

**Thermal Systems Design
Spring 2010
Exam 2
03/30/10**

Name _____

ID# _____

Instructions:

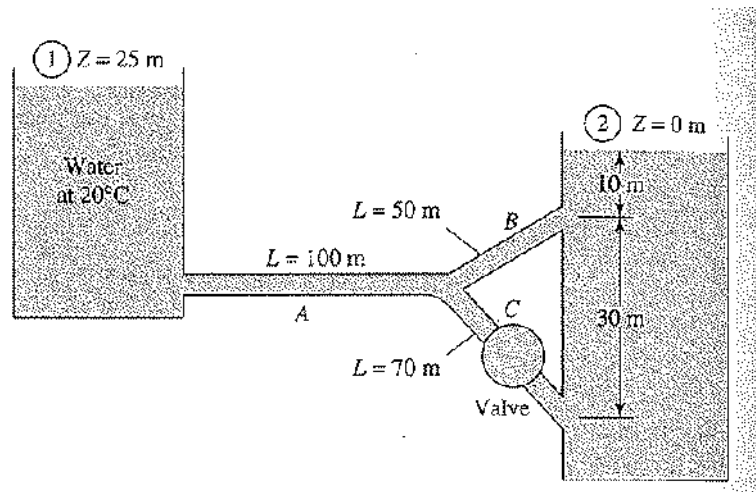
1. This is a take home exam, which means you can use your book for the exam. Any other reference should be completely referenced on your exam (e.g. another book or the web). Be careful about sources you may consult.
2. The work on the exam must be performed by you not in consultation with any one else. If you need to ask a question you can send Dr. Lemley an e-mail.
3. The exam will be due by 11:59 p.m. on Thursday April 1, 2010. Note that at a minimum, this page must be signed and submitted by April 2, 2010. The solved problems and associated spreadsheets, programs, etc... may be submitted electronically.
4. You will need to sign the statement below before turning the exam.
5. You MUST NOT consult any other person regarding the solution to this exam.
6. You MUST submit work that is yours only and not taken from another source. It is acceptable to consult thermal systems design textbooks (or related) for basic equations, tables, and graphs, but if you find a very similar problem you MUST NOT use the solution to the problem.

I have read and understand the rules above and also understand that violation of these rules may result in a decreased grade for the exam or other academic action.

Sign Here

Problem One

In the figure all pipes are 8-cm-diameter cast iron. Determine the flow rate from reservoir 1 and the flow rates in each of the two branches, B and C. The valve is open and has a loss coefficient of 0.5. Assume that the loss at the branch in line B is $K = 0.9$. Assume that the loss in the branch in line C is 1.3.

**Problem Two**

A galvanized steel pipe (sch. 40) conveys water from a pump to a heat exchanger. Determine the optimum economic diameter and the optimum velocity for the following conditions:

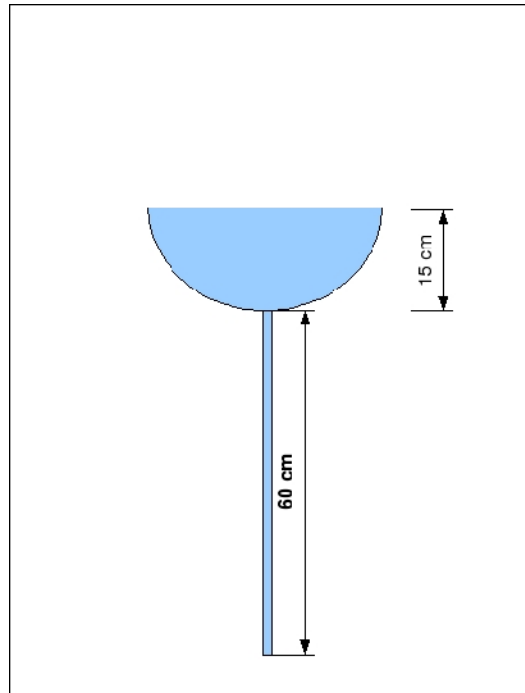
$$\begin{array}{ll}
 C_2 = \$0.042/(\text{kW}\cdot\text{hr}) & t = 5000 \text{ hr/yr} \\
 C_1 = \$42/\text{ft}^2 & F = 7.0 \\
 n = 1.0 & a = 1/(8\text{yr}) \\
 b = 0.01 & \eta = 70\%
 \end{array}$$

$$\dot{m} = 1 \times 10^5 \text{ lb}_m/\text{hr}$$

Also construct a graph of cost/length vs. diameter similar to Fig. 4.3 in your text.

Problem Three

A funnel is made of plastic tubing (inside diameter of 0.75 cm) connected to a half-sphere of radius of 15 cm on the top. Initially the funnel is completely filled with linseed oil as shown. Find and plot the height of the linseed oil as it falls from its initial position to 2 cm (in the funnel itself).

**Problem Four**

Work Problem 5.8 from your textbook.

Problem Five

Work Problem 3.63 from your textbook.