PASS MOCK MIDTERM

– FOR PRACTICE ONLY –

Course: MAAE2300 BCDF **Facilitator: Mahmoud El-Hennawey**

Dates and locations of mock exam take-up:

- **Thursday, Feb 12th (4:30-6pm) – SA 409**
- **Monday, Feb 23rd (6-7:30pm) – ML 402**

It is **most beneficial** to you to write this mock midterm **UNDER EXAM CONDITIONS**. This means:

- Complete the midterm in 1.5 hour(s).
- Work on your own.
- Keep your notes and textbook closed.
- Use your equation sheet
- Attempt every question.

After the time limit, go back over your work with a different colour or on a separate piece of paper and try to do the questions you are unsure of. Record your ideas in the margins to remind yourself of what you were thinking when you take it up at PASS.

The purpose of this mock midterm is to give you practice answering questions in a timed setting and to help you to gauge which aspects of the course content you know well and which are in need of further development and review. Use this mock midterm as a ***learning tool*** in preparing for the actual exam.

Please note:

- Come to the PASS session with your mock midterm complete. There, you can work with other students to review your work.
- Often, there is not enough time to review the entire exam in the PASS session. Decide which questions you most want to review – the Facilitator may ask students to vote on which questions they want to discuss.
- Facilitators do not bring copies of the mock exam to the session. Please print out and complete the midterm before you attend.
- **Facilitators do not produce or distribute an answer key for mock midterm.** Facilitators help students to work together to compare and assess the answers they have. If you are not able to attend the PASS session, you can work alone or with others in the class.

Good Luck writing the Mock Midterm!!

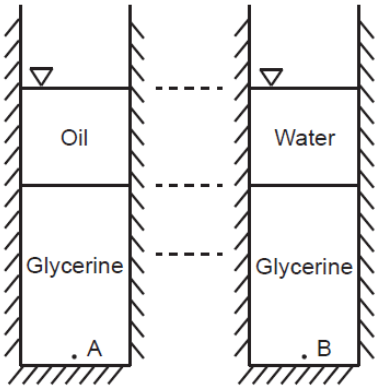
Section 1: Theory Questions

1. Incompressible fluid means that:
    a) the pressure is equal and constant at every point in the fluid
    b) the density is equal and constant at every point in the fluid
    c) although the density is different at various points in the fluid, it is constant at these points, i.e. it does not change with time.

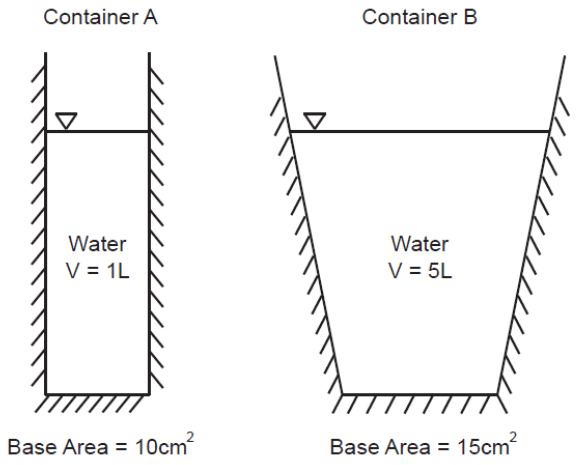
2. For the Control Volume approach,
    a) we need to know the fluid properties (such as velocity, pressure, density) at every point inside the Control Volume
    b) we need to know the fluid properties (such as velocity, pressure, density) along the Control Surface only, i.e. there is no need to know the fluid properties inside the Control Volume.
    c) we need to know the fluid properties (such as velocity, pressure, density) at every point inside the Control Volume as well as along the Control Surface as well.

3. When a fluid moves past a solid stationary wall, the speed of the fluid changes with distance from the solid wall. However, the fluid adjacent to the wall is also stationary. This condition is known as:
    a) The stationary condition
    b) The no slide condition
    c) The no slip condition
    d) The no shear stress condition
    e) The solid wall principle of flow

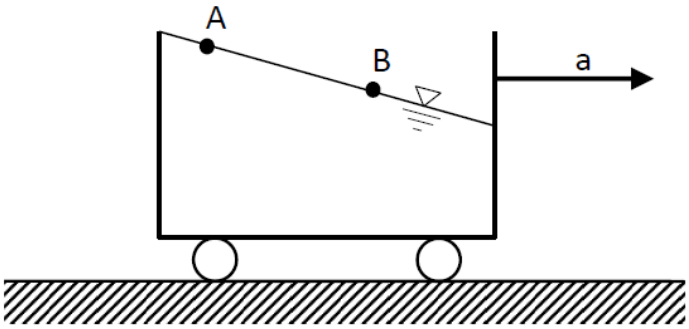
4. If the density of oil and glycerine is 917 kg/m^3 and 1,258 kg/m^3, respectively, than what is the relationship between the pressures at point A and B for the figure shown below? Note that the density of water is 1,000 kg/m^3.
    a) $P_A < P_B$
    b) $P_A > P_B$
    c) $P_A = P_B$
    d) Not enough information to come to a solution



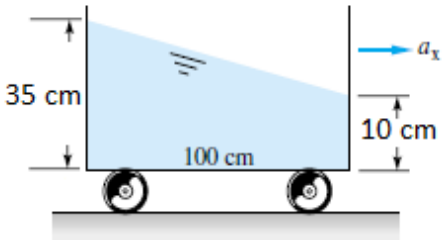
5. What is the relationship between the force acting on the bases of containers A and B?
    a) $F_A = F_B$
    b) $1.5F_A = F_B$
    c) $5F_A = F_B$
    d) $3.3\ F_A = F_B$



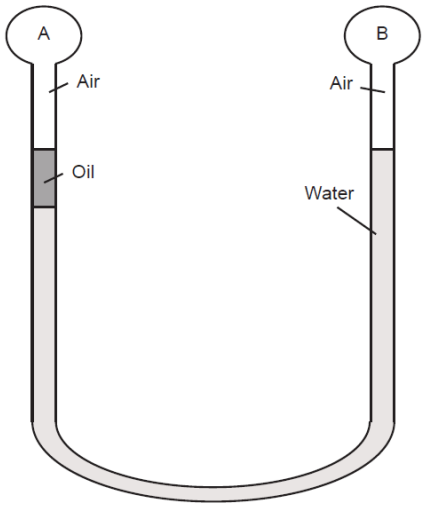
6. When a fluid is accelerated in a translational motion, such as shown in the figure below, then,
    a) the pressure at point A is larger than at point B, since it sits on a higher "column" of liquid
    b) the pressure at point A is lower than at point B, since it is located higher than point B
    c) the pressures at points A and B are equal



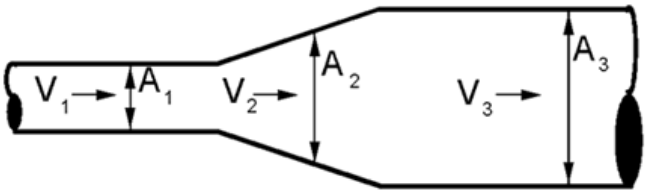
7. What is the acceleration of the cart shown in the figure below?
    a) 1.2 m/s²
    b) 2.45 m/s²
    c) 4 m/s²
    d) 39.24 m/s²



8. If the density of oil and water is 917 kg/m^3 and 1,000 kg/m^3, respectively, than what is the relationship between the pressures at point A and B?
    a) $P_A < P_B$
    b) $P_A > P_B$
    c) $P_A = P_B$
    d) Not enough information to come to a solution

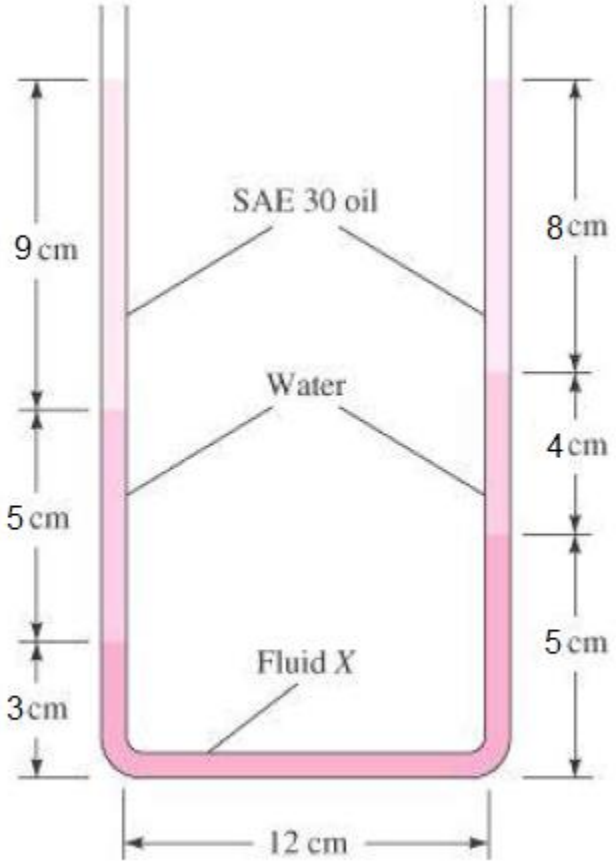


9. Unsteady (or non-stationary) flow means that:
    a) the fluid properties (such as velocity, pressure, density, etc.) vary in space, i.e. between two points, such as cross sections A_1 and A_3 in the figure below
    b) the fluid properties (such as velocity, pressure, density, etc.) do not vary in space, i.e. between two points, such as cross sections A_1 and A_3 in the figure below
    c) the fluid properties (such as velocity, pressure, density, etc.) vary in time at a given point, such as cross section A_1 in the figure below
    d) the fluid properties (such as velocity, pressure, density, etc.) do not vary in time at a given point, such as cross section A_1 in the figure below

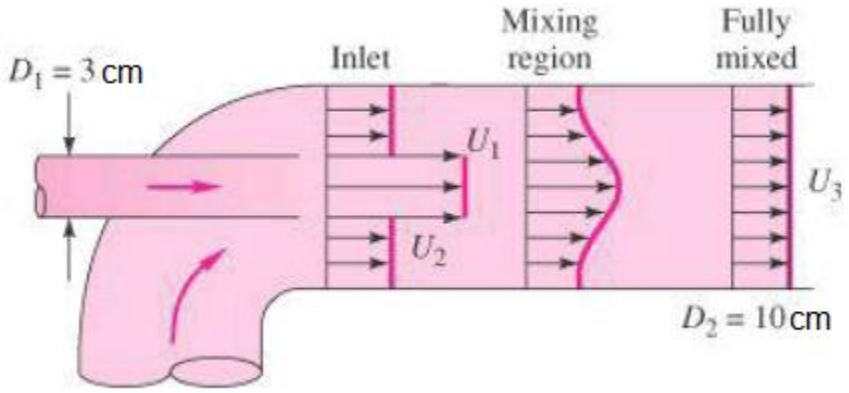


Section 2: Long Answer Questions

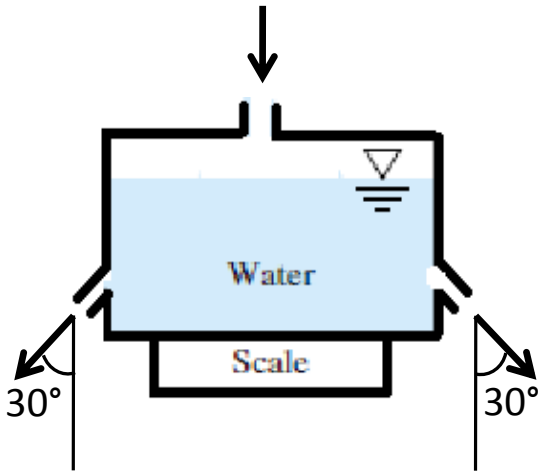
1. Both ends of the manometer are open to the atmosphere. Calculate the specific gravity of fluid X. $SG_{oil} = 0.89$



2. The jet pump injects water at 1 (U_1 = 50m/s) and entrains a secondary flow of water (U_2 = 5 m/s) in the annular region around the small pipe. The two flows become fully mixed downstream, where U_3 is approximately constant. Assuming steady, incompressible flow, calculate U_3.



3. A 1 m diameter tank, having a mass of 50 kg when empty, is placed on a scale as shown in the figure. The tank is being filled with room-temperature water at the rate of 100 L/s, through an opening in the top. At the same time, water is draining from the tank through two small pipes of 10 cm in diameter, near the bottom. The diameter of the inflow jet is 20 cm.



Assuming that the velocity of an outflow from a small pipe can be calculated from: $v = (2gh)^{1/2}$, where "*h*" is the depth of the water in the tank, and "*g*" is the gravitational acceleration, answer the following questions:

A. When the volume of the water in the tank reaches 200 L, what would be the rate of change of the water level inside the tank:
   a) 0 cm/s
   b) 4.96 cm/s
   c) 8.3 cm/s
   d) 12.1 cm/s

B. How much water has been accumulated in the tank by the time the steady state condition is reached (i.e. when the water level would remain unchanged)?
   a) 1,622 L
   b) 1,507 L
   c) 856 L
   d) 2,143 L

C. At steady state flow, the scale reading would be closest to:
   a) 55 kg
   b) 762 kg
   c) 2,158 kg
   d) 1,649 kg