Name: ____CM Box: ___________

Circle your section:

Sanders – 05 Sanders – 06 Lui – 07 Lui – 08

ES 202
Fluid & Thermal Systems

Examination II
January 24, 2005

Problem	Score
1	/34
2	/66
Total	/100

Show all work for credit
One page of equation sheet allowed
Laptops allowed

Problem 1 (34 points)

a) True/False For a vertically submerged surface, the center of pressure is ALWAYS lower than the centroid.

b) True/False The position of the centroid of an object is invariant with the depth of submergence.

c) True/False The position of the center of pressure on an object is invariant with the depth of submergence.

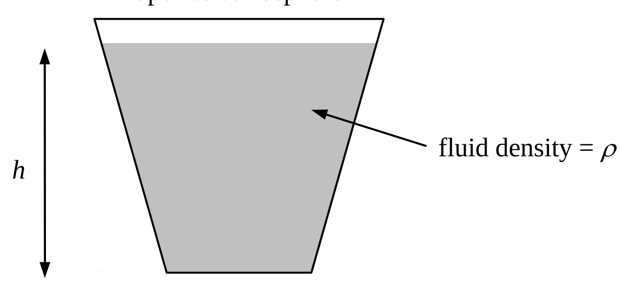
d) The trapezoidal shaped vessel contains a fluid at rest. Circle the correct answer that best describes the gage pressure at the base of the vessel.

i. $P_{base} > \rho g h$

ii. $P_{base} = \rho g h$

iii. $P_{base} < \rho g h$

iv. indeterminate



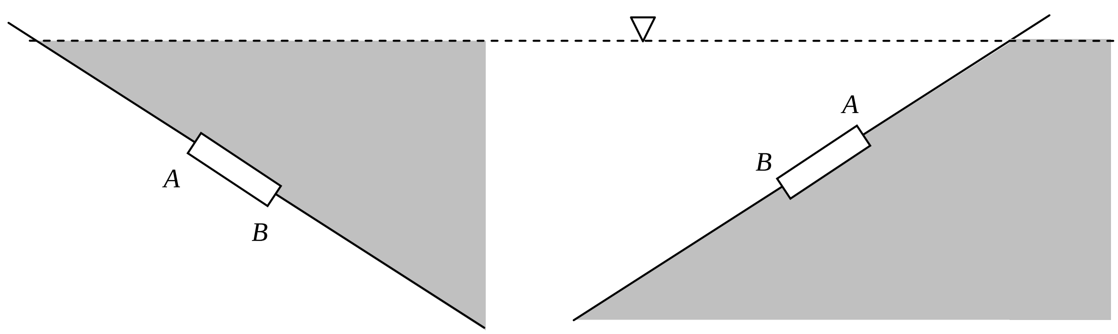
e) Consider two identical inclined object (*AB*) which is submerged in the same liquid to the same depth at two different orientations. Circle the correct answer that best describes the pressure force on the object *AB*.

i. $F_{pressure,1} > F_{pressure,2}$

ii. $F_{pressure,1} = F_{pressure,2}$

iii. $F_{pressure,1} < F_{pressure,2}$

iv. indeterminate



(1) (2)

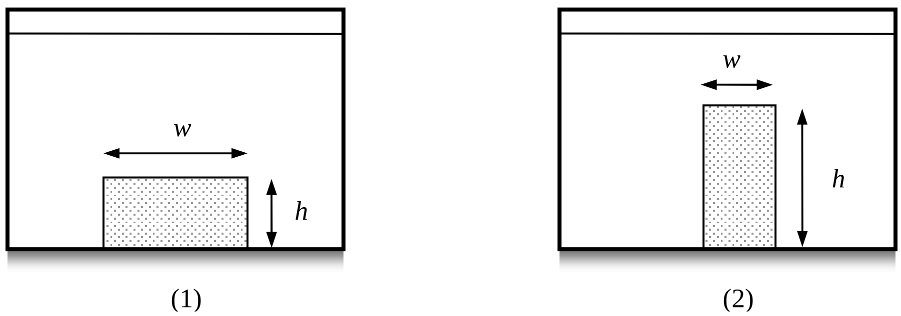
f) Consider the same object ($w < h$) being positioned in two different orientations in a tank of water. <u>Circle the correct answer</u> that best describes the buoyant force on the object.

i. $F_{buoyancy,\,1} > F_{buoyancy,\,2}$

ii. $F_{buoyancy,\,1} = F_{buoyancy,\,2}$

iii. $F_{buoyancy,\,1} < F_{buoyancy,\,2}$

iv. indeterminate



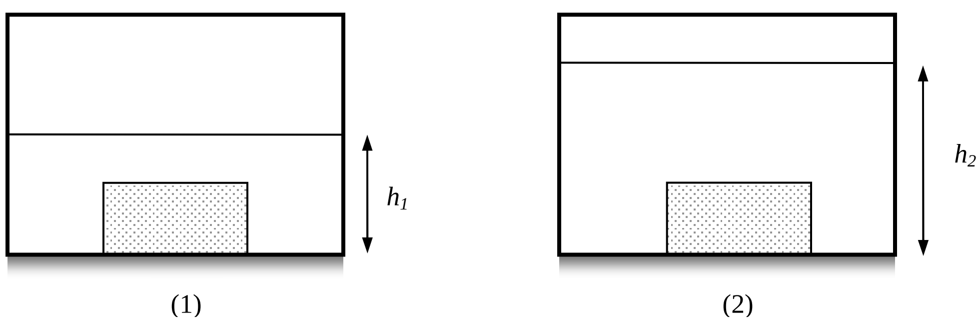
g) Consider the same object described in Part (f). The water level is filled to different heights in this part with $h_1 < h_2$. <u>Circle the correct answer</u> that best describes the buoyant force on the object.

i. $F_{buoyancy,\,1} > F_{buoyancy,\,2}$

ii. $F_{buoyancy,\,1} = F_{buoyancy,\,2}$

iii. $F_{buoyancy,\,1} < F_{buoyancy,\,2}$

iv. indeterminate



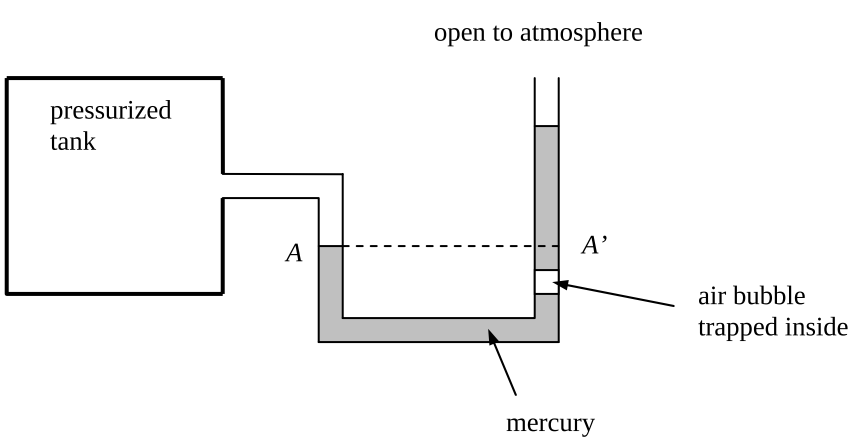
h) <u>Circle the correct answer</u> that best compares the pressure between two points (A and A') on the same level.

i. $P_A > P_{A'}$

ii. $P_A = P_{A'}$

iii. $P_A < P_{A'}$

iv. indeterminate



Problem 2 (66 points)

A thin, 1.5-m wide (into the page), right-angle gate with negligible mass is free to pivot about a frictionless hinge at Point *O*. The horizontal portion of the gate is 2-m long and covers a 30-cm diameter drain pipe which contains air at atmospheric pressure. A 10-kg concrete block ($\rho = 2300$ kg/m^3) is tied as a hanging weight to the end of the horizontal section. Denote the minimum water depth at which the gate will pivot to allow water to flow into the pipe to be h_{min}. Develop <u>an equation</u> with h_{min} as the only unknown. DO NOT SOLVE THE EQUATION.
<u>Remark:</u> The lightly shaded area in the figure is filled with water.