Department of Mathematics and Natural Sciences

PHY111 - Principles of Physics-I (Summer 2021)

Assignment-4

Total Marks: 20

Answer all questions.

1. Two blocks, of masses M = 2.3 kg and 2M are connected to a spring of spring constant k = 180 N/m that has one end fixed, as shown in the Figure-1. The coefficient of kinetic friction between the horizontal surface and the block is 0.12. The pulley is frictionless and has a negligible mass. The blocks are released from rest with the spring relaxed.

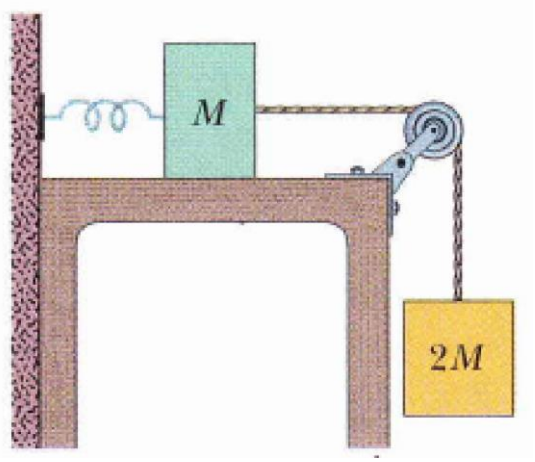

Figure-1

(a) What is the work done by the friction on the block of mass M? [2 marks]

(b) What is the combined kinetic energy of the two blocks when the hanging block has fallen 8 cm? [4 marks]

(c) What maximum distance does the hanging block fall before momentarily stopping? [4 marks]

2. A block of mass m rests on a plane inclined at θ with the horizontal. The block is attached to a spring of constant k as shown in Figure-2. The coefficients of static and kinetic friction between the block and plane are μ_s and μ_k respectively. Very slowly, the spring is pulled upward along the plane until the block starts to move.

(a) Obtain an expression for the extension *d* of the spring the instant the block moves.

[4 marks]

(b) Determine the value of μ_k such that the block comes to rest just as the spring is in its unstressed condition, that is, neither extended nor compressed.

[6 marks]

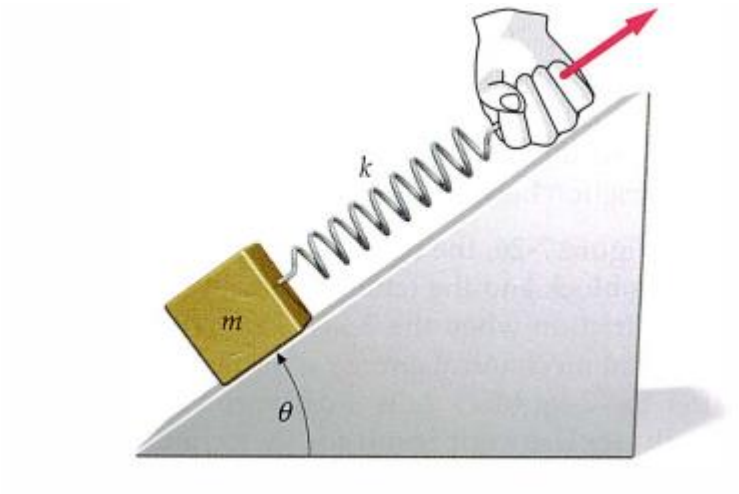

Figure-2