Name _____

Why Atwood Problems Are Important!!!!

Physics in Action (ouch!) - The following bricklayers accident report was submitted to the Worker's Compensation Board

Dear Sir:

I am writing in response to your request for additional information in Block #3 of the accident reporting form. I put "Poor Planning" as the cause of my accident. You asked for a fuller explanation and I trust the following details will be sufficient.

I am a bricklayer by trade. On the day of the accident, I was working alone on the roof of a new six-story building. When I completed my work, I found I had some bricks left over. Rather than carry the bricks down by hand, I decided, to lower them in a barrel by using a pulley that was attached to the side of the building at the sixth floor. **The combined weight of the bricks and barrel was 960 N.**

Securing the rope at ground level, I went up to the roof, swung the barrel out and loaded the bricks into it. Then I went down and untied the rope, holding it tightly to insure a slow descent.

You will note on the accident reporting form that **my weight is 540 N**.

Due to my surprise at being jerked off the ground so suddenly, I lost my presence of mind and forgot to let go of the rope. I proceeded at a rapid rate up the side of the building. In the vicinity of the third floor, I met the barrel, which was now proceeding downward at an equally impressive rate. This explains the fractured skull, minor abrasions, and the broken collarbone, as listed on the accident reporting form. **# 1**

Slowed only slightly, I continued my rapid ascent, not stopping until the fingers of my right hand were two knuckles deep into the pulley, which I mentioned in Paragraph 2 of this correspondence. Fortunately, by this time I had regained my presence of mind and was able to hold tightly to the rope, in spite of the excruciating pain I was now beginning to experience.

At approximately the same time, however, the barrel of bricks hit the ground - and the bottom fell out of the barrel. Now devoid of the weight of the bricks, the barrel weighed approximately **200 N. #2**

I refer you again to my weight.

As you might imagine, I began a rapid descent down the side of the building. In the vicinity of the third floor, I met the barrel coining up. This accounts for the two fractured ankles, broken tooth, and severe lacerations of my legs and lower body.

Here my luck began to change slightly. The encounter with the barrel seemed to slow me enough to lessen my injuries when I fell into the pile of bricks and fortunately, only three vertebrate were cracked.

I am sorry to report, however, as I lay there on the pile of bricks, in pain, unable to move, and watching the empty barrel six stories above me, I again lost my composure and presence of mind and let go of the rope **#3**

For each calculation: draw force diagrams and show all calculations!

Calculate the acceleration of the man-barrel system for **#1**

$2.75\ m/s^2$

Calculate the final velocity of the man **as** he reaches the top of the 6th floor if each floor is approximately 4 m in height

$11.5\ m/s$

Calculate the acceleration of the man-barrel system for **#2**

$4.5\ m/s^2$

Calculate the final velocity of the man as he reaches the ground after falling 6 floors.

$14.7\ m/s$

Calculate the acceleration of the barrel for **#3**

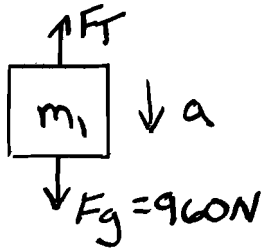
$9.8\ m/s^2$

Calculate the final velocity of the barrel as it reaches the ground after falling 6 floors.

$21.7\ m/s$

For each calculation: draw force diagrams and show all calculations!

Calculate the acceleration of the man-barrel system for **#1**



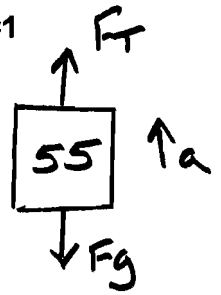
$m = \frac{F}{g} = \frac{960}{9.8}$

$m = 98kg$

$F_{net} = m_1(-a)$

$F_T - F_g = -98a$

$F_T = 960 - 98a$



$F_{net} = m_2a$

$F_T - F_g = m_2a$

$F_T = 540 + 55a$

$m = \frac{540}{9.8} = 55kg$

$960 - 98a = 540 + 55a$

$-153a = -420$

$a = \frac{420}{153} = 2.75 m/s^2$

Calculate the final velocity of the man **as** he reaches the top of the 6th floor if each floor is approximately 4 m in height

$V_i = 0$

$d = 4m$

$a = 2.75$

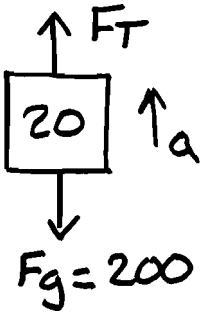
$V_f^2 = V_i^2 + 2ad$

$V_f^2 = 2(2.75)(24) = 132$

$V = \sqrt{132}$

$V = 11.5 m/s$

Calculate the acceleration of the man-barrel system for **#2**



$F_T - F_g = +ma$

$F_T - 200 = +20a$

$F_T = 200 + 20a$

$200 + 20a = 540 - 55a$

$75a = 340$

The man is the same But accelerating down

$F_T - F_g = -m_2a$

$F_T = 540 - 55a$

$\rightarrow a = \frac{340}{75} = 4.5 m/s^2$

Calculate the final velocity of the man as he reaches the ground after falling 6 floors.

$V_f^2 = V_i^2 + 2ad$

$V_f^2 = 2(4.5)(24) = 216$

$V_f = \sqrt{216} = 14.7 m/s$

Calculate the acceleration of the barrel for **#3**

$g = 9.8 m/s^2 \downarrow$

Calculate the final velocity of the barrel as it reaches the ground after falling 6 floors

$V_f^2 = 2ad$

$V_f^2 = 2(9.8)(24) = 470$

$V = \sqrt{470} = 21.7 m/s$