HW1
due January 29, 2026

Show all your work and indicate your reasoning in order to receive the full credit.

Name: ______________________________

Date: ______________________________

Collaborators: ____

(Collaborators submit their individually written assignments together, in class, in person)

Question:	1	2	Total
Points:	15	15	30
Score:			

Instructor/grader comments:

1. (15 points) **Running across water**

   Basilisk lizards, a group of reptiles found in Central America, are capable of running across water using only their feet as a source of both lift and thrust. (See the Wikipedia article) The basilisk's weight is too great to be supported by the water's surface tension, so animals cannot simply reside at rest on the water surface, but must be in a constant state of motion.

   Use dimensional analysis to determine the vertical speed of the lizard's foot required for running across water. Assume that the relevant physical parameters are the weight of the lizard, W, the area of its foot, A, and the density of the water, ρ.

   Give a numerical estimate of the speed using the following values of the parameters: $W = 0.9$ N, $A = 10^{-4}$ m^2, $\rho = 10^3$ kg/m^3.

2. (15 points) **The oscillation period of an underwater explosion bubble**

   A deep underwater explosion instantaneously converts explosive material into a gas at extremely high temperature and pressure. This creates a gas bubble that pushes the surrounding water outward, causing the bubble to expand rapidly. As it expands, the internal gas pressure drops; due to the inertia of the outward-flowing water, this pressure eventually falls below the equilibrium level (the sum of atmospheric and hydrostatic pressures). This pressure deficit eventually halts the expansion, causing the bubble to contract. The inward motion continues until the compressed gas pressure becomes high enough to overcome the inward motion of the water. This cycle repeats, resulting in a series of expansions and contractions of the bubble.

   Use dimensional analysis to determine the period of the bubble's oscillations, T. Assume that the relevant physical parameters are the water density, ρ, the static pressure at the depth of the explosion, p, and the total energy of the explosion, E.

   Based on your derived formula, how will the period of oscillation change if the energy of the explosion is decreased eightfold while the depth (and thus the static pressure) remains constant?