

Greetings AP Physics 2 Adventurer:

Congratulations, you made a bold decision signing up for AP Physics 2! I hope this class will challenge and push how we see the unseeable world around us. You're in for a challenge, but we're in it together. Buckle up. We have work to do.

The information covered in AP Physics 2 is similar in scope and rigor to that of the second semester of a serious college physics course. This year we will conceptually and mathematically dominate the topics of fluids; thermodynamics; electric force, field, and potential; electric circuits; magnetism; electromagnetic induction; geometric and physical optics; and quantum, atomic, and nuclear physics.

While AP Physics 2 an extension of AP Physics 1, College Board expects you to leave this class with a much stronger ability to be able to communicate in prose and with data. In order to get you back in the physics groove I would like you to complete a task this summer.

- 1) Read the CollegeBoard's statement on [experimental uncertainty](https://secure-media.collegeboard.org/digitalServices/pdf/ap/uncertainty-text.pdf). (<https://secure-media.collegeboard.org/digitalServices/pdf/ap/uncertainty-text.pdf>)
- 2) Design and conduct a lab at home to determine **What is the relationship between the depth of a fluid and the pressure of a fluid**. I don't care what fluid you use (but water is easiest). I don't care what depths you use, consider anywhere from a Tupperware container to the deep end of a swimming pool. I don't want you to buy or borrow expensive equipment, the beauty of this experiment is finding a way to measure pressure indirectly.

This assignment might be tricky. I am more interested in how you communicate your experiment, collect your data, and deal with experimental uncertainties than I am with your actual outcomes. In chemistry we discussed pressure in units of Pascals, atmospheres, and mmHg, but you probably don't have any equipment to measure in those units. Find a way to gauge the pressure of a fluid and use those units however weird they may sound. (*example: light intensity is measured in lumens or lux, but if I don't have an expensive meter I could measure the intensity in how many seconds I can hold my hand in the beam before I cry.*)

Report your experiment and your findings hand written in a lab notebook (last year's is fine) for us to compare next fall. Rather than following our traditional lab report format, answer this question like it is an AP "Design your Own Experiment" Free response question. I have included a specific question on the next page.

Question:

Some students were arguing if the pressure of a fluid changes as the depth of that fluid increases. One student suggested that since the density of the fluid stays constant the pressure should not change. Another student suggests that as the depth increases the total amount of fluid increases so the pressure will increase. Design an experiment to determine how, or if, fluid pressure changes with depth.

- 1) List materials you will need for your investigation.
- 2) Describe the procedure you will follow to collect data to complete this investigation.
- 3) Clearly show the data you have collected in a well-labeled data table and graph. Be certain to show units. (at least 4 data points)
- 4) Use your data to describe how, or if, the pressure of a fluid changes with depth. Your answer should be consistent with your data. (reread experimental uncertainties document linked above to make sure you are coming to conclusions that your data supports.)

WARNING - this experiment may be frustrating. I care DEEPLY that you think about the process. I care DEEPLY that you collect data and are proud of what you come up with. I care DEEPLY that you use your data, no matter how flawed, to come up with a model describing pressure and depth. I don't care so much if it is correct or if the units you use to measure pressure are "weird". Good Luck!

If you have ANY questions, please feel free to contact me by email bbuehler@yorktown.k12.in.us or Twitter @thebenbuehler. Have an awesome summer. I will see you in the fall.

Yours in Physics,

A handwritten signature in blue ink, appearing to read 'Ben', followed by a horizontal line extending to the right.

Mr. Ben Buehler