Week 6 Challenge Homework

Fluid Statics

Submission Details | Submit a digital copy (PDF, jpg, etc.) to Canvas. Include solutions to the metacognitive exercise and each question. Please use the interface to associate each page of your submission with the assignment. It makes grading much easier. Please clearly indicate which question is being solved. If data is needed to complete a problem, be sure to cite the source you've acquired your data from. Typed work will not receive credit. See the course website for further details.

Group Submissions | You may submit a group collaboration to Canvas. Add each group member to the submission. Each group member should contribute to the work. Clearly indicate which part of the submission is written by each member (color or labels are preferable).

Sensemaking | You will be asked to apply sensemaking in some problems. More information about sense-making can be found on the BoxSand Sensemaking page, which is linked on the Canvas homepage.

Metacognitive Exercise

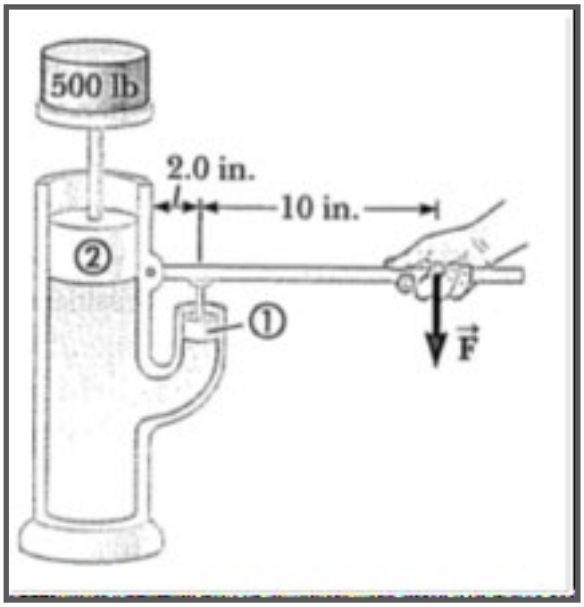
Each week will feature a metacognitive exercise, followed by one or two challenge problems to solve. The metacognitive exercise will usually ask you to reflect on your solution to the previous week's challenge problems.

Review your solution to the Week 5 Challenge Homework. If you do not have a copy of it anymore, you can find it on Canvas or Gradescope, under the Week 5 Challenge Homework assignment. Also, review the solution which has been posted to the BoxSand solutions archive (click here for a link). Solutions are posted a few days after the assignment is due.

(a) After reviewing the provided solution, your own solution, and any grader feedback in Gradescope, how are you feeling about your PV diagram drawing skills? What questions do you have about how to draw or what to draw on PV diagrams? How do you plan to find answers to those questions?

(b) What graphical interpretation methods have we used in this course when analyzing PV diagrams of thermodynamic cycles? And what significance do they have? (What aspects of the graph tell you something, and what do they tell you?) The goal of this question is to help you reflect and identify patterns in what we are learning.

Question 1:



Piston 1 in the figure to the right has a diameter of 0.250 in. Piston 2 has a diameter of 1.50 in and is 2 inches higher than piston 1. The hydraulic fluid is oil.

(a) In jacks like this (think changing a flat tire on your car), there are two forms of mechanical advantage simultaneously working to make the force applied much smaller than what it lifts. What are the two forms of mechanical advantage in this system?

(b) Determine the magnitude, F, of the force supplied by the hand which is necessary to support the 500 lb. load in the absence of friction.

(c) Use *Order of Magnitude* sense-making to determine if including the height difference between pistons is necessary when calculating the force in part (b). Make sure to:

- Compare the orders of magnitude* of your answers **with** and **without** accounting for the height difference.
- Explain whether or not it is reasonable to neglect the height difference in your answer to part (b).

*Wikipedia has a good article on order of magnitude, here: https://en.wikipedia.org/wiki/Order_of_magnitude