Open Ended Problem #2
Planet Naboo's Watery Core
Individual work only, Due 9/18/24 at beginning of class
(Don't be afraid to "Google" good assumptions!)

Star Wars Episode 1 Clip

Master Jin and Obi-Wan need to find and take the fastest way from the Gungan city in the ocean to the Naboo capital, but there is significant danger in taking this path. One obvious risk is being eaten by massive sea creatures. An additional risk was being crushed by the hydrostatic pressure of the oceans. Neglecting the teeth/jaws of the predators, at what point(s) do the Jedi (and Jar-Jar) run the greatest risk of being crushed, and how significant is that risk?

1) What is this problem actually asking for? (hint – 2 things… be sure to find both!)

2) Draw a sketch depicting the conditions of interest.

3) a)What physical laws apply to this problem?
b) Indicate equations, correlations, and/or formulae that can model these laws.
c) What are the potential limitations of these equations?

3) What assumptions should be made?
a) List ALL the assumptions that you need to in order to solve the problem.
(hint – ***INITALLY, assume water density and g are both constant***… you will change this assumption later)
b) Justify your assumptions (references, reasoning, judgment, common sense, etc.) Is the water density assumption reasonable? Why or why not? Is the gravity assumption reasonable? Why or why not?

5) What are the physical properties used in this problem?

6) Calculate the quantities that you listed in part 1 (both of them)

7) Verify your answer... Does it look reasonable? Anything odd about the calculation?
a) What is the pressure based on your assumptions at the center of the planet? Is this reasonable? What is the actual value of g at the center of a symmetric planet?
b) Re-evaluate the answer assuming g is NOT constant (list both the new equation for g, as well as a reference/assumptions for why it's valid)
(hint – the g equation shouldn't indicate that g at the center of the planet is infinite… this represents an incorrect correlation… look for one (or derive one, if you're ambitious) that takes into account the fact that gravity is based the integral of the mass-distance.
c) Was the constant g assumption a good assumption? Why or why not? Would you have done anything differently in 3(a) had you known g was not constant?
d) Is assuming constant density a reasonable assumption? (Prove it!!!)