



**AMEE 202, ACEH 315**  
**Introduction to Fluid Mechanics**

**Duration: 1/2 hour**  
**Lecturer: Marios M. Fyrillas**

**Student Name: .....**

**Registration Number: .....**

**QUIZ (GROUP A)**

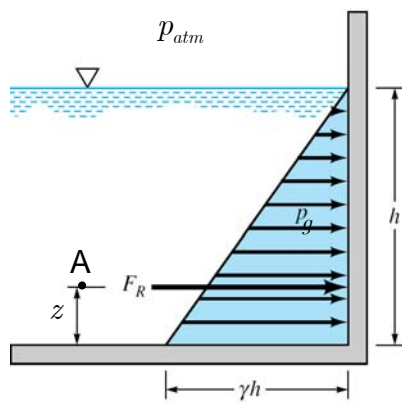
**Instructions to candidates:**

Show all steps and explain the assumptions you take in order to solve a problem. Use the following constants if needed:

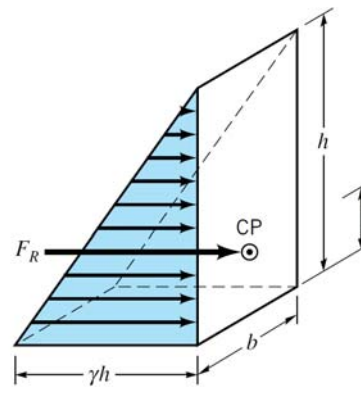
$\rho_{H_2O} = 1000 \text{ kg/m}^3$ ,  $\mu_{H_2O} = 1.15 \times 10^{-3} \text{ Pa} \cdot \text{s}$ ,  $\rho_{air} = 1.225 \text{ kg/m}^3$ ,  $\mu_{air} = 1.79 \times 10^{-5} \text{ kg/(m} \times \text{s)}$   
 $g = 9.81 \text{ m/s}^2$ ,  $p_{atm} = 1.01 \times 10^5 \text{ N/m}^2$ ,  $1.0 \text{ in} = 0.0254 \text{ m}$ ,  $12 \text{ in} = 1 \text{ ft}$ .

**Question 1 [40 points]**

The tank shown on the figure contains a liquid of density  $\rho$ . State whether the following statements are true (T) or False (F). For every wrong answer 5 points would be subtracted.



(a)



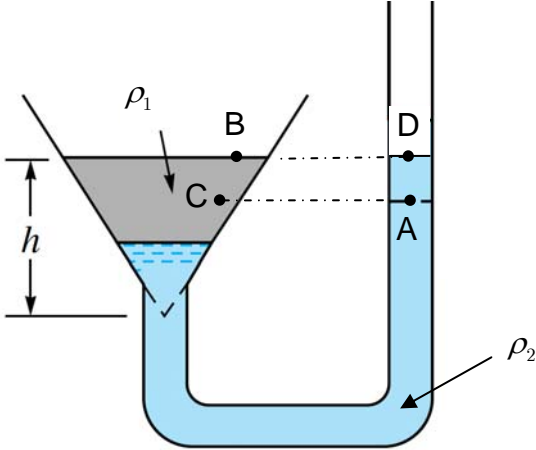
(b)

i.	$z = h / 2$	
ii.	$F_R = (p_{atm} + \rho gh / 2)hb$	
iii.	$p_A = p_{gA} + p_{atm}$	
iv.	$p_A = \rho gh + p_{atm}$	

v.	$z = h / 3$	
vi.	$F_R = (p_{atm} + \rho gh / 2)h\gamma h$	
vii.	$p_g$ is gauge pressure	
viii.	$p_A = \rho gh / 3 + p_{atm}$	

**Question 2 [20 points]**

The U-tube shown below contains two different liquids. State whether the following statements are true (T) or False (F). **For every wrong answer 5 points would be subtracted.**



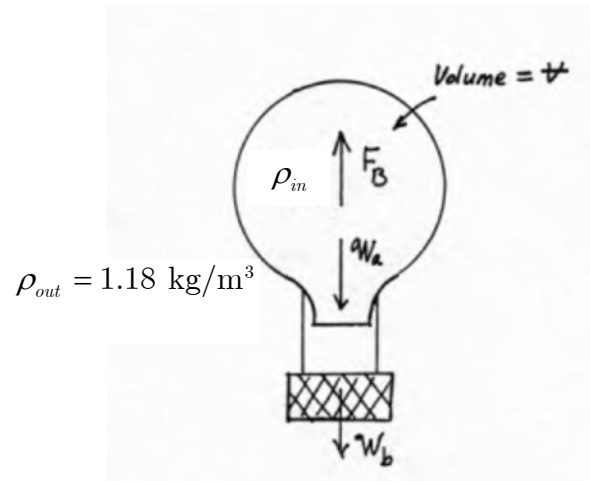
Final

i.	$p_A < p_B$	
ii.	$p_A = p_C$	

iii.	$p_C > p_D$	
iv.	$\rho_1 = \rho_2$	

### Question 3 [40 points]

A hot air balloon weighs 230 kg, including the weight of the balloon, the basket and one person. If the density of the hot air inside the balloon is  $\rho_{in} = 1.04 \text{ kg/m}^3$ , determine the required volume of the balloon to support the weight. If the balloon had a spherical shape  $\left( V = \frac{4}{3} \pi r^3 \right)$ , what would be the required diameter?





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**QUIZ (GROUP B)**

**Instructions to candidates:**

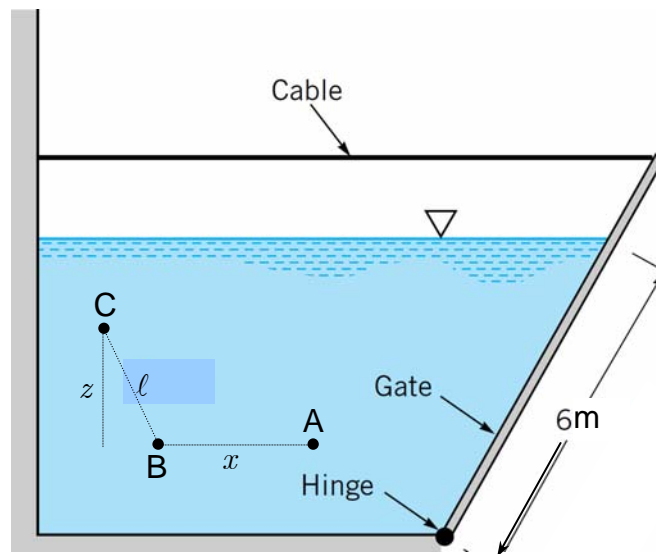
Show all steps and explain the assumptions you take in order to solve a problem. Use the following constants if needed:

$$\rho_{H_2O} = 1000 \text{ kg/m}^3, \mu_{H_2O} = 1.15 \times 10^{-3} \text{ Pa} \cdot \text{s}, \rho_{air} = 1.225 \text{ kg/m}^3, \mu_{air} = 1.79 \times 10^{-5} \text{ kg/(m}\cdot\text{s)}$$

$$g = 9.81 \text{ m/s}^2, p_{atm} = 1.01 \times 10^5 \text{ N/m}^2, 1.0 \text{ in} = 0.0254 \text{ m}, 12 \text{ in} = 1 \text{ ft.}$$

**Question 1 [40 points]**

The tank shown on the figure contains a liquid of density  $\rho$ . State whether the following statements are true (T) or False (F). For every wrong answer 5 points would be subtracted.

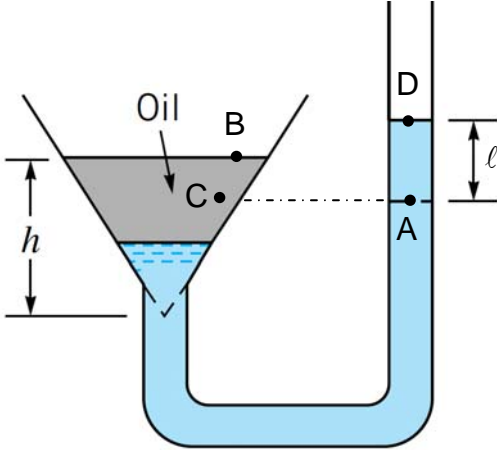


i.	$p_A > p_B$	
ii.	$p_A < p_C$	
iii.	$p_B = p_{atm} + 6\rho g$	
iv.	$p_B = p_C$	

v.	$p_A = p_B + \rho g \ell$	
vi.	$p_C = p_A + \rho g z$	
vii.	$p_B > p_C$	
viii.	$p_B = p_C + \rho g x$	

**Question 2 [20 points]**

The U-tube shown below contains oil and water. State whether the following statements are true (T) or False (F). **For every wrong answer 5 points would be subtracted.**



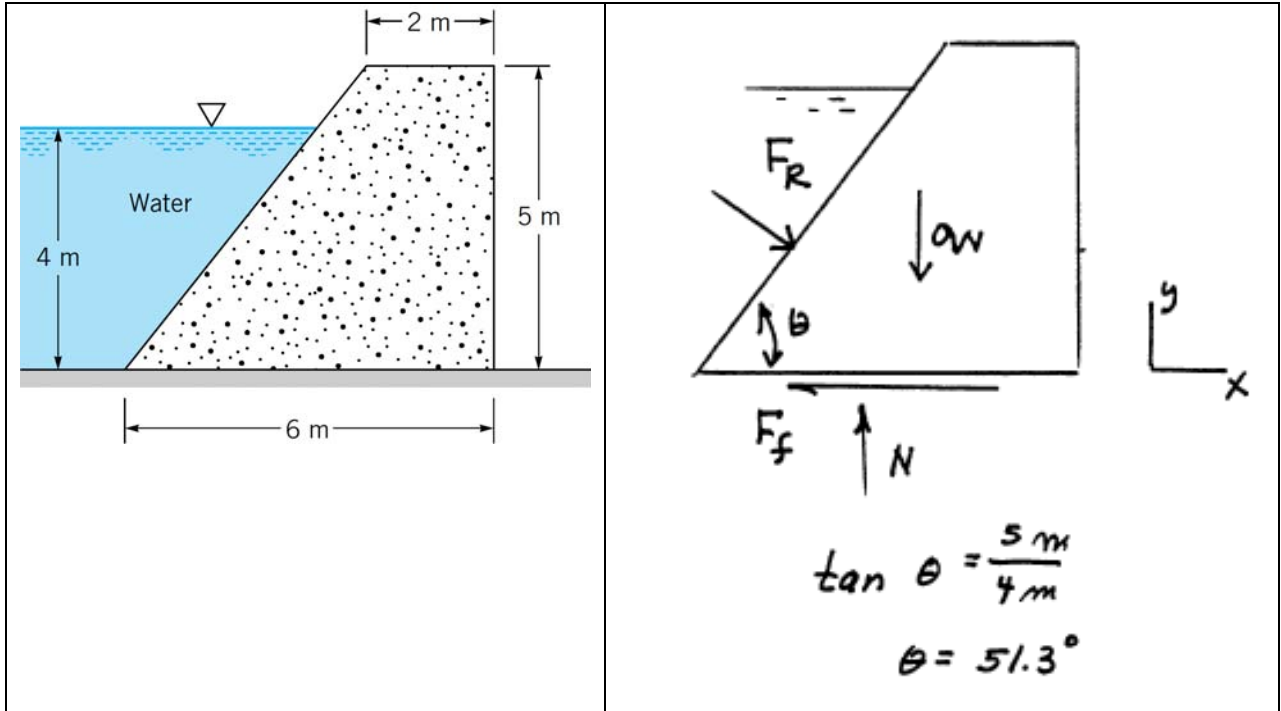
Final

i.	$p_A < p_B$	
ii.	$p_C = p_D$	

iii.	$p_D = p_B + \rho_{water} g l$	
iv.	$p_C = p_A + \rho g h$	

### Question 3 [40 points]

Assume that the concrete dam shown in the Figure weighs 236 kN and rests on a solid foundation. Determine the minimum coefficient of friction between the dam and the foundation required to keep the dam from sliding at the water depth shown. The length of the dam is 10 m. The forces are shown on the right Figure. To calculate the hydrostatic pressure force  $F_R$ , use that the average pressure is the pressure acting at the mid-depth.





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**QUIZ (GROUP C)**

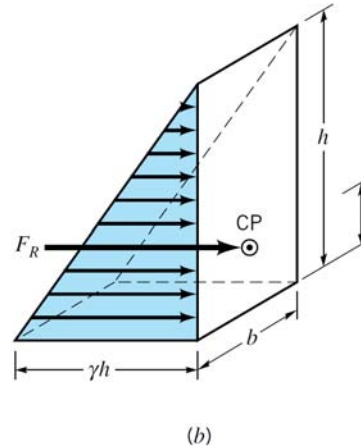
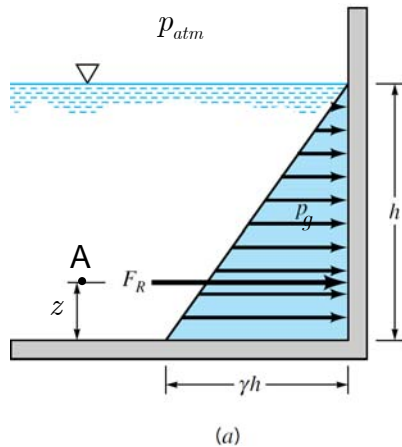
**Instructions to candidates:**

Show all steps and explain the assumptions you take in order to solve a problem. Use the following constants if needed:

$\rho_{H_2O} = 1000 \text{ kg/m}^3$ ,  $\mu_{H_2O} = 1.15 \times 10^{-3} \text{ Pa} \cdot \text{s}$ ,  $\rho_{air} = 1.225 \text{ kg/m}^3$ ,  $\mu_{air} = 1.79 \times 10^{-5} \text{ kg/(m}\cdot\text{s)}$   
 $g = 9.81 \text{ m/s}^2$ ,  $p_{atm} = 1.01 \times 10^5 \text{ N/m}^2$ ,  $1.0 \text{ in} = 0.0254 \text{ m}$ ,  $12 \text{ in} = 1 \text{ ft}$ .

**Question 1 [40 points]**

The tank shown on the figure contains a liquid of density  $\rho$ . State whether the following statements are true (T) or False (F). **For every wrong answer 5 points would be subtracted.**

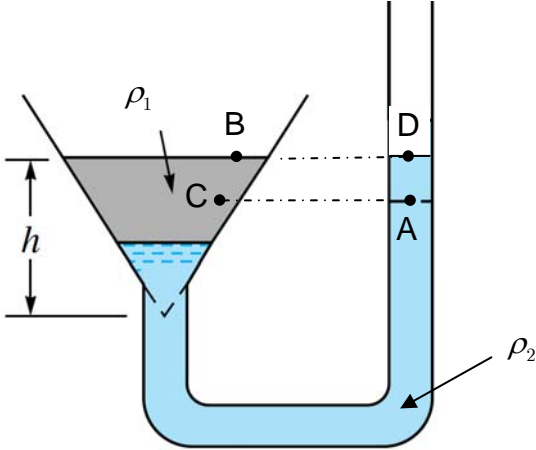


i.	$z = h / 2$	
ii.	$F_R = (p_{atm} + \rho gh / 2)hb$	
iii.	$p_A = p_{gA} + p_{atm}$	
iv.	$p_A = \rho gh + p_{atm}$	

v.	$z = h / 3$	
vi.	$F_R = (p_{atm} + \rho gh / 2)h\gamma h$	
vii.	$p_g$ is gauge pressure	
viii.	$p_A = \rho gh / 3 + p_{atm}$	

**Question 2 [20 points]**

The U-tube shown below contains two different liquids. State whether the following statements are true (T) or False (F). **For every wrong answer 5 points would be subtracted.**



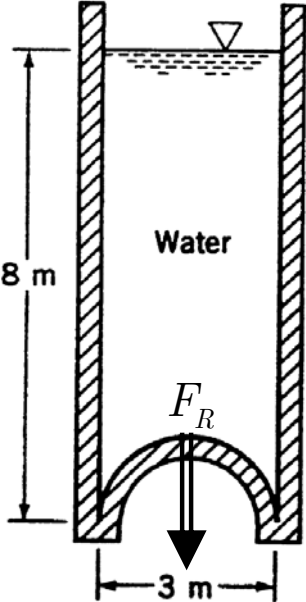
Final

i.	$p_A < p_B$	
ii.	$p_A = p_C$	

iii.	$p_C > p_D$	
iv.	$\rho_1 = \rho_2$	

**Question 3 [20 points]**

A 3-m diameter open cylindrical tank contains water and has a hemispherical bottom as shown in the Figure. Determine the magnitude of the force of the water on the curved bottom ( $F_R$ ).



**Question 4 [20 points]**

An irregularly shaped piece of a solid material weighs 35.8 N in air and 23.4 N when completely submerged in water. Determine the density of the material.