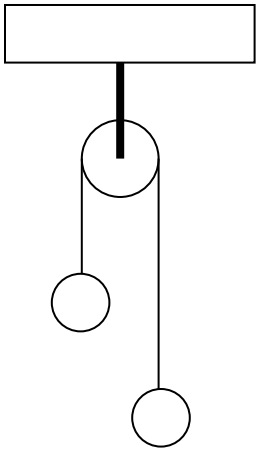
Dynamics Sample Problems #2

Atwood Machine

A light string looped over a frictionless pulley ties two spheres of masses $1.5\ kg$ and $3.0\ kg$ together, as shown below. They are allowed to hang freely.

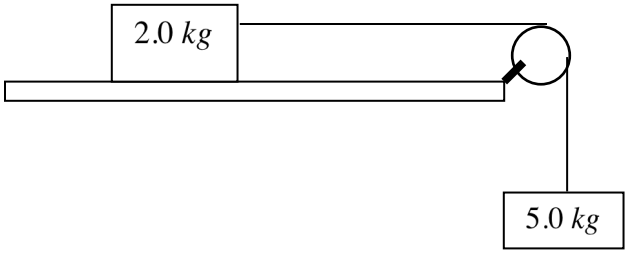


What will the acceleration of each mass be?

Determine the tension in the string.

Table with Pulley

A 2.0 *kg* mass is placed on a smooth, level table. It is attached by a light string passing over a frictionless pulley to a 5.0 *kg* mass hanging freely over the edge of the table, as illustrated.

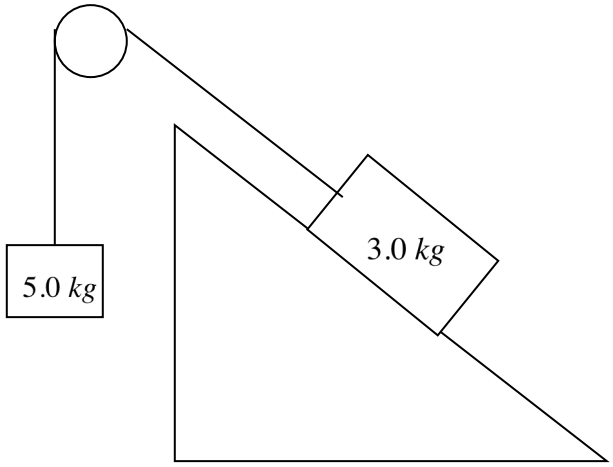


Determine the acceleration of the system.

Determine the tension in the string.

Incline Plane with Pulley

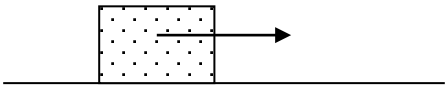
What are the magnitude and direction of the acceleration of the system below if the surface is inclined at $20°$?



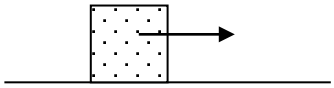
What is the tension in the string?

Dynamics Worksheet #2

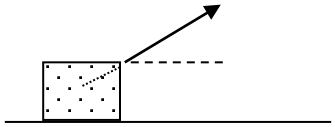
1. A 15 kg object, initially at rest, is pulled to the right with a force of 50 N. With a coefficient of friction, $\mu = 0.3$, calculate:
   a) acceleration ($0.39\ m/s^2$)
   b) velocity after 3 s ($1.18\ m/s$)
   c) how far it traveled in the 3 s ($1.77\ m$)



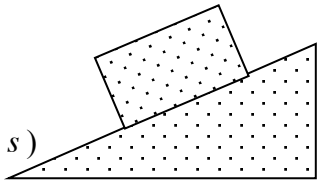
2. A 10 kg object is pulled to the right with a force of 35 N at a constant speed of 5 m/s. Calculate:
   a) the object's weight ($98\ N$)
   b) $\vec{F_f}$ ($-35\ N$)
   c) coefficient of friction (0.36)
   d) the time required for the object to travel 10 m ($2.0\ s$)



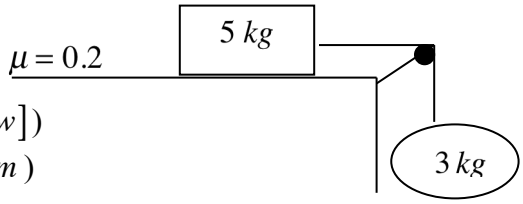
3. A 25 kg object, initially at rest, is pulled to the right with a force of 90 N at an angle of 20° to the horizontal. With a coefficient of friction, $\mu = 0.2$, calculate:
   a) $\sum \vec{F}$ ($41.2\ N$)
   b) acceleration ($1.65\ m/s^2$)
   c) how far the object travels in 4 s ($13.2\ m$)



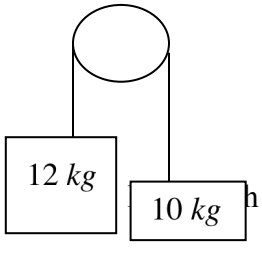
4. A 20 kg object, initially moving at 5 m/s, accelerates down a ramp. The ramp is inclined at 25° and has a coefficient of friction of $\mu = 0.15$. Calculate:
   a) $\sum \vec{F}$ ($56\ N$)
   b) acceleration ($2.8\ m/s^2$)
   c) the time required to reach the bottom of the 8 m long ramp ($1.2\ s$)



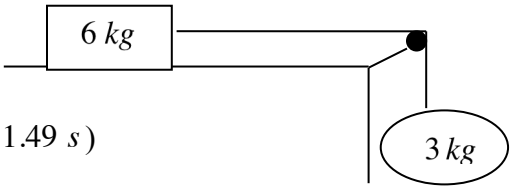
5. Given the diagram, calculate:
   a) $\sum \vec{F}$ ($19.6\ N$)
   b) acceleration of the mass on the table ($2.45\ m/s^2\ [cw]$)
   c) the distance the overhanging mass falls in 2 s ($4.9\ m$)



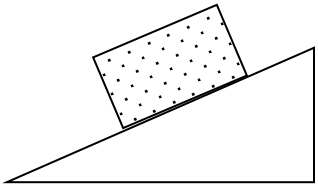
6. Calculate the acceleration and Tension for the Atwood machine shown. How far down does the 12 kg mass move after 3 s? ($0.89\ m/s^2\ [ccw]$, $T = 107\ N$, $4\ m$)



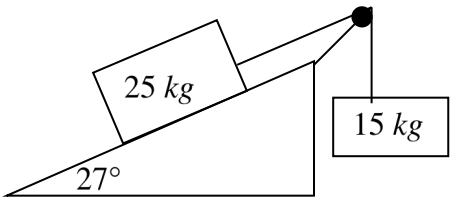
7. The force of friction is $5\ N$. Calculate:
   a) acceleration ($2.71\ m/s^2\ [cw]$)
   b) tension in the cord ($T = 21\ N$)
   c) the time required for the $6\ kg$ mass to move $3\ m$ ($1.49\ s$)



8. If the force of friction is $65\ N$ between a $30\ kg$ block and an inclined plane, what must be the angle of the incline so that the block will slide down at a constant speed? ($12.8°$)



9. Determine (a) the acceleration of the blocks and (b) the tension in the system below. There is a force of friction of $12\ N$ between the $25\ kg$ block and the inclined plane.
   ($0.59\ m/s^2\ [cw]$, $T = 138.2\ N$)



10. Two blocks are at rest on a frictionless, horizontal surface. Block X has a mass of $6\ kg$ and is attached by means of a taut string to block Y. Block Y has a mass of $12\ kg$. A force of $36\ N$ is applied to block X. Calculate:
    a) acceleration of the system ($2.0\ m/s^2$)
    b) the tension in string 2 ($T = 24\ N$)