PHYS 101: General Physics 1 — KOÇ UNIVERSITY — Spring Semester 2015

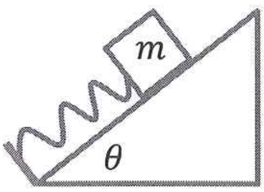
College of Sciences

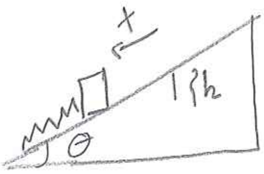
Section 2 — Quiz 7 — 17 April 2015

Closed book. Duration: 10 minutes

Name: **Student ID:** **Signature:**

A massless spring is fixed at the bottom of the inclined surface of angle (θ). A box of mass (m) is placed in front of the spring when the spring is at its natural length, and then the box is released. The kinetic friction coefficient of the incline is (μ_k), the spring constant is (k), gravitational acceleration is (g).
Find the maximum amount the spring can compress in terms of given quantities.





$x = \frac{h}{\sin\theta}$

let the change in the height of the block is h when the spring is maximum compressed.

using the conservation of energy

$K_1 + U_{grav,1} + U_{el,1} + W_{other} = K_2 + U_{grav,2} + U_{el,2}$

$mgx\sin\theta + 0 - \mu_k mg\cos\theta\, x = \frac{1}{2}kx^2$

$mgx(\sin\theta - \mu_k\cos\theta) = \frac{1}{2}kx^2 \Rightarrow \boxed{x = \frac{2mg}{k}(\sin\theta - \mu_k\cos\theta)}$

PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Spring Semester 2015**

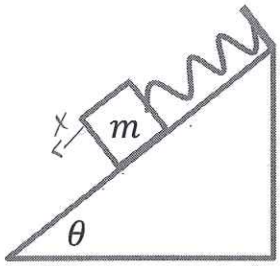
College of Sciences

Section 1 **Quiz 7** **17 April 2015**

Closed book. Duration: 10 minutes

Name: **Student ID:** **Signature:**

A box of mass (m) is on an inclined surface of angle (θ). The kinetic friction coefficient of the incline is (μ_k). The box is attached to a massless spring which is fixed at the top of the incline. The spring constant is (k), gravitational acceleration is (g).
The box is released at a point where the spring is at its natural length. Find the maximum amount the spring can stretch in terms of given quantities.



Let the change in the height of the block is h when the spring is maximum stretched.

using the principle of conservation of energy

$$K_1 + U_{gra,1} + U_{el,1} + W_{others} = K_2 + U_{gra,2} + U_{el,2}$$

$$0 + mg\,x\sin\theta + 0 - \mu_k\, mg\cos\theta\, x = \frac{1}{2}kx^2$$

$$mg\,x\,(\sin\theta - \mu_k\cos\theta) = \frac{1}{2}kx^2$$

$$\Rightarrow \boxed{x = \frac{2mg}{k}(\sin\theta - \mu_k\cos\theta)}$$

PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Spring Semester 2015**

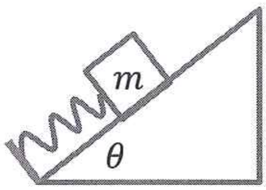
College of Arts and Sciences

Section 3 **Quiz 7** **17 April 2015**

Closed book. Duration: 10 minutes

Name: **Student ID:** **Signature:**

A massless spring is fixed at the bottom of the inclined surface of angle (θ). A box of mass (m) is placed in front of the spring when the spring is compressed by an amount (x), and then the box is released. The kinetic friction coefficient of the incline is (μ_k), the spring constant is (k), gravitational acceleration is (g).
Find the maximum distance (d) the box can move up on the inclined surface from its release point in terms of given quantities.



Using the conservation of energy, we can write

$$K_1 + U_{grav,1} + U_{el,1} + W_{other} = K_2 + U_{grav,2} + U_{el,3}$$

$$0 + 0 + \frac{1}{2} kx^2 - \mu_K mg \cos\theta \, d = 0 + mgd \sin\theta + 0$$

$$d = \frac{\frac{1}{2} k x^2}{mg.(\sin\theta + \mu_k \cos\theta)}$$