Physics 200 (Stapleton) Name: ____
Test Format, Newton's Laws in 1D

Short answer:

1. **Force Diagram With Numbers:** Draw, label, and calculate all of the individual forces acting on an object. Arrow lengths must be in reasonable proportion. Each force must be named. Numerical values must be calculated, and units must be included.

2. **Force Diagram Without Numbers (just arrows):** Draw and label the individual forces and net force acting on an object at various times during an extended event (e.g. the falling and bouncing of a balloon, the acceleration of a car…) Arrow lengths must be in reasonable proportion, but numerical values are not expected. [This is similar to the graph question (#2) on last year's test.]

3. **Falling object with drag:** Analyze various moments during the fall of an object that reaches at least one terminal velocity. This could be something like a falling brick, or it could be a skydiver whose parachute opens (see the class 32 warmup for a practice problem like this). This will probably be in the form of a table that you must complete. The table will have cells for the object's mass, weight, drag force, acceleration, net force, and velocity.

4. **Action/reaction:** Identify the action and reaction forces that are at work in some event. Be familiar with the examples in the 3rd law notes, but the event chosen for the test is not limited to what's on those notes.

Problems: Most of these problems will require you to be able to identify the individual and net forces acting on an object. You will also need to have an understanding of which system (or systems) to use to solve problems.

A. **Weight formula:** There will be at least one problem requiring an understanding of the weight formula. You may be solving for weight, mass, or g.
B. **Sliding**: There will be multiple problems relating to an object that is sliding with and without friction. The objects may be accelerating, decelerating, or moving at a constant speed. There may be a force (other than friction) pushing or pulling the objects, or they may be acted on only by friction – or there may be none of these forces. You will need to use the friction formula for some of these problems.
C. **Elevator and scale:**There will be at least one problem featuring someone (or something) on a bathroom scale in an elevator. The elevator may be accelerating upward or downward. It may not be accelerating at all. It may be doing more than one of these. Variables that you will be solving for could include mass, acceleration, normal force, or scale reading.
D. **Hanging from rope:** There will be at least one problem featuring someone (or something) hanging from a rope. The hanging object may be accelerating upward or downward. It may not be accelerating at all. It may be doing more than one of these. Variables that you will be solving for could include mass, acceleration, or tension.
E. **Kinematics:** There will be problems requiring kinematics. The problems described in letters B, C, and D above may require the use of kinematics equations to solve for acceleration, displacement, or time. For example…
    - An elevator/bathroom scale problem may ask for the time it takes an elevator to descend 10m if you know the mass of the person on the scale and the scale reading.
    - An "object on a rope" problem may ask for the distance an object of known mass may be lifted by the rope in a given amount of time, based on the breaking strength of the rope and the mass of the object.

- A sliding object problem might ask for the coefficient of friction that would result in an object coming to rest in a particular time period.

F. **"Find the accelerations of the objects and the tensions in the strings."** There will be one problem of this type. There will be two masses hanging from pulleys, two separate strings, and a mass sliding (with friction) on a surface. You will need to analyze different systems to find a, T_1, and T_2.

Formulas that may be necessary:

Kinematics:

$\bar{v} = \frac{\Delta x}{\Delta t}$ $a = \frac{\Delta v}{\Delta t}$ $v = v_0 + at$ $\Delta x = v_0 t + \frac{1}{2}at^2$

$v^2 = v_0^2 + 2a\Delta x$

Newtons Laws:

$\Sigma F = ma$ $w = mg$ $F_{Fr} = \mu F_N$