Test 2 review

Test 2 auditorium assignments by the first one/two letter of your last name:

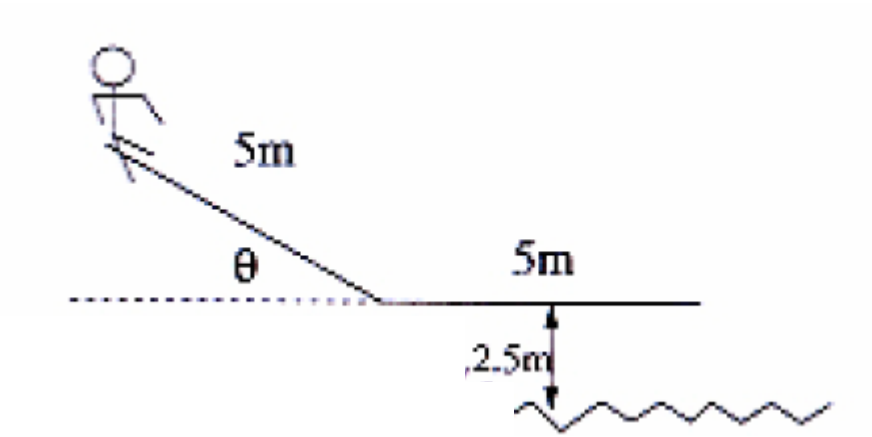
A - B: FLG 270
C - D: LIT 109
E - Gh: LIT 113
Gi - H: MAEA 303
I - K: LIT 121
L - N: BRY 130
O - S: WEIM 1064
T - Z: NEB 100

Test 2 announcements cont'd

- Test is Tuesday, Feb 27 8:20-10:10pm
- May bring 1 81/2 x 11 handwritten sheet
- Must bring UFID
- Calculators are allowed, no cell phones, blackberries, …
- Test conflicts see me after class

Test 2 F06 selected problems

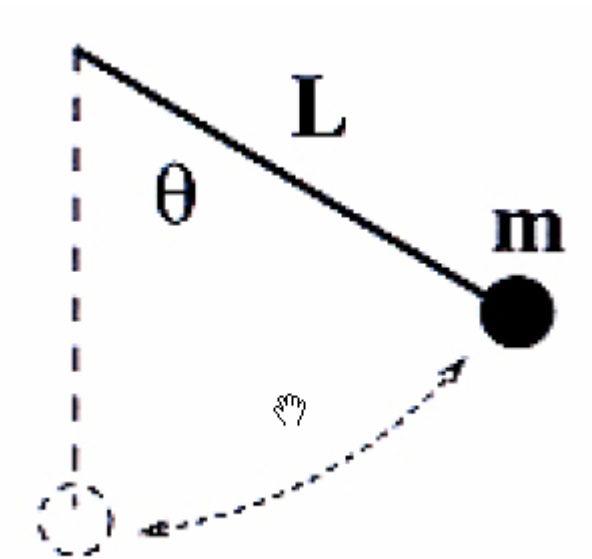
1. A water slide consists of a 5m slope downwards at $\theta = 30°$ to the horizontal followed by a 5 meters horizontal stretch that ends 2.5 meters above the water. Assuming no friction and a starting speed of zero, how fast are you traveling when you hit the water (in m/s)?



Ans: 10m/s

Test 2 F06 selected problems

2. A simple pendulum consists of a mass, m, hanging on a massless string of length L. You move the mass so that the string is now at an angle of $\theta = 60°$ to the vertical. How much work do you need to do to do this?



Ans: *mgL/2*

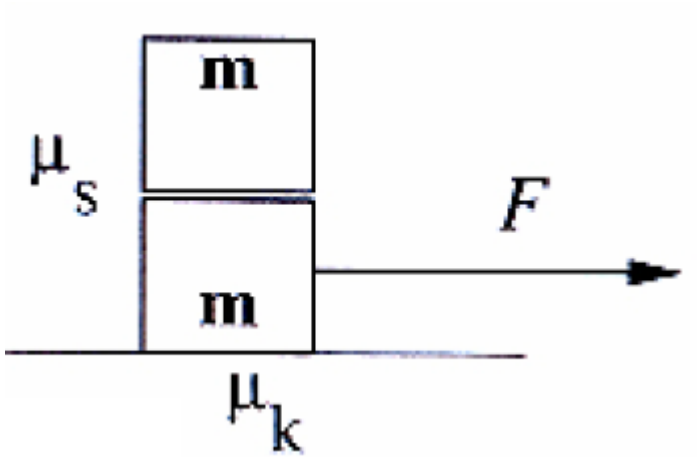
Test 2 F06 selected problems

3. An ice cube, starting at rest on top of a hemispherical igloo of radius R, slides off. How fast is it going when it hits the ground?

Ans: $\sqrt{2Rg}$

Test 2 F06 selected problems

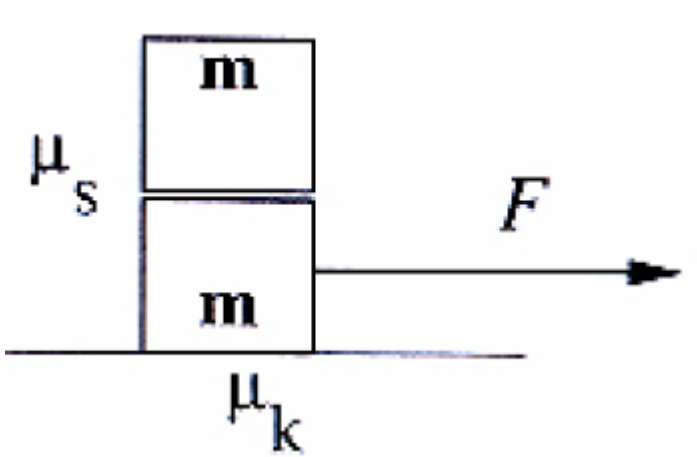
4. Two identical blocks, each of mass $m = 2\,\text{kg}$, are stacked one above the other on a table. A rope is attached to the lower one, and a force $F = 50\,\text{N}$ drags it horizontally. It is found that the two blocks accelerate together at $a = 5\,\text{m/s}^2$. What is the coefficient of kinetic friction μ_k for the block-table interface?



Ans: 0.75

Test 2 F06 selected problems

5. What is the minimum coefficient of static friction μ_s for the block-block interface in order that the two blocks move together?



Ans: 0.5

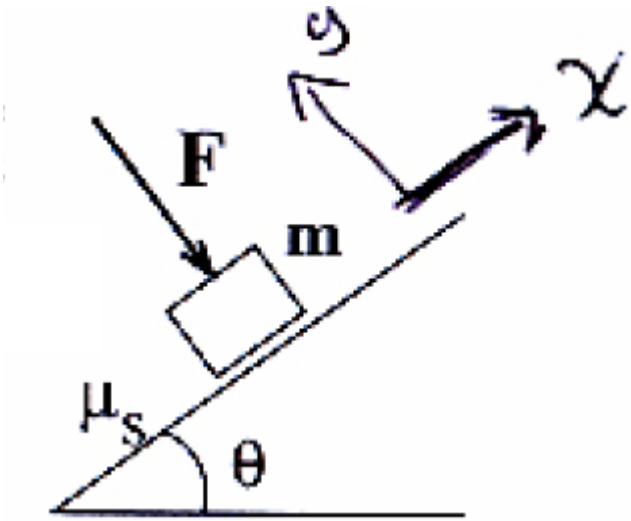
Test 2 F06 selected problems

6. Two forces, $\vec{F}_1$ and $\vec{F}_2$ act on a 5 kg object so that it accelerates in the x-direction with $a_x = 5\,\mathrm{m/s^2}$. $\vec{F}_1$ is 20 N directed at an angle of 37° from the x-direction. What is the magnitude of $\vec{F}_2$ in Newtons?

Ans: 15

Test 2 F06 selected problems

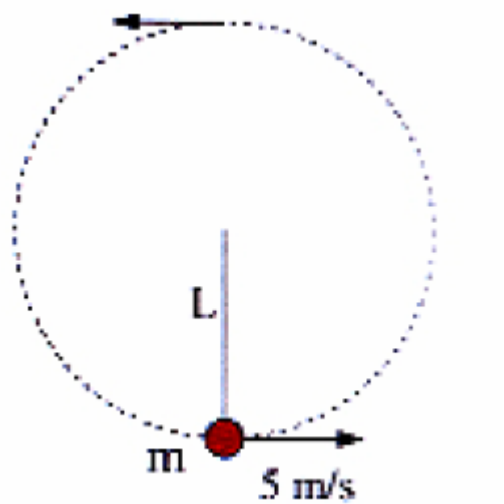
7. A $m = 1\,\text{kg}$ block is sitting on a slope of $\theta = 37°$ to the horizontal, held in place by a force $\vec{F}$ pointing at right angles to the slope. It is found that $\vec{F}$ has to be at least 10 N to stop the block from slipping down the slope. What is μ_s?



Ans: 0.333

Test 2 F06 selected problems

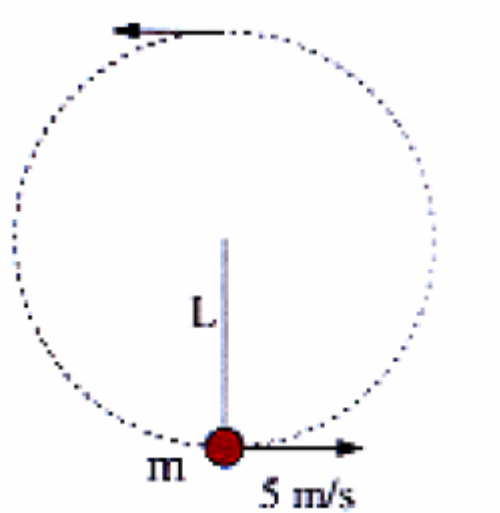
9. A ball of mass $m = 1\,\text{kg}$ is whirling in a vertical circle on a string of length $L = 0.5\,\text{m}$. At the bottom of the circle the speed of the ball is $5\,\text{m/s}$. What is the tension in the string when the ball is at the bottom of the circle?



Ans: 60N

Test 2 F06 selected problems

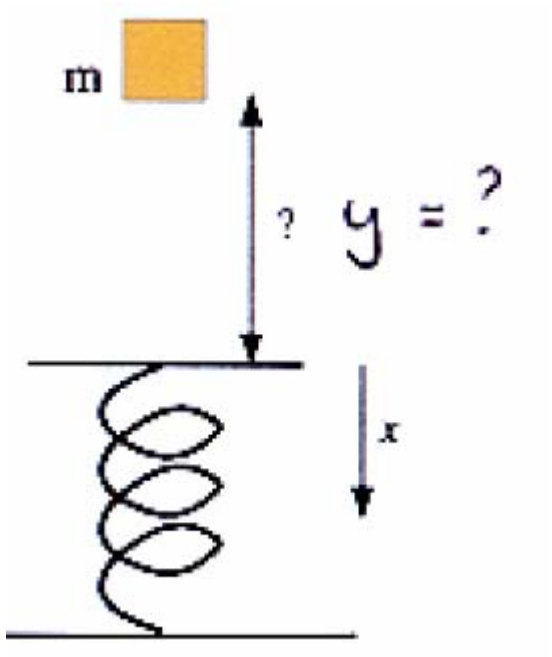
10. What is the speed of the ball when it is at the top of the circle?



$\sqrt{5}$ m/s

Test 2 F06 selected problems

13. A block of mass $m = 1\,\text{kg}$ is dropped from rest onto a spring, of spring constant $k = 400\,\text{N/m}$. The spring is compressed a distance $x = 0.1\,\text{m}$ when the block stops for an instant. How far did the block fall before it hit the spring?



Ans: 0.1m

Test 2 F06 selected problems

11. Assume the moon is revolving around the earth in a perfectly circular orbit. Which of the following statements about the moon's motion is correct?

(1) The moon's velocity is tangent to the orbit and its acceleration is always towards the earth.

(2) The moon's velocity is towards the earth and the acceleration is tangential to the orbit.

(3) The moon is not accelerating because the speed is constant

(4) If the earth's gravity were cut off somehow, the moon would move in the direction of the earth

(5) If the earth's gravity were cut off somehow, the moon would move directly away from the earth

Ans: (1)

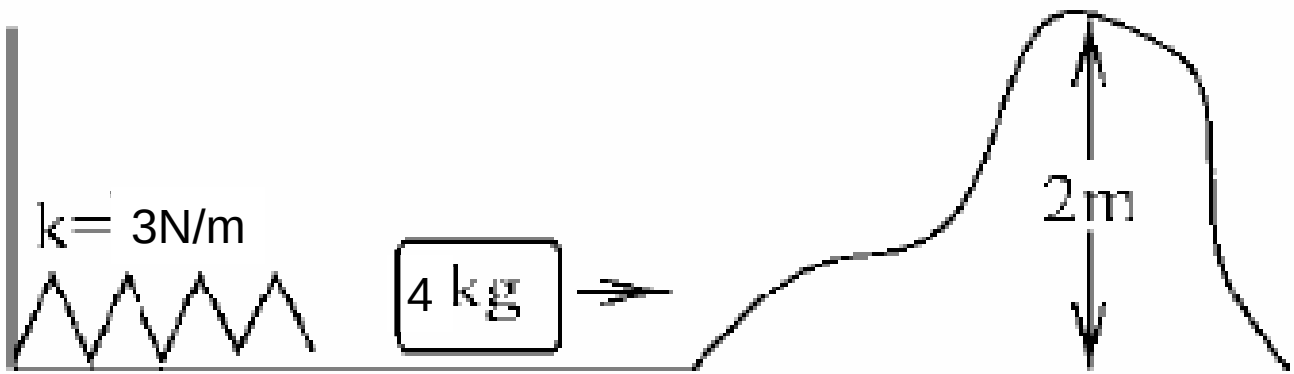
Test 2 F00 selected problems

11. A 3.00-kg mass slides down an inclined plane; the plane makes an angle of 30.0° with respect to the horizontal. The mass starts with an initial velocity of 4.00 m/s. The total distance travelled parallel to the plane is 2.00 meters. The final velocity is 5.00 m/s. How much energy is converted into heat?

Ans: 15.9 J

Test 2 F00 selected problems

14. A mass $m = 4$ kg can slide along a frictionless track. At its left end the track is horizontal and contains a massless spring with spring constant $k = 30,000$ N/m. The mass is pushed against the spring, compressing the spring by $x = 0.1$ m, and released from rest. The spring accelerates the mass. The mass then continues along the frictionless track, which turns into a hill of maximum height 2 m as shown. What is the speed of the mass at the top of the hill?



Ans: 6 m/s

Test 2 F00 selected problems

15. In an emergency braking maneuver, a 600-kg car decelerates at 8 m/s^2 beginning at t=0, when the car is going 10m/s and continuing until it stops. What power is being dissipated in the brakes at t=1s?

Ans: 9600 W

Test 2 F00 selected problems

18. A spring is made of a strange material which does not obey Hooke's Law for the restoring force when stretched from its relaxed length a distance x, F=-kx, but rather is found to obey $F=-kx^{3/2}$. The ``spring constant'' k is measured to be 10.0 $N/m^{3/2}$. How much work must you do to stretch it 10.0 cm?

Ans: 0.013 J