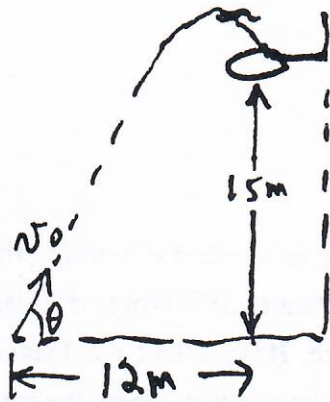


(1)



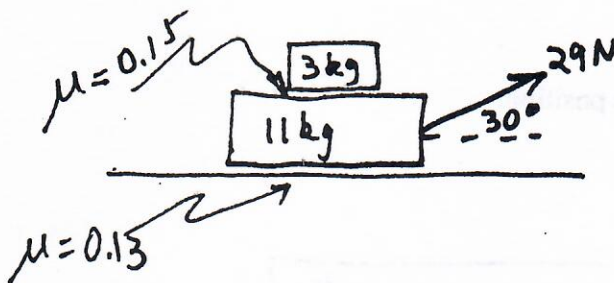
A basketball is projected at an angle θ with initial velocity v_0 . We know that after a time of 2.1 seconds the basketball drops through a basket at a distance of 12 m and a height of 15 m, as in the figure.

(6 pt) (a) What are the x and y components of the initial velocity at which it was projected?

(2 pt) (b) What is the magnitude of the initial velocity, v_0 , and the angle, θ , at which it was projected?

(6 pt) (c) What is the maximum height reached by the basketball before it drops through the basket?

(2)



A mass of 3 kg moves together with a mass of 11 kg which is pulled by a force of 29 N acting on the 11 kg mass at an angle of 30° , as shown in the figure. The 11 kg mass slides on a surface with a coefficient of friction of 0.13 and the coefficient of friction between the two masses is 0.15.

(3 pt) (a) Draw a free body diagram of the system consisting of both masses.

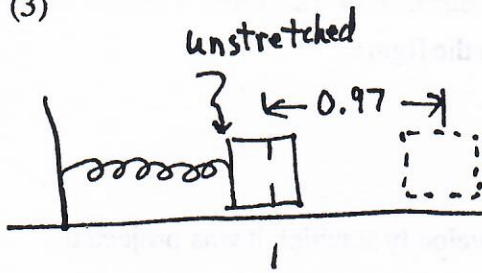
(5 pt) (b) What is the normal force exerted by the surface on the 11 kg mass?

(3 pt) (c) What is the friction force exerted on the 11 kg mass?

(5 pt) (d) What is the acceleration of the masses?

(4 pt) (e) What is the friction force exerted by the 11 kg mass on the 3 kg mass? (magnitude and direction)

(3)



A mass of 6.2 kg is attached to a spring that has a force constant of 387 N/m and slides on a horizontal table. It is pulled out a distance of 0.97 m from the position where the spring is unstretched and released.

(a) If there is no friction between the table and the mass, find:

(i) (3 pt) the frequency of vibration

(ii) (3 pt) the total mechanical energy of the system

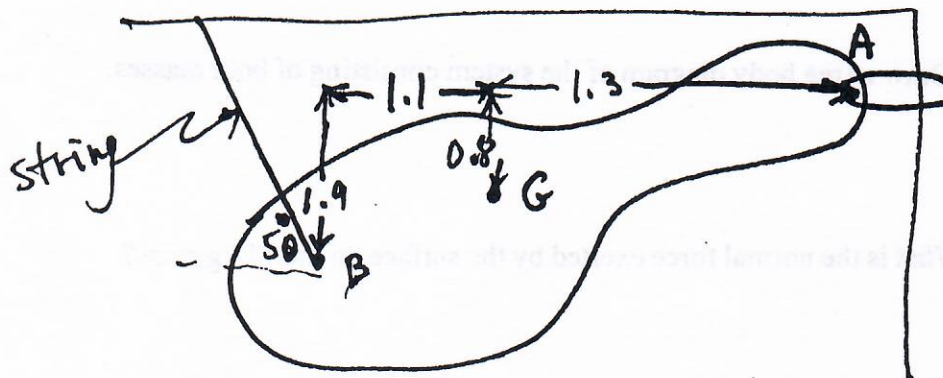
(iii) (3 pt) the maximum acceleration of the mass

(b) Suppose that there is a constant friction force of 18 N acting on the mass. calculate:

(i) (5 pt) the work done by friction during the time that the mass returns to the position of the unstretched spring

(ii) (6 pt) the velocity that the mass has at this position.

(4)



An irregular object has its center of gravity at point G on the figure. It is held up by a hinge at A and a string at B, as shown. The tension in the string is 343 N, and the string is at an