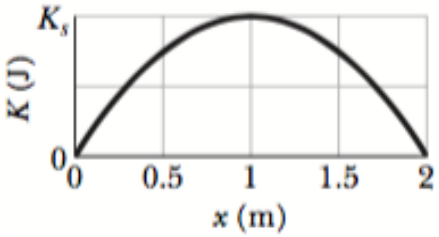
NOTE This is HW 2 based on the materials from 'Work and Energy' and 'Potential Energy'. Please, read each question carefully and answer. You must show all of your working to get full credit. Students can discuss with other students, but each student must submit his/her own work. Total points for this HW is 40.

Q1

Is positive or negative work done by a constant force $\vec{F}$ on a particle during a straight-line displacement $\vec{d}$ if (a) the angle between $\vec{F}$ and $\vec{d}$ is 30°; (b) the angle is 100°; (c) $\vec{F} = 2\hat{i} - 3\hat{j}$ and $\vec{d} = -4\hat{i}$? [2+2+2]

Q2

A block of mass m lies on a horizontal frictionless surface and is attached to one end of a horizontal spring (spring constant k) whose other end is fixed. The block is initially at rest at the position where the spring is unstretched (x= 0) when a constant horizontal force $\vec{F}$ in the positive direction of the x axis is applied to it. A plot of the resulting kinetic energy of the block versus its position x is also shown below. The scale of the figure's vertical axis is set by $K_s = 4.0J$. (a) What is the magnitude of $\vec{F}$? (b) What is the value of k? **Hint**: $K = -0.5kx^2 + Fx$ [3+3]



Q3

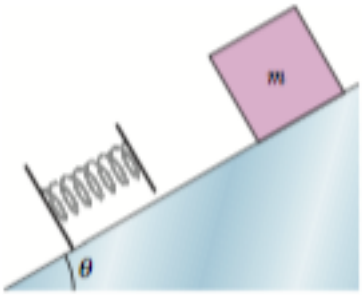
A force $\vec{F} = (cx - 3.00x^2)\hat{i}$ acts on a particle as the particle moves along an x axis, with $\vec{F}$ in newtons, x in meters, and c a constant. At x=0, the particle's kinetic energy is 20.0 J; at x = 3.00 m,it is 11.0J. Find c. [5]

Q4

What is the spring constant of a spring that stores 25 J of elastic potential energy when compressed by 7.5 cm? [3]

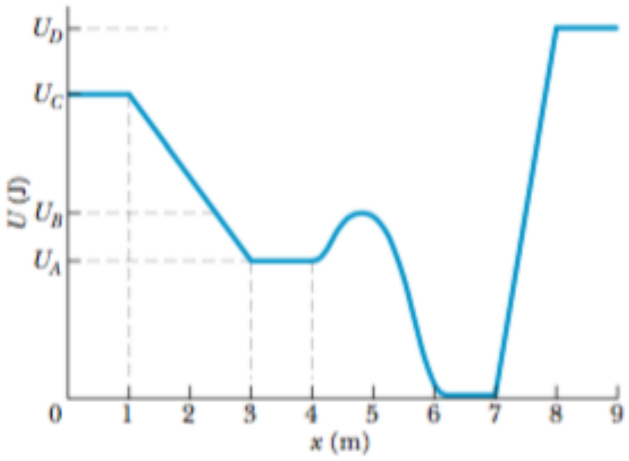
Q5

A block of mass m = 12 kg is released from rest on a frictionless incline of angle $\theta = 30°$. Below the block is a spring that can be compressed 2.0 cm by a force of 270 N. The block momentarily stops when it compresses the spring by 5.5 cm. (a) How far does the block move down the incline from its rest position to this stopping point? (b) What is the speed of the block just as it touches the spring? [3+3]



Q6

The figure below shows a plot of potential energy U versus position x of a 0.200 kg particle that can travel only along an x axis under the influence of a conservative force. The graph has these values: $U_A = 9.00J$, $U_C = 20.00J$, and $U_D = 24.00J$. The particle is released at the point where U forms a potential hill of height $U_B = 12.00J$, with kinetic energy 4.00 J. What is the speed of the particle at (a) x = 3.5 m and (b) x = 6.5 m? What is the position of the turning point on (c) the right side and (d) the left side? [2+2+2+2]



Q7

A rope is used to pull a 3.57 kg block at constant speed 4.06 m along a horizontal floor. The force on the block from the rope is 7.68 N and directed $\theta = 15.0°$ above the horizontal. What are (a) the work done by the rope's force, (b) the increase in thermal energy of the block-floor system, and (c) the coefficient of kinetic friction between the block and floor? [2+2+2]