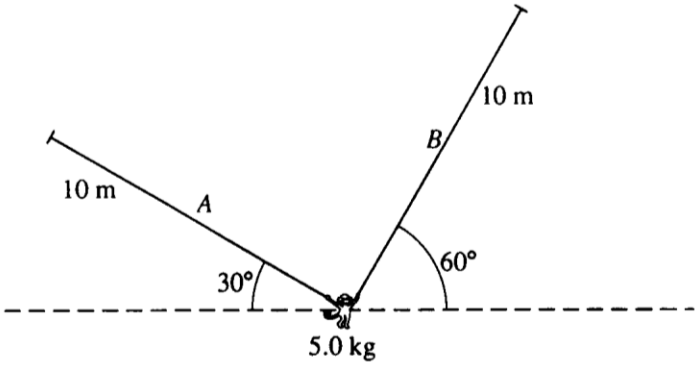
AP Physics – Assignment #11
Applications of Newton's Laws Review

Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must:

1. *Draw a picture or diagram* to visualize the problem
2. *Show each step of your calculations clearly*
3. *Write a few sentences* explaining important steps and discussing the reasonableness of your result.

It is ok to collaborate with your peers, but the work must be your own.

You must take assignments seriously to learn physics

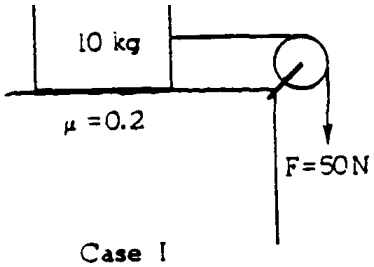


$\sin 30° = 0.50$	$\sin 60° = 0.87$
$\cos 30° = 0.87$	$\cos 60° = 0.50$
$\tan 30° = 0.58$	$\tan 60° = 1.73$

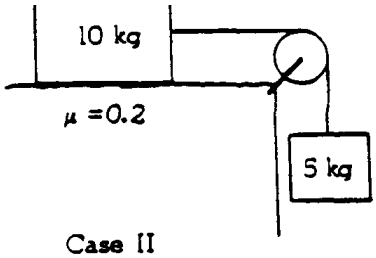
1. (1991 FR1) A 5.0-kilogram monkey hangs initially at rest from two vines, A and B. as shown above. Each of the vines has length 10 meters and negligible mass.
   a. On the figure below, draw and label all of the forces acting on the monkey. (Do not resolve the forces into components, but do indicate their directions.)

   b. Determine the tension in vine B while the monkey is at rest. [42 N]

"The philosopher who said that work well done never needs doing over never weeded a garden."
- Ray D. Everson



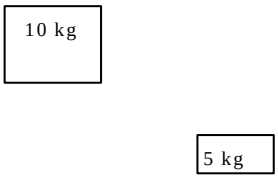
Case I



Case II

2. (1979 FR2) A 10-kilogram block rests initially on a table as shown in cases I and II above. The coefficient of sliding friction between the block and the table is 0.2. The block is connected to a cord of negligible mass, which hangs over a massless frictionless pulley. In case I a force of 50 newtons is applied to the cord. In case II an object of mass 5 kilograms is hung on the bottom of the cord. Use g = 10 meters per second squared.
   a. Calculate the acceleration of the 10-kilogram block in case I. [3 m/s/s]

   b. On the diagrams below, draw and label all the forces acting on each block in case II



   c. Calculate the acceleration of the 10-kilogram block in case II. [2 m/s/s]

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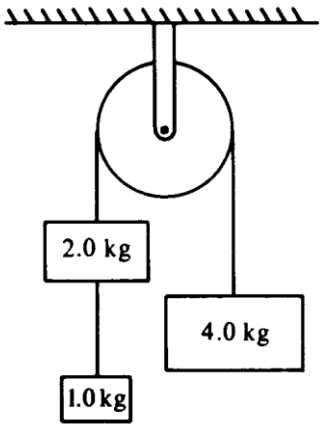

3. (1986 FR1) Three blocks of masses 1.0, 2.0, and 4.0 kilograms are connected by massless strings, one of which passes over a frictionless pulley of negligible mass, as shown above. Calculate each of the following.
   a. The acceleration of the 4-kilogram block. [1.4 m/s/s]

   b. The tension in the string supporting the 4-kilogram block. [33.6 N]

   c. The tension in the string connected to the l-kilogram block [11.2 N]

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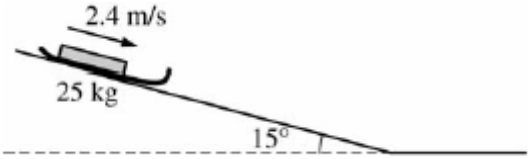

4. (2007 FR1) An empty sled of mass 25 kg slides down a muddy hill with a constant speed of 2.4 m/s. The slope of the hill is inclined at an angle of 15° with the horizontal as shown in the figure above.

   a. Calculate the time it takes the sled to go 21 m down the slope. [8.75 s]

   b. On the dot below that represents the sled, draw and label a free-body diagram for the sled as it slides down the slope.

   c. Calculate the frictional force on the sled as it slides down the slope. [63.4 N, 64.7 N if g=10m/s/s is used]

   d. Calculate the coefficient of friction between the sled and the muddy surface of the slope. [μ=0.27]

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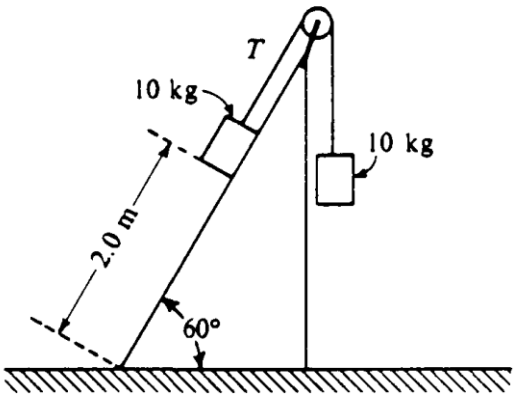
e. The sled reaches the bottom of the slope and continues on the horizontal ground. Assume the same coefficient of friction.

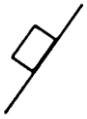
i. In terms of velocity and acceleration, describe the motion of the sled as it travels on the horizontal ground.

ii. On the axes below, sketch a graph of speed *v* versus time *t* for the sled. Include both the sled's travel down the slope and across the horizontal ground. Clearly indicate with the symbol *t* the time at which the sled leaves the slope.



5. (1985 FR2) Two 10-kilogram boxes are connected by a massless string that passes over a massless frictionless pulley as shown above. The boxes remain at rest, with the one on the right hanging vertically and the one on the left 2.0 meters from the bottom of an inclined plane that makes an angle of 60° with the horizontal. The coefficients of kinetic friction and static friction between the left-hand box and the plane are 0.15 and 0.30, respectively. You may use $g = 10\ m/s^2$, sin 60° = 0.87, and cos 60° = 0.50.
   a. What is the tension T in the string? [100 N]

   b. On the diagram below, draw and label all the forces acting on the box that is on the plane.



   c. Determine the magnitude of the frictional force acting on the box on the plane. [13 N]

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