Physics 1
Dynamics Lab Activity
Investigating Newton's Second Law

Printer-friendly versions of this lab:

- Adobe Acrobat Reader (*.pdf)
- Microsoft Word (*.doc)

Purpose:

To investigate Newton's Second Law by observing the motion of a dynamics cart in various situations.

Discussion:

Newton's First Law tells what happens to an object *when no unbalanced forces* act on it, and Newton's Second Law tells what happens to an object when *an unbalanced force does act* on it (acceleration = net force/mass). It is one thing to be able to recite all of this, but quite another thing to understand and apply it to real situations.

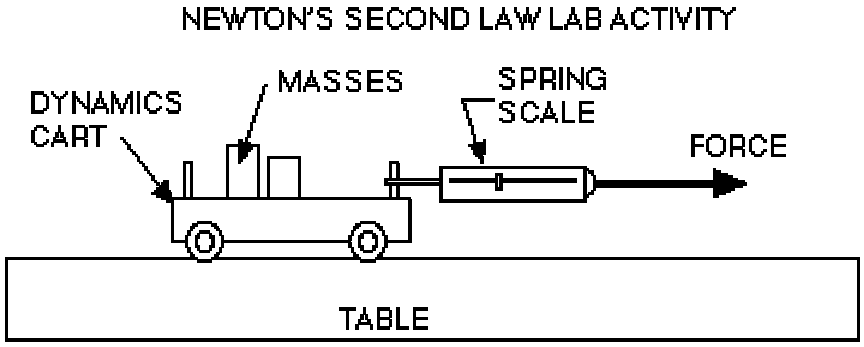
In this activity, you are not going to actually measure accelerations. As you will see, it is not easy to apply a constant force to a dynamics cart with a spring scale! Try to think of a way to apply a constant force to a cart. How could its acceleration be determined?

Equipment:

dynamics cart	spring scale	long, level table (or floor)
string	set of standard masses	

Hint: Do **not** try to answer these questions in the space provided on this sheet. Invest in a sheet of paper, please. Also, please use complete (English) sentences.

Procedure:



Part 1 - Constant Velocity (Dynamic Equilibrium):

1. Be sure that the spring scale reads "0 Newtons" when nothing is hanging from it. You can "zero" it by sliding the scale up or down.
2. Make a loop of string long enough to loop around the end of the cart and the hook of the spring scale. Be sure that the string is long enough so that you can read the scale as you pull the cart across the table or floor.
3. Measure the horizontal force required to pull the dynamics cart across the table at constant velocity. Try a higher (faster) constant velocity. Do you notice much change in the force required to move the cart?
4. Draw a diagram showing the horizontal forces acting on the dynamics cart.
5. Why is this force necessary to move the cart at constant velocity?

Part 2 - Acceleration

1. Apply a constant horizontal force to the cart greater than the force you applied in step 1. (Hint: Pull the scale so it reads "1 Newton". As you pull the cart, keep the scale reading 1 Newton. No, it isn't easy.) What happens?
2. What happens if you apply an even larger force (like 2 Newtons)?
3. Add mass to the dynamics cart by placing a box of weights on it. How does this affect the acceleration of the cart when you apply the same forces that you did in step 1 and 2?

Part 3 - Some Numbers

1. A dynamics cart has a mass of about 0.9 kilograms. A friction force of 1 Newton opposes the motion of the cart and you exert a horizontal force on the cart of 10 Newtons. The net force on the cart is ____ Newtons, and it will have an accelerlation of _____ meters/second^2.

last update November 2, 2001 by JL Stanbrough