Problem 1:

Three forces, given by $\vec{F}_1 = (-2\hat{\imath} + 2\hat{\jmath})\ N$, $\vec{F}_2 = (5\hat{\imath} - 3\hat{\jmath})\ N$ and $\vec{F}_3 = (-45\hat{\imath})\ N$ act on an object to give it an acceleration of magnitude $3.75\ m/s^2$.

a) What is the direction of the acceleration?

b) What is the mass of the object?

c) If the object is initially at rest, what is its speed after $10\ s$?

d) What are the velocity components of the object after $10\ s$?

Problem 2:

A $3\ kg$ object is moving in a plane, with its x and y coordinates given by $x = 5t^2 - 1$ and $y = 3t^3 + 2$, where x and y are in $meters$ and t is in $seconds$. Find the magnitude of the net force acting on this object at $t = 2\ s$.

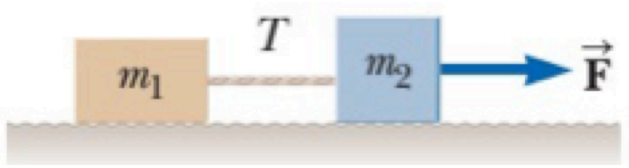
Problem 3:

A horizontal force is dragging two blocks connected by a rope of negligible mass. Suppose $F = 68.0\ N$, $m_1 = 12\ kg$, $m_2 = 12\ kg$ and the coefficient of kinetic friction between each block and the surface is 0.100.

a) Draw a free-body diagram for each block.

b) Determine the acceleration of the system.

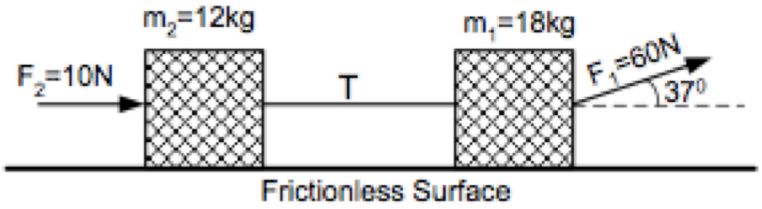
c) Determine the tension T in the rope.



Problem 4:

Two forces as shown in the figure below are dragging two blocks connected by a rope of negligible mass. Suppose $F_1 = 60N, F_2 = 10N, m_1 = 18kg$ and $m_2 = 12kg$, and the surface is frictionless.

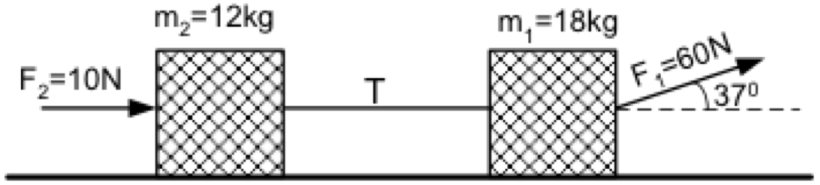
a) Draw a free-body diagram for each block,
b) Determine the magnitude of the tension in the rope, T =? ,
c) Determine the magnitude of the acceleration of the system, a =?



Problem 5:

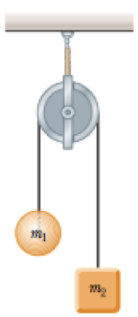
Two forces, as shown in the figure below, are dragging two blocks connected by a rope of negligible mass. Suppose $F_1 = 60N, F_2 = 10N, m_1 = 18kg$ and $m_2 = 12kg$, and the surface is rough where as the coefficient of kinetic friction between the surface and the boxes are $\mu_k = 0.1$ for m_1 and $\mu_k = 0.2$ for m_2.

a) Draw a free-body diagram for each block,
b) Determine the magnitude of the tension in the rope, T =? ,
c) Determine the magnitude of the acceleration of the system, a =?

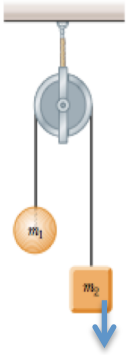


Problem 6:

Two masses of $m_1 = 20kg$ and $m_2 = 10kg$ are connected by a light weighted string passing over a frictionless pulley. If $|\vec{F}| = 120N$, find the acceleration of the system, and the tension in the cord.



a=3.27, T=130.8



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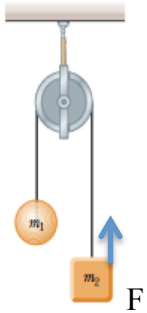
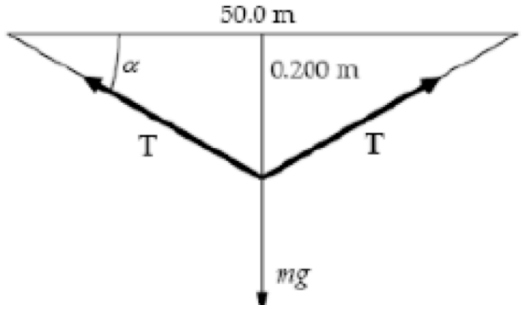


F

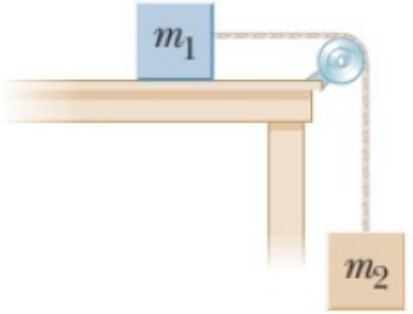
Problem 7:

The distance between two telephone poles is $50.0\ m$. When a $1.00\ kg$ bird lands on the telephone wire midway between the poles, the wire sags $0.200\ m$. Draw a free-body diagram of the bird. How much tension does the bird produce in the wire? Ignore the weight of the wire.



Problem 8:

1. An object of mass $m_1 = 55.00\ kg$ placed on a frictionless, horizontal table is connected to a string that passes over a pulley and then is fastened to a hanging object of mass $m_2 = 59.00\ kg$ as shown in figure.
   a) Draw free-body diagrams of both objects.
   b) Find the magnitude of the acceleration of the objects.
   c) Find the tension in the string.
   d) If there is a friction $\mu_k = 0.2$ on the surface, repeat the part a ,b, c and d.



Problem 9:

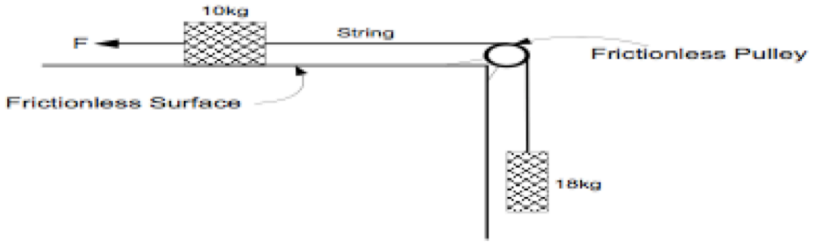
As it can be seen from the figure below, an 18kg hanging box is connected by a light, inextensible string over a light, frictionless pulley to a 10kg block that is pulled by an external force having magnitude F to **the left with constant speed**.

a) Draw a free-body diagram for the each box,

b) Determine the acceleration of the system,

c) Determine the magnitude of the tension in the string,

d) Determine the value of F.



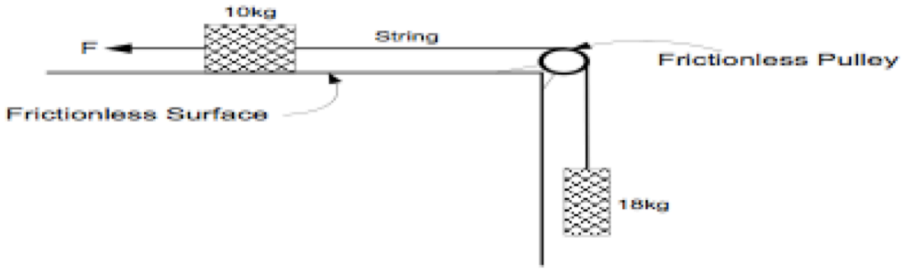
Problem 10:

As it can be seen from the figure below, an 18kg hanging box is connected by a light, inextensible string over a light, frictionless pulley to a 10kg block that is pulled by an external force having magnitude F to the left with constant acceleration, $a = 2\,m/s^2$ in the direction of F.

a) Draw a free-body diagram for the each box,

b) Determine the magnitude of the tension in the string,

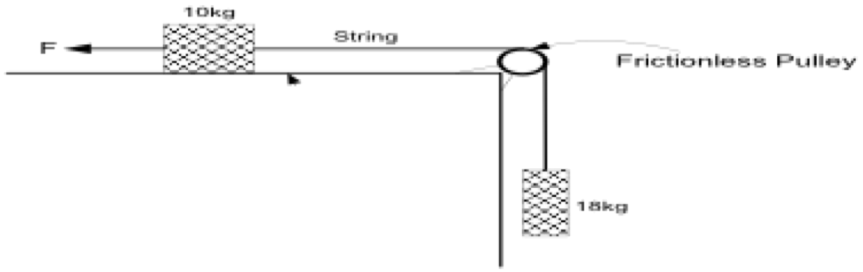
c) Determine the value of F.



Problem 11:

As it can be seen from the figure below, an 18kg hanging box is connected by a light, inextensible string over a light, frictionless pulley to a 10kg block that is pulled by an external force having magnitude *F=300N*.

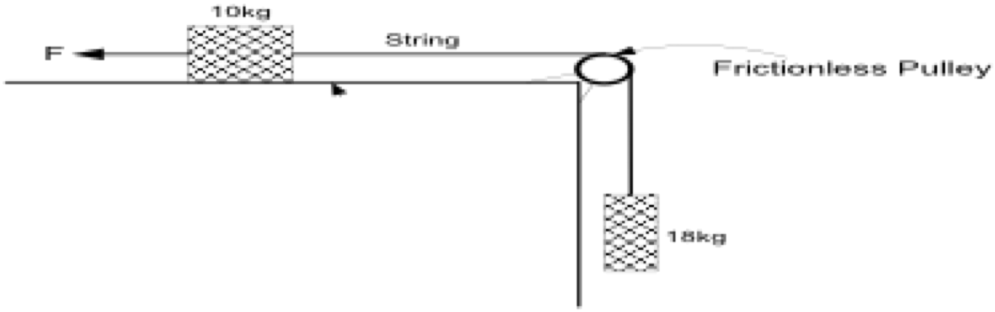
a) Draw a free-body diagram for the each box,
b) Determine the acceleration of the system,
c) Determine the magnitude of the tension in the string,



Problem 12:

As it can be seen from the figure below, an 18kg hanging box is connected by a light, inextensible string over a light, frictionless pulley to a 10kg block that is pulled by an external force having magnitude *F=300N*. If the coefficient of kinetic friction between the surface and the *10kg* mass is *0.1*.

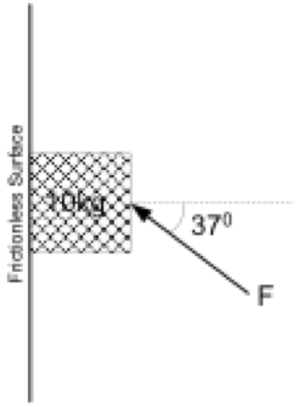
a) Draw a free-body diagram for the each box,
b) Determine the acceleration of the system,
c) Determine the magnitude of the tension in the string.



Problem 13:

As it can be seen from the figure, a constant force possessing magnitude of F is exerted upon a box of mass 10kg, which is placed on a frictionless vertical surface. This force makes an angle of 37^0 with the horizontal.

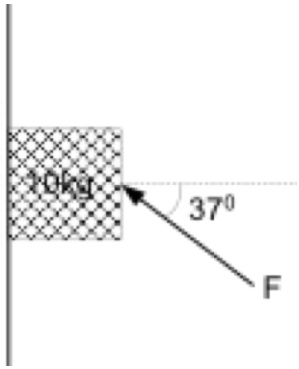
a) Draw a free-body diagram for the box,
b) Determine F if the box does not move, (163.5N)
c) Determine F if the box accelerates **upward** with an acceleration of $a = 1m/s^2$, (180.2N)
d) Determine F if the box accelerates **downward** with an acceleration of $a = 2m/s^2$. (1302.2N)



Problem 14:

As it can be seen from the figure, a constant force possessing magnitude of F is exerted upon a box of mass 10kg, which is placed on a rough vertical surface. This force makes an angle of 37^0 with the horizontal, and the coefficient of kinetic friction between the vertical wall and the box is $\mu_k = 0.1$. Draw a free-body diagram for the box and Determine F if;

a) the box accelerates **upward** with an acceleration of $a = 1m/s^2$, (208N)
b) the box accelerates **downward** with an acceleration of $a = 2m/s^2$. (115N)

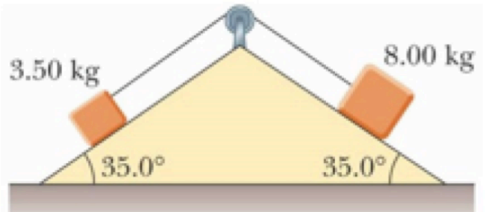


Problem 15:

A massless string that passes over a frictionless pulley as shown in figure connects two blocks of mass 3.5kg and 8kg. The inclines are rough and $\mu_K = 0.1$ for both blocks.

a) Find the magnitude of the acceleration of each block,

b) Find the tension in the string.

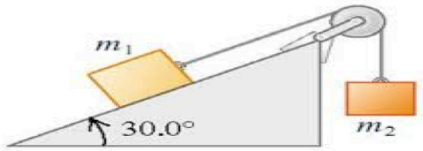


Problem 16:

Two blocks of masses $m_1 = 8kg$ and $m_2 = 1kg$ are connected by a light cord passing over a massless pulley as shown in the figure. If the mass m_1 is lying on a smooth inclined surface;

a) Draw the free body diagram for both masses m_1 and m_2?

b) Find the tension in the cord and the acceleration magnitude of the system? (12.35N, 2.51m/s^2)

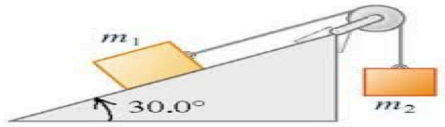


Problem 17:

Two blocks of masses $m_1 = 8kg$ and $m_2 = 14kg$ are connected by a light cord passing over a massless pulley as shown in the figure. If the mass m_1 lying on a rough inclined surface, and the coefficient of kinetic friction between the inclined surface and the box is $\mu_k = 0.1$:

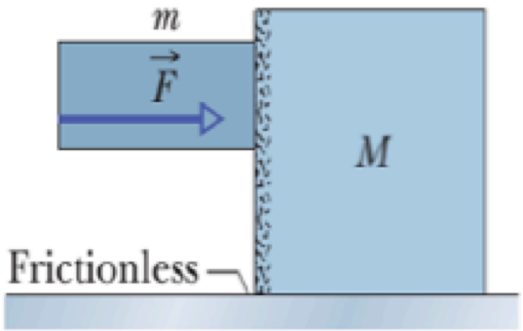
a) Draw the free body diagram for both masses m_1 and m_2?

b) Find the tension in the cord and the acceleration magnitude of the system? (a=4.14,T=79)



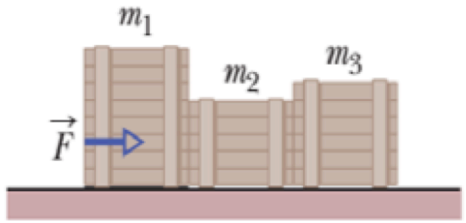
Problem 18:

The two blocks ($m = 16kg\ and\ M = 88kg$), shown in the figure, are not attached to each other. The coefficient of static friction between the blocks is $\mu_s = 0.33$, but the surface beneath the larger block is frictionless. What is the ***minimum magnitude*** of the horizontal force $\vec{F}$ required **to keep the smaller block from slipping down** the larger block? (561.5N)



Problem 19:

The figure shows three crates being pushed over a concrete floor by a horizontal force of magnitude $425N$. The masses of the crates are $m_1 = 30kg, m_2 = 10kg,$ and $m_3 = 20kg$. The coefficient of kinetic friction between the floor and each of the crates is 0.7. what is the magnitude F_{32} between the crates 2 and 3? (141.7N)



Problem 20:

Two blocks made of different materials connected together by a thin cord, slide down a plane ramp inclined at angle θ to the horizontal as shown in the figure. The masses of the two blocks are m_A and m_B, and the coefficients of friction are μ_A and μ_B. If $m_A = m_B = 5kg$, and $\mu_A = 0.2$ and $\mu_B = 0.3$,

a) Determine the acceleration of the blocks.

b) Determine the tension in the cord, for angle $\theta = 32^{\circ}$.