

PHYS2325-02 MID TERM EXAM N.2**Question 1**

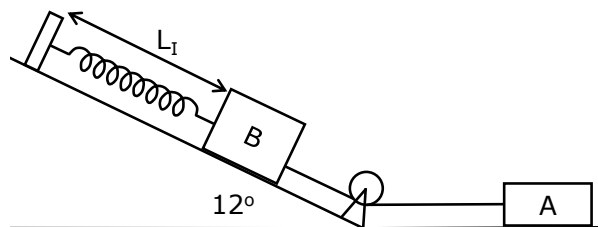
A system is made of two blocks, A and B, connected by a massless string and placed on a incline as sketched in the figure. The pulley is massless and its motion is without friction. Instead, between the blocks and the planes there is a friction of coefficient $\mu_k = 0.15$. The masses are $m_A = 2$ kg and $m_B = 6$ kg. Initially the system is at rest and the massless spring, of constant $k = 500$ N/m and length at rest of $L_o = 40$ cm, is stretched to a length of $L_I = 65$ cm.

Calculate the speed of the blocks when the spring has a length of 43 cm.

The two blocks have the same speed as long as there is a tension on the string. There is tension on the string as long as the acceleration of block B without string attached is greater than the acceleration of block A calculated without the pulling of the string. Calculate what is the stretching ΔL of the spring when the tension of the string drops down to zero.

The following criteria are used to assess your work:

- (4 pts) Drawing and sketches of initial and final situations and forces
- (4 pts) Expression of work for the relevant forces
- (1 pts) Kinetic energy theorem expression
- (3 pts) Calculation of final speed
- (2 pts) Answer to the final question

**Question 2**

Two particles with masses m and $2m$ are moving toward each other along the x axis with the same initial speeds v_i . Particle m is traveling to the left, and particle $2m$ is traveling to the right. They undergo an elastic glancing collision such that particle m is moving upward after the collision at right angles from its initial direction. (a) Find the final speeds of the two particles. (b) What is the angle θ at which the particle $2m$ is scattered?

The following criteria are used to assess your work:

- (4 pts) Drawing and sketches of initial and final situations
- (4 pts) Expression of total initial and final momentum in a vectorial form
- (2 pts) Answer question (a)
- (2 pts) Answer question (b)

Question 3

What is the definition of mechanical energy? Is it preserved? Starting from the knowledge of the kinetic energy theorem, demonstrate the conservation of mechanical energy.