Test Format and Instructions

- 4 problems on 2 pages
- 20 - 30 points per problem, 100 points total
- closed book, w/ 3 pages of hand-written notes, and homeworks allowed
- initial all pages, staple solutions to test and hand in package
- start at 9:30, end at 10:50, Thursday, March 23, 2000

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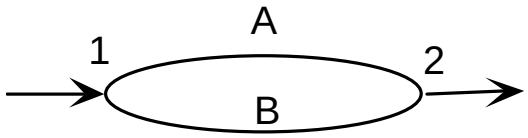
1. Flow in Parallel (20 points)

Pipes A and B are connected as shown below, and have the following characteristics.

Pipe	L(ft.)	D (ft.)	C
A	1000	.5	120
B	1000	.75	120

If the head loss from 1 to 2 is 5 ft., what are the flows through each pipe, and the total flow through the system? Use the Hazen-Williams equation to estimate flows.



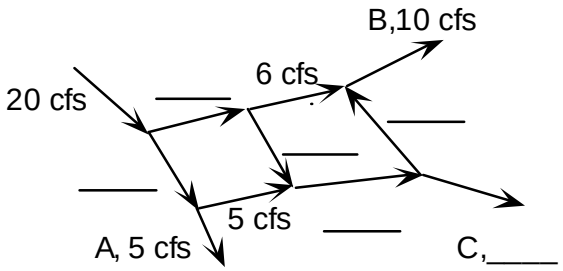
2. Flow in Closed Conduits (30 points)

Two reservoirs are connected by a 2000-ft. 12-inch water main. The elevation of the lower reservoir is 50 ft. below the upper reservoir. There are three gate valves along the length of pipe, all of which are fully open. The entrance from the upper reservoir to the pipe is perpendicular and sharp. The exit from the pipe to the lower reservoir is also sharp and perpendicular. Assuming the flow to be fully rough, estimate the flow between the reservoirs.

Local Loss Coefficients (K's): Open Gate Valve = 0.15, Sharp Entrance = 0.5, Sharp Exit = 1.0

3. Flow Networks (20 points)

a) Fill in the missing flows in the network below.
b) If all pipes are of the same diameter, with relative lengths as shown in the figure, which outlet, A, B, or C will have the lowest pressure (circle it) ?



4. Short Answer/Multiple Choice (30 Points)

A. A viscous liquid is flowing through a 1/2-inch, plastic pipe. The Reynolds number is 1200. What is the friction factor, f ?

B. The friction factor in fully developed turbulent flow (fully rough) depends upon the following: (circle one or more):

a) the pipe diameter b) the pipe roughness c) the fluid velocity d) the fluid viscosity
e) none of these

C. Water flows through a nozzle, which reduces the pipe diameter by a factor of three. The velocity has increased by a factor of how much?

D. Water flows through a 8-inch, concrete pipe (C=120). The drop in pressure head in the pipe is 10 ft./1000 ft. Using the Hazen-Williams equation, estimate the velocity.

E. Water flows through a 6-inch cast iron pipe at 3 ft/sec. What is the friction factor. Use a kinematic viscosity of 10^{-5} ft^2/s.