Energy Problems – Set 3

A brick is lifted to a certain height and then dropped to the ground. Next, a second identical brick is lifted twice as high as the first and also dropped to the ground. When the second brick strikes the ground, it has

A. half as much kinetic energy as the first.
B. square root of 2 as much kinetic energy as the first.
C. twice as much kinetic energy as the first.
D. four times as much kinetic energy as the first.

Explain:

A bottle dropped from a balcony strikes the sidewalk with a particular speed. To double the speed of impact, you would have to drop the bottle from a balcony

A. twice as high.
B. three times as high.
C. four times as high.
D. five times as high.
E. six times as high.

Explain:

A car is going 10 mph. The driver hits the brakes. The car travels 3 feet after the brakes are applied. A while later, the same car is going 20 mph. The driver hits the brakes. About how far does the car go after the brakes are applied?

A. 3 ft.
B. 6 ft.
C. 9 ft.
D. 12 ft.
E. 15 ft.

Explain:

A block of mass m on an incline plane that has a coefficient of friction μ_k. It begins a distance d_0 from the bottom of the ramp with an initial velocity v_0 directed up the ramp. What is its distance, d_f,from the bottom of the ramp when the block comes to rest?

1) Explicitly list the given and wanted information.
2) Draw an Action Diagram with all relevant dimensions, velocities, etc.
3) Draw a Free Body Diagram with all of the relevant forces and the displacement vector.

What is the net work done by the **C**onservative **F**orces?

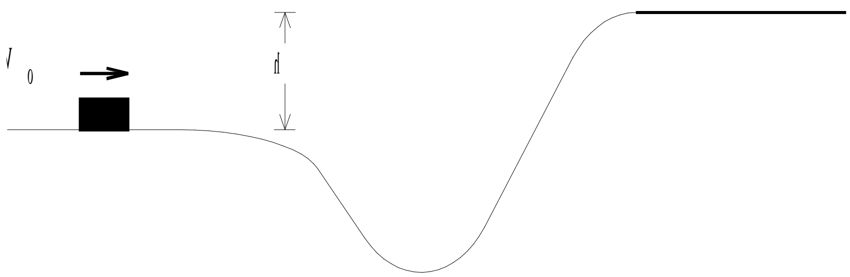
What is the net work done by the **N**on-**C**onservative **F**orces?

What is ΔK?

Put it all together! What is the final height above the ground?

What, then, is d_f?

A block slides along the track shown below. The track is frictionless until the block reaches the level portion at the top of the hill, where the coefficient of friction is μ_k.



a) First, Assume that there's no friction in the problem.
Write expressions for each of the terms:

$U_I =$ $K_I =$

$U_F =$ $K_F =$

$W_{NCF} =$

b) Write out the conservation of energy and solve for the final velocity.

c) Now assume that the there is friction on the upper level part of the track.
Write expressions for each of the **C**onservation of **E**nergy terms:

U_I =

K_I =

U_F =

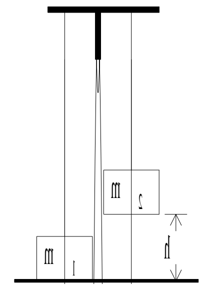
K_F =

W_{NCF} =

d) How far does the block slide on the level part of the track?

Energy Problems – Set 3 6

Use work-energy techniques to solve the following problem.



Two masses are connected by a light string passing over a light frictionless pulley. The mass m_2 is released from rest at a height of 4.0 m above the ground.

Determine the speed of m_1 just as m_2 hits the ground and the maximum height m_1 rises above the ground.

$m_1 = 3.0$ kg
$m_2 = 5.0$ kg

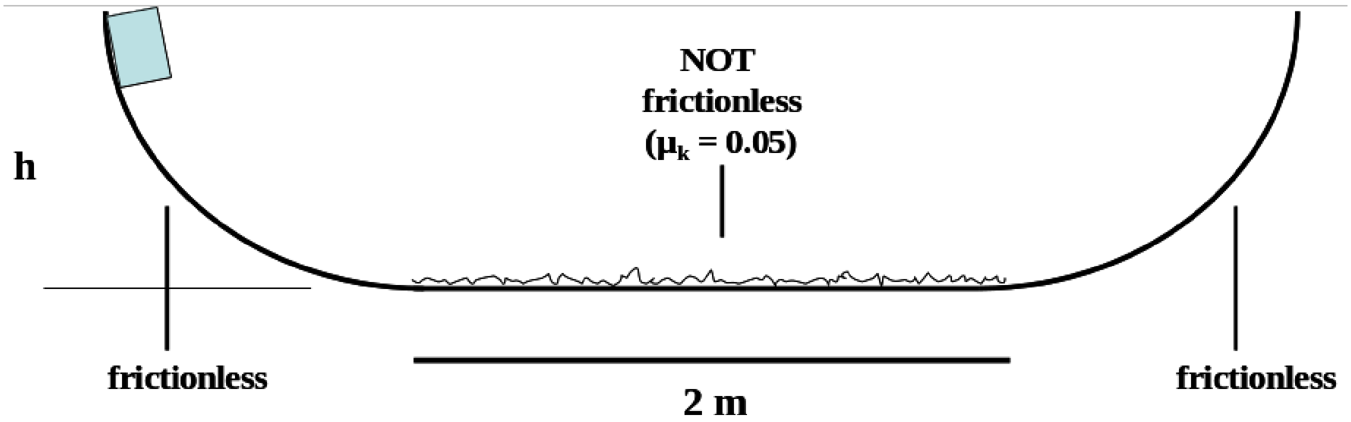
A block of mass m is pushed against a spring of spring constant *k* and the spring is compressed a distance l. The block is released and slides across a frictionless surface for a short distance before encountering a surface with a coefficient of friction μ_k.

a. Use conservation of energy to find an expression for the velocity of the block after it leaves the spring.

b. Use conservation of energy to find an expression for how far it slides on the surface with friction before coming to a stop.

*Use **C**onservation of **E**nergy to solve the following problem.*

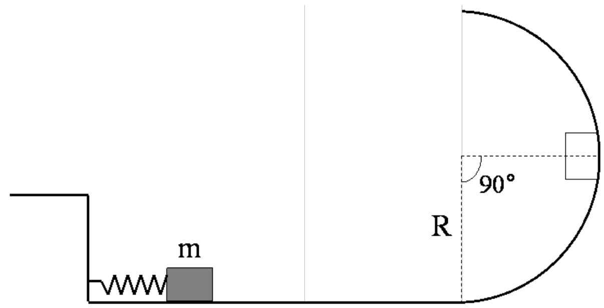
An 8.75-kg block starts at rest, at height h = 1.0 m, and slides down a frictionless ramp onto a horizontal plane where $\mu_k = 0.05$. If the block has enough energy after passing the plane, it will rise onto another frictionless ramp, and so forth.



(a) The block is released, makes its first trip to the right hand side, returns to the left hand side, and then returns once more to the right. On this second excursion to the right side, how high up the ramp does the block go?

A mass *m* rests on a frictionless horizontal track while compressing a horizontal spring of spring constant *k* a distance *d*. The mass is released and it slides along a frictionless horizontal track before sliding up a frictionless circular surface of radius *R*.

a. Find an expression for the compression *d* such that the mass just comes to rest at a radius position of θ=90° as shown in the picture?



b. Now include friction in the problem. If the spring is compressed the same distance *d* and the block stops at $\theta<90°$, how much work was done by the frictional force acting on the block?