
ME 379
THERMAL-FLUIDS
LABORATORY MANUAL



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Department of Mechanical Engineering
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1. General Lab Safety

- a) Know the location of the nearest first aid and fire equipment.
- b) Emergency guidelines book is available in each laboratory room.
- c) For immediate emergency assistance dial 3-5333 and/or contact instructor.
- d) Sandals and shorts are prohibited in all labs.
- e) Consult lab manuals for specific instruction and safety rules pertaining to each experiment.
- f) Do not work on an experiment alone; in case of an accident, the presence of a lab partner next to you is essential.
- g) Do not attempt to run equipment you do not understand.
- h) Treat all equipment with care.
- i) Consult technicians and mechanics when needed.
- j) Make sure that equipment is working properly before taking data.
- k) Follow instructions particular to each experiment.

2. Instructions

- a) The lab sessions will meet in Room 192 ELB.
- b) The students in each group will perform each lab. The class will be divided into several groups during the first lab session. Each student is advised to select lab partners (total of about four in each group).
- c) Each student should have a laboratory manual.
- d) All that is needed for the lab sessions is your lab manual and calculator.

3. Weekly Laboratory Report Guidelines

The following guidelines must be strictly followed. If any one of the guidelines is not followed, the report may be rejected.

A. Each group will submit a formal lab report. All members of a group are expected to contribute equally to the Lab report. The instructor will determine the due date. The following format will be required in the report:

- 1) Cover page: List the title of the experiment, names of students performing the experiment (and not the names of the students in the group, necessarily), the course and the section number, date the experiment was conducted and the due date. Also include your honor pledge (with signatures).
- 2) Abstract: Provide on an individual page, a brief summary of what was measured and the most important results and conclusions. This is written last.
- 3) Objectives: Discuss exactly what you are trying to show and learn by performing the experiment. Elaborate on how the accomplishments relate to class discussion. This is very important to the reader because he will critically read this report in terms of meeting the prescribed objectives.
- 4) Theory: Present any theoretical information that is needed to fulfill the objectives, include important derivations, assumptions, and equations.
- 5) Experimental Apparatus: Describe the equipment utilized in the experiment. Include a neat sketch of the apparatus with appropriate labels to aid the description.

- 6) Experimental Procedure: Describe the procedure used to perform the experiment. This should be general and not a step by step account.
- 7) Results: Introduce, present, and discuss computed results in a clear and concise form by using tables and graphs. Compare and discuss theoretical expectations with the experimental results.
- 8) Conclusions: Discuss how well the experiment accomplished the objectives.
- 9) References: List sources by the authors in the order in which they appear in the report.
- 10) Appendix: Use a cover sheet for the Appendix to separate it from the body of the report. Append sample calculations used to develop the tables and graphs along with the raw data (Xerox copy) from the experiment, and computer programs.

B. It is necessary to type the lab write-up. Pencil or pen is not allowed in parts listed above. Report must be neat. All reports must be on 8 1/2 x 11" size paper and stapled together in the upper left-hand corner.

C. All tables and graphs should be clearly labeled and appropriate units should be given. Graphs usually require a best-fit curve.

D. Rules for Using SI Units¹

1. Periods are never used after symbols unless at the end of a sentence.
2. Unit symbols are written in lowercase letters unless the symbol derives from a proper name.
3. A space is left between the numerical value and the unit symbol.
(Exception: No space is left between numerical values and the symbols for degree, minute, and second of angles, and degree Celsius.)
4. No space is left between the prefix and the unit symbol.
5. When writing unit names, all letters are lowercase except at the beginning of a sentence, even if the unit name is derived from a proper name.
6. The symbol should be used in preference to the unit name except when a number is written in words preceding the unit.
7. When writing unit names as a product, always use a space or hyphen.
(Exception: watt-hours)
8. When writing unit names as a quotient, always use the word "per".
9. When writing a unit name that requires a power, use a modifier after the unit name. (Exception: Area or volume, the modifier is placed before the unit name)
10. When expressing products using unit symbols, a center dot is preferred.

¹ Eide, Jenison, Mashaw, Northrup, "Engineering Fundamentals and Problem Solving," (New York: McGraw-Hill, Inc.) p. 109.

11. To denote a decimal point, use a period on the line. Numbers less than one, a zero should be placed before the decimal point.

12. Separate digits into groups of three, counting from the decimal point to the left or right, by adding a small space instead of using a comma.

E. Rules for Presenting Data²

1. The independent variable should be located on the abscissa and the dependent variable on the ordinate.
2. Graphs should be presented in such a format as to stand-alone.
3. Graphs and tables in body of report should be referred in the discussion of results.
4. Graphs and tables should use the same font as the body of the report.
5. The following factors should be considered in constructing a graph.
 - a) Scale graduations are to be selected so that the smallest division of the axis is a positive or negative integer power of 10 times 1, 2, or 5.
 - b) Proper calibration
 - i. Number of calibrations is a matter of good judgement.
 - ii. Contracting or expanding an axis can give incorrect impression of the data.
 - iii. Use of SI prefix used to simplify calibrations.
 - c) Titles
 - i. At a minimum, the axis label should contain the name of the variable, its symbol, and its units.

² Eide, Jenison, Mashaw, Northrup, "Engineering Fundamentals and Problem Solving," (New York: McGraw-Hill, Inc.) p. 109.

- ii. Empirical data should be represented by a point or symbol without connection of data points.
- iii. Theoretical relations are constructed with smooth curves without symbol designation.
- iv. Curves should be heavier than grid ruling.
- v. A key or legend should be placed in an isolated portion of the grid to define point symbols or line types that are used for curves.
- vi. Each graph must be identified with a complete title.

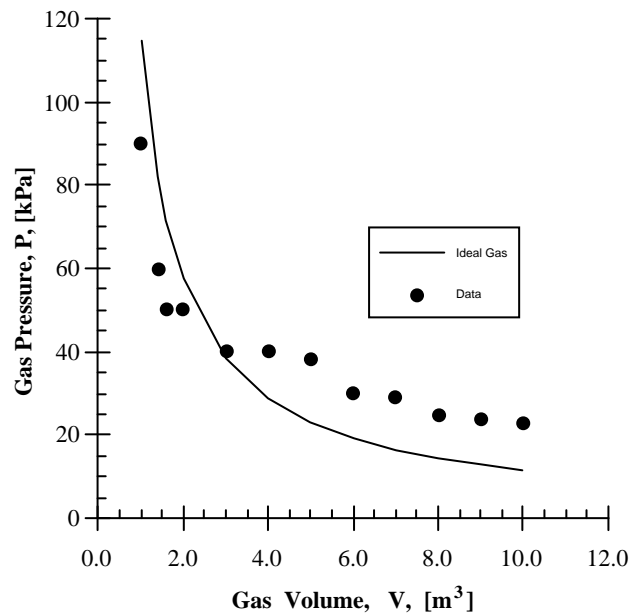


Figure 1: Comparison of Air in Piston/Cylinder with Ideal Gas Behavior

F. Report Grading Policy

General format of the report (Style, grammar, spelling, etc.)	20%
Abstract	10%
Objectives	5%
Theory and experimental procedure	10%
Results and discussion	20%
Calculations	20%
Conclusions	5%
Uncertainty analysis	10%