Lab2: Manometer

Group Number: \_\_\_\_\_\_\_ Section Number:\_\_\_\_\_\_\_\_

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Other team members \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Circle the name of the person who acted as leader/coordinator this week--make sure you get a turn every 4th lab)

**SAFETY SECTION:**

The manometer apparatus contains water as well as a relatively safe hydrocarbon (glycerin). If you apply too much pressure the fluids could be expelled from the manometer, so use caution when applying pressure. If liquids are spilled they must be cleaned up promptly. Please alert the instructor or TA if you have a safety incident. As always, long pants, closed toed shoes and safety glasses must be worn at all times.

**Begin your lab by holding a team planning session (3 minutes):**

1. Review the lab and read the safety section if you haven’t already.
2. One person should serve as leader/coordinator. All team members should strive to take make the team function better through various roles: observer, recorder, devil’s advocate, etc. Ask for each other’s input and opinions, help each other, and try to come to consensus after an appropriate amount of brainstorming and analysis.
3. Make a plan for how you will complete the lab activities. Each person should fill out their own lab report as activities are completed. At the end of the hour, after cleaning up, get the TA to initial the end of your report.

**Background:** Pressure is a fundamental quantity used in chemical engineering. This lab helps you to get experience measuring pressure with a manometer and other instruments.

**Project:** Go to the manometer station, perform the indicated activities, and answer the questions in the spaces below. The stations and questions do not need to be done in any particular order.

1. What are the formulas that convert between absolute and gauge pressure and between pressure difference and height of fluid?
2. **Explore**: Carefully look at the apparatus and figure out where the various tubes are connected. Draw a diagram of how the manometers are connected and where the other two pressure gauges are located.
3. **Measure Pressure**:
   1. Reset the manometers by loosening and then re-tightening the silver-screw openings near the top of the manometers. What are the readings on the two pressure gauges?
   2. Use the hand-screw to adjust the force on the bladder at the bottom of the apparatus. This puts pressure into the line. Try different pressure levels and give the results for the two pressure gauges and two manometers, in table form below.
   3. Prove that your independent measurements are measuring essentially the same pressure, for one case.
4. Use your manometer results above to deduce the density of glycerin relative to water. How good is your measurement?
   1. A practical range for a water manometer might be about a meter high. How much pressure change can this measure?
   2. Consider that pressure range as a dynamic pressure, what is the corresponding velocity range of air? Of water?
   3. Redo parts a and b for mercury.
   4. Some manometers are inclined. What advantage would that have?

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**Grading Rubric (to be completed by TAs)**

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| --- | --- | --- |
|  | Points | Max |
| Completed Activities and write-up |  | 6 |
| Accurate calculations and reasonable estimates |  | 3 |
| Safety and cleanup: **TA initial:\_\_\_\_\_\_** |  | 1 |
| Total |  | 10 |