Name: _____ NetID: _____

NYU Physics I—Term Exam 1

Problem 1: We spoke of densities in lecture on 2016-09-08. By what factor, roughly, is rock more dense than air? No need to be precise.

Problem 2: In lecture on 2016-09-13, we had a stone traveling on a parabolic trajectory (a gravitational trajectory for which air resistance can be ignored). We drew the velocity vector at two points on the trajectory. We compared these two vectors. For this problem, name one property of the velocity vector that changes with time. Name one property of the velocity vector that stays the same over time.

Problem 3: In lecture on 2016-09-20, we drew a free-body diagram for a block on an inclined plane. What if the plane wasn't frictionless? Draw a new free-body diagram including friction, and the old free-body diagram for comparison.

Problem 4: In Problem Set 1, I asked you about a typical American car traveling at speed v. The formula $\rho A v^3$ has units of *power* or W or $\mathrm{J\,s^{-1}}$. What does this formula say is the power in W for a typical American car traveling at speed $60\,\mathrm{mi\,h^{-1}} \approx 30\,\mathrm{m\,s^{-1}}$? You will need to make assumptions about ρ and A; state them clearly. And no need to do your arithmetic or calculation precisely, just get one digit of accuracy.

Problem 5: In Problem Set 2, you made a plot of the vertical velocity v_y as a function of time t. Now make a very similar plot, but for a stone thrown upwards at time $t = 0$ at an initial upwards velocity $v_y = +1.0\,\mathrm{m\,s^{-1}}$. For simplicity, set the acceleration due to gravity as $g_y = -10.0\,\mathrm{m\,s^{-2}}$. Make your plot for the time range $0 < t < 1\,\mathrm{s}$. Clearly label the axes, including the beginning and ending velocity, so everything can be checked quantitatively.

Problem 6: In recitation last week, you did a numerical integration on paper! What change could you have made to make that integration more accurate? There are multiple possible answers here; choose one.