Name: _____ NetID: _____

NYU Physics I—Term Exam 4

Problem 1: (from lecture 2018-10-30) What is the pressure difference, roughly, between the top surface of an ice cube and the bottom, when that ice cube is floating in water? Imagine that the ice cube is 2 cm on a side, and make any other (correct) assumptions you need to make. Give your answer in Pa or $\mathrm{N\,m^{-2}}$.

Problem 2: (from Problem Set 7) You calculated that a pendulum with a period of 2 s has a length very close to 1 m. What would be the length of a pendulum with a period of 4 s?

Problem 3: (from Problem Set 8) A very thin ladder of length L and mass M leans against a vertical wall, on a horizontal floor, making an angle of θ with respect to the wall. Imagine that there is a large coefficient of friction μ at the floor such that the ladder is in static equilibrium, but assume that the wall is effectively frictionless. Draw a free-body diagram for the ladder, showing all forces acting.

Problem 4: (from Problem Set 8) In the equation

$$\frac{\mathrm{d}^2 x}{\mathrm{d}t^2} + Q\,\frac{\mathrm{d}x}{\mathrm{d}t} + P\,x = 0 \quad ,$$

what are the units of Q and P?

Problem 5: (from worksheet on potentials) If you have a potential of the form

$$U(x) = A\,x^3 - B\,x + C$$

where A and B and C are positive constants, find a location $x = x_0$ where the force is zero.

Problem 6: (from worksheet on ideal gas) You have a number density n (units of particles per unit volume) and they are moving at speed v (units of length per time) in the x direction. What is the rate Γ (units of particles per unit time) at which they will hit a wall of area A (units of length squared)? The wall is oriented perpendicular to the x direction.