611-1028 (40-247) Atwood's Machine

Description: Atwood's Machine, or (Atwood's Pulley) is a classic physics problem involving two unequal masses hanging from a wire over a pulley. Since one of the masses is heavier, the whole thing will move so that the heavier mass moves down and the lighter mass moves up.

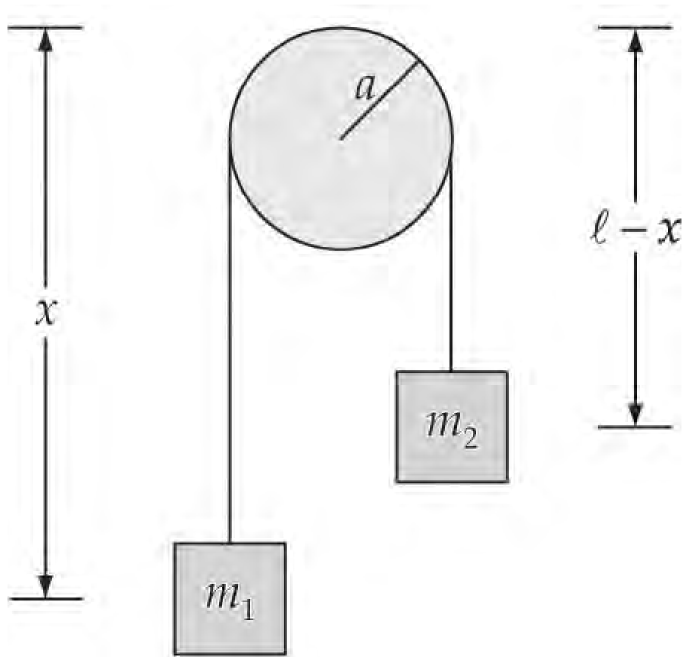

Figure 1

Warranty and Parts:
We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.

Introduction: In 1784, Reverend George Atwood (1745-1807), invented a machine to illustrate the law of uniformly accelerated motion**.** In a perfect Atwood's machine, the unequal masses depicted in figure 1 would be hung from a flexible, massless string which rests on a frictionless, massless pulley. In real life however, everything has mass and two objects that are pulled against one another creates friction. Therefore, we have designed our Atwood's machine to have a pulley on each side and a solid connecting rod between them. This helps to negate the effects of friction.

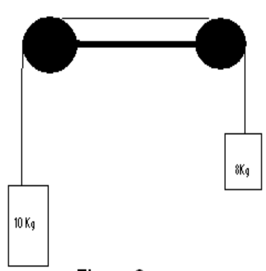

Figure 2

Setup:

Mount the Atwood's Machine by affixing the connecting rod to some standard lab rod clamps (not included). Affix a string to two weights of different masses and lay them on the two pulleys as pictured above.

Example:

If mass one is 10.00 kg and mass two is 8.00 kg, determine the acceleration of each mass.

● Since we are dealing with two masses that are attached, we will add the masses.

● We will need to be careful, since the net force is pulling the 10Kg mass down and the 8Kg mass up, but is made up of two forces due to gravity pulling down on different sides.

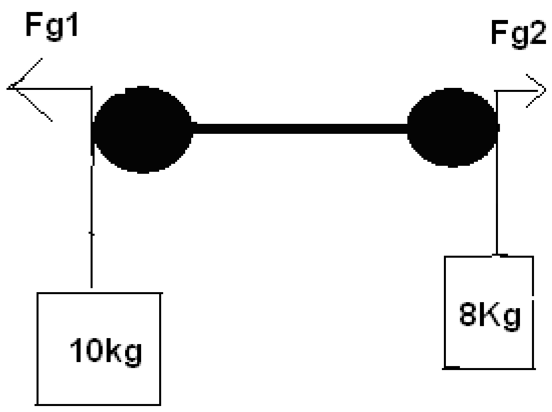

Figure 3

To simplify this, we will take our single mass and pretend that one force due to gravity is pulling it to the left, while the other force due to gravity is pulling it to the right. See figure 3. (**Note: When doing questions that involve a pulley, just remember that a pulley really only changes the direction a force is acting in. That's why we can change the directions some of the forces are pointing, even though we typically cannot change the direction of vectors!)**

Next, we will rotate the two forces due to gravity horizontally, and show them acting
on the combined mass See Figure 4.

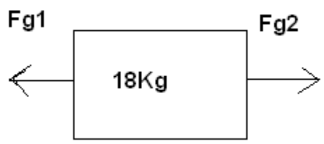

Figure 4

Mass One
Fg1=mg
Fg1=10.00Kg * 9.81M/Sec^2
Fg1=−98.1N
Mass One pulls to the left with a force of 98.1N.

Mass Two
Fg2=mg
Fg2=8.00Kg * 9.81M/sec^2
Fg2=78.48N
Mass two pulls to the right with a force of 78.48N.

Fnet=Fg1+Fg2
Fnet=−98.10N+78.48N
Fnet=−19.62N

Fnet=−19.62N
Fnet=ma
a=(Fnet/m)

Fnet =−19.62
M= 18Kg

a=−1.09m/sec^2

The minus sign, based on Figure 3, just shows that mass one will drop as mass two rises. Both will have an acceleration of 1.09 m/sec^2.