

Name _____

Dynamics Lab Activity

Force, Weight, and Motion



Discussion:

We have defined weight as "the force on an object due to gravity", we know that $W = mg$, and we know that we measure weight with a scale. If this all seems very straightforward to you, then you are in trouble - it isn't. Weight is a very "slippery" and nasty concept requiring great intellectual alertness.

Equipment:

small object (a hooked mass, 200 - 500 grams, works well)
spring scale

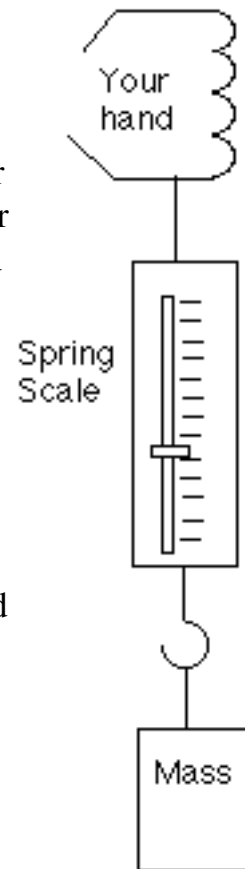
Procedure:

Follow the instructions below. Record your results and answer the questions on a separate sheet of paper. Work with a partner and share your observations and ideas, but each person should turn in his/her own paper.

A. Weight:

1. Calculate the weight of your object ($F_g = mg$). If you are using a "standard mass" its mass is stamped on it, otherwise, use a triple-beam balance to find its mass.
2. "Zero" the sliding scale on the spring scale so that it reads "0 Newtons" when nothing is hanging from it, then weigh your object. How do the weights (calculated and measured) compare?
3. Identify the forces that act on both the object and the spring scale as the object hangs from the scale at rest. Draw diagrams showing all forces that act on your object and spring scale. What is the net force acting on each?

B. Motion at Constant Velocity:



1. Move the scale and object vertically (up and down) at constant velocity, observing the scale. How does the scale reading compare to the scale reading when the object was at rest?
2. Identify the forces that act on both the object and the spring scale as they move vertically at constant velocity. Draw diagrams showing all forces that act on your object and spring scale. What is the net force acting on each? Why?

C. Accelerating Upward:

1. What happens to the scale reading when you accelerate the object upward? Does the object actually weigh more when it accelerates upward? Does the earth actually pull harder on the object when it accelerates upward? What does the extra upward force do? Defend your answer.
2. Identify the forces that act on both the object and the spring scale while the object accelerates upward. Draw diagrams showing all forces that act on your object and spring scale. What is the net force acting on each? (You won't be able to come up with a number here - but you can tell if there is a net force and which way it is pulling.)

D. Accelerating Downward:

1. What happens to the scale reading when you accelerate the object downward? Does the object actually weigh less when it accelerates downward? Does the earth actually pull less on the object when it accelerates downward? What happens to the "missing" weight? Defend your answer.
2. Identify the forces that act on both the object and the spring scale while the object accelerates downward. Draw diagrams showing all forces that act on your object and spring scale. What is the net force acting on each? (You won't be able to come up with a number here - but you can tell if there is a net force and which way it is pulling.)

E. Free Fall:

1. What happens to the scale reading when the object is accelerated more and more rapidly downward? It is almost impossible to observe, but it isn't difficult to figure out what the scale reads when the object and scale are in free fall - when you just let go. What would the scale read during free fall? Does this mean that the earth no longer pulls on the object? What then? Defend your answer.
2. Identify the forces that act on both the object and the spring scale while the object is in free fall. Draw diagrams showing all forces that act on your object and spring scale. What is the net force acting on each?

