MET 422 HQ 2 Oct 24, 2012

MI 222 (open book) 11:00 AM

**ASK THE EXAM PROCTOR NO QUESTIONS ABOUT THE EXAM**

* If there seems to be a problem, note the trouble, make a reasonable assumption and work the problem under your assumed correction.
* There has been no attempt to write problems with errors.

**OPEN BOOK / CLOSED NOTES / NO CALCULATORS**

* Algebraic Answers Preferred

**UNITS (Algebraic answers should be left in a form to obtain these units unless units are otherwise stated)**

* q, w, U, and H [=] Joules
* F[=] Newtons
* Vol[=]m3
* V[=] m/s
* T [=] K
* P [=] Pa

**SHOW ALL WORK ON THE SHEETS PROVIDED.**

* Turn in only the problem sheets with the problems on them.
* Keep or discard all other paper

**PROBLEMS ARE OF EQUAL VALUE UNLESS OTHERWISW NOTED**

* Work the problems that seem the easiest first.

1 atm = 14.7 psi = 1.013x106 dynes/cm2 = 101,300 N/m2 = 101,300 Pa; g = 9.80 m/s2

1. Three hundred and fourteen kilograms of Ni shot is to be fluidized (Mond Process) in a 0.2-m diameter cylindrical reactor. What pressure drop must there be across the bed in psi if the void fraction is
2. 0.4
3. 0.7
4. A tank of water shown below is to be drained as rapidly as possible. Ambient pressure is acting at the tank surface and the pipe exit.

L = total length of straight from the tank pipe = 2.0 m

Lv= total length of the vertical section of pipe = 1.0 m

D = Diameter of pipe = 2 cm

H = Initial height of water in the tank = 20 cm

f = friction factor of the pipe (assumed constant at 0.004)

ef = contraction coefficient at the pipe entrance = 0.5

ef = expansion coefficient at the pipe exit = 1.0

Dt = Diameter of the tank = 100 cm

1. Develop an equation that shows the time to drain the tank.
2. If you were to make an estimate of the time to drain the tank, what are the most significant terms?

Globe Valve ½ open

Standard Elbow

100 W Pump

1. A packed bed of spherical ion exchange resin beads with a 0.04 cm diameter are in a column 20 cm in diameter and 200 cm long. Assuming that the water flowing through the column is well within the laminar flow regime, what velocity (in terms of superficial velocity) through the bed would be expected from a pressure drop of 2.9 psi (20,000 Pa)? The void fraction is 0.35.

4. What superficial velocity would be required to fluidize the bed in Problem #3 to a void fraction of 0.6?

Scratch paper (discard)