<u>Atwood's Machine</u> Alex Chen

Aim and task:
$2(m1+m2)h = (MA+B)t^2$

Assuming that (m1 + m2) is constant, plot a graph from which the value of the constants A and B can be deduced. And find out what the values should be.

Method:
Set up a pulley with 2 masses, m1 and m2 suspended on either side by a strong thread/string so that m2 is about 1.5m off the ground when m1 is resting on it.

With m2 = 280g and m1 = 250g, obtain an accurate time for m2 to travel from rest through the distance 'h' to the ground.

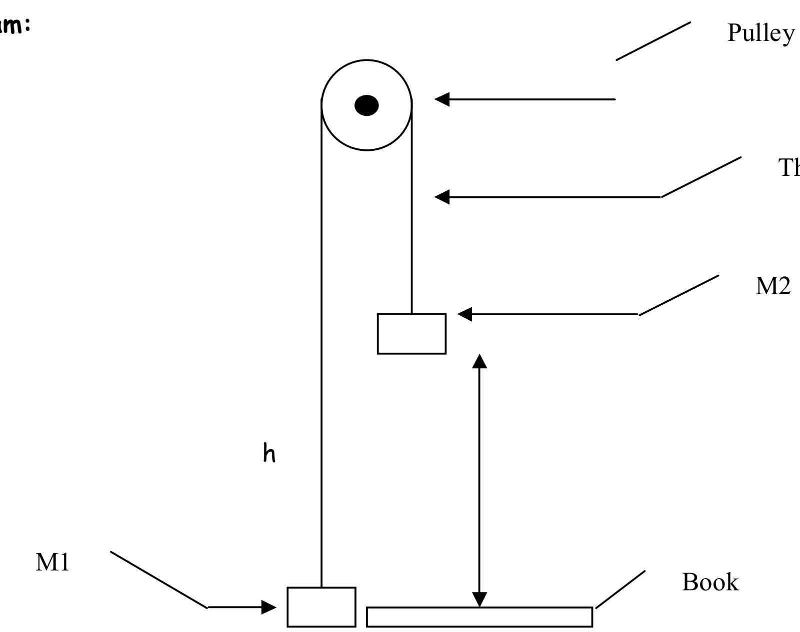
To do this, hold on mass m2 and ready to time, let m2 fall freely, and start the timer the same time. Stop the timer when it hits the ground (book). It will produce a loud noise when it hit the book.

Repeat this five times to get an accurate result.

Repeat the same experiment but with different values of M=(m2-m1), where M=30,35,40,45,50,55g.

Keep (ma+m2) with 1%of 510g(i.e. constant)

Diagram:



Working formulas out:

2(m1+m2)h=(MA+B)t^2
kh = (MA+B)t^2
kh=Mat^2+Bt^2
kh-Bt^2=Mat^2
(kh-Bt^2)/M=At^2
(((kh-Bt^2)/M)^1/2)/t=A
(2k^2)/(t^2)=MA-B

((m1-m2)*g-Ff)t=(m1=m2)2h

Ff= frictional force

Conclusion:

I have found out that A would be the gravity, and B would be the frictional force in this equation. And the value I have found is that **A= 10, B=72** I was allowed 10% errors as I have explained in the evaluation below, and my only have very small errors since that I knew gravity should be about 9.8. My experiment was very well done.

Evaluations:

Over all I think my experiment went well, there were some errors, but they were good enough to prove my theory. The errors can all be explained. First there are some obvious errors, such as the errors coming from the weights. Our teachers told us that the weight has about 1% difference, so that will effects my results by 1% since that the weights value were very closely related to my results. As the weight changes, my timing results would change. During the experiments, I timed every thing by using my eyes and hands. It that wasn't accurate at all. To find my timing errors, I took a 50 mass, and knocked it down the table, and start timing as soon as the weight goes off the table, and stopped timing when it lands on the ground. Doing the same experiments over and over again I found out that my timing had 0.05 seconds variation out of a 2 seconds timing job. So my timings would have about 2.5% timing errors. Also the meter ruler I was using was a bit bent, because it is made out of wood and after a long time the heat changed its shape. I measured it with another meter ruler, and they had a 5 mm difference. Also when I put the rule down, it was very hard to get it up right. It could have had another 5mm variation in it so 1cm in a meter ruler can cause a 1% error. There was another problem during the experiment, when the weights m1 and m2 go pass each other, very often they touch and collides, which some times knocks out some of the weights. This affects my results very much. So to solve it I had to give one of the weights a very small push horizontally to make sure that they don't collide. But this also causes a small delay on the timing results at the end, about 0.1 seconds. So out of 4 seconds 0.1 causes 2.5% errors. There is also the systematic error. This is very important because this errors actually comes from my results over all, this can never be avoid unless the results are perfects, but equipments can never be absolutely perfect, so there is always a systematic error. The error comes from the best fit line of my graphs, because to prove my theory I need the gradient of my best fit line,. But I could have drawn my best-fit line in many different ways since that my results varied a bit. The variation from the ways I could have drawn my best-fit lines would be my systematic errors. In this case it's 5%. So over all there is a total of 15% errors that I could have had.