1. Conceptual problems on pressure variation in pipe flows:
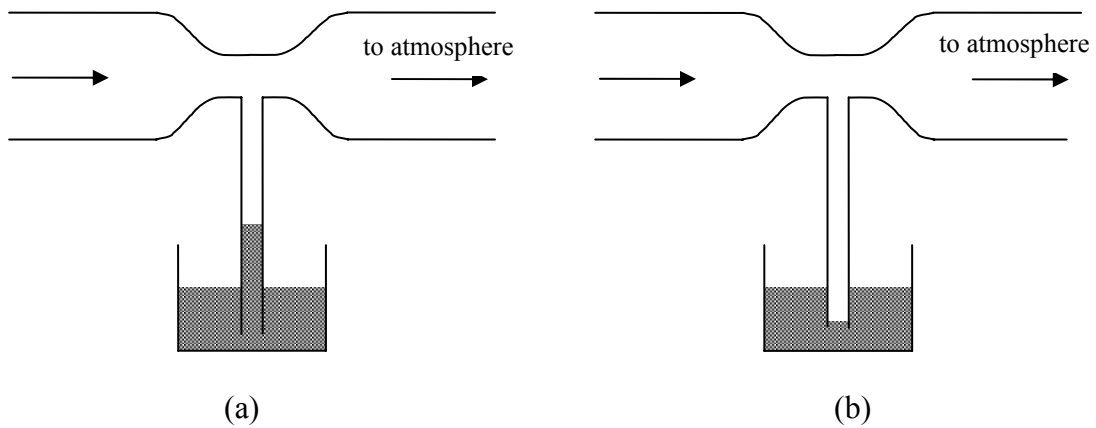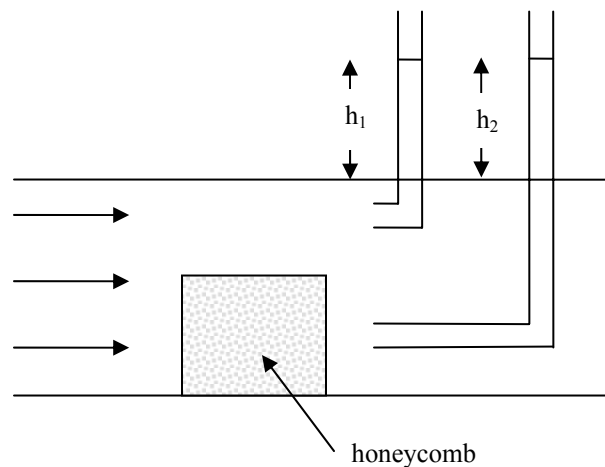

(a)   (b)

a)   Which figure depicts the correct physics? Explain your choice.

b)   Given the liquid column height from the liquid surface is H, what is the flow velocity in the larger
     section of the contoured passage?

2. Select the correct answer and explain your choice:
    a) $h_1 < h_2$
    b) $h_1 = h_2$
    c) $h_1 > h_2$

honeycomb

3. A plate of negligible weight closes a 10-cm diameter hole in a tank containing air and water as shown
    below. A 100 kg block of concrete is suspended from the plate and is completely immersed in the
    water. As the air pressure is increased, the differential reading, Δh, on the inclined-tube mercury
   manometer increases. Determine Δh just before the plate starts to lift off the hole.

air

Δh

mercury

30 deg
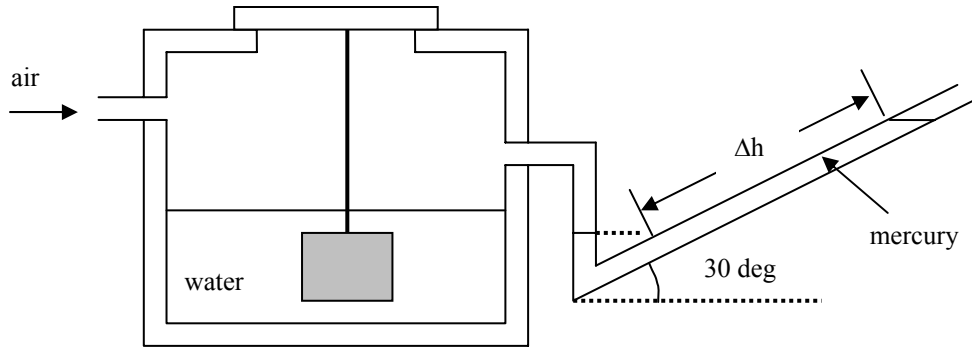
water

4. <u>Hydrostatic forces and moments on sloped surfaces</u>: Consider the figure below, a rigid body **OAB** is
    placed under water in a lake. Compute
    a)   the hydrostatic pressure force acting on the rigid body
    b)   the total moment due to hydrostatic forces about Point **O**

∇

H

L_1 **O**

θ_1

A

L_2

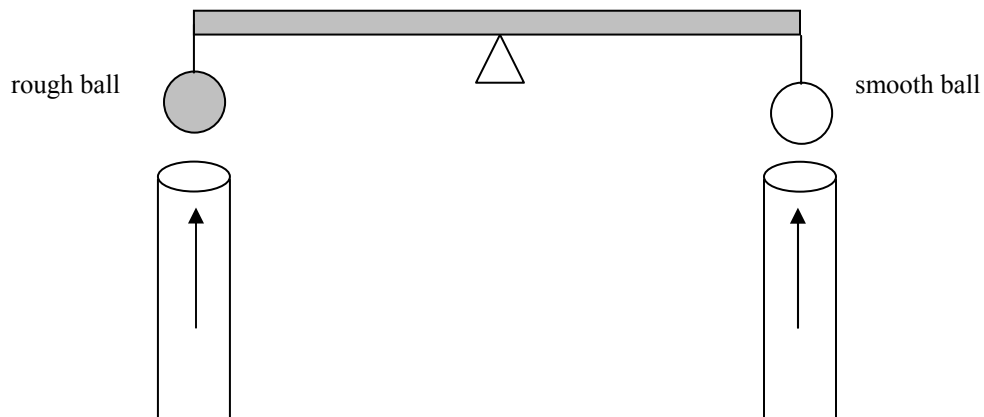bottom of lake θ_2

B
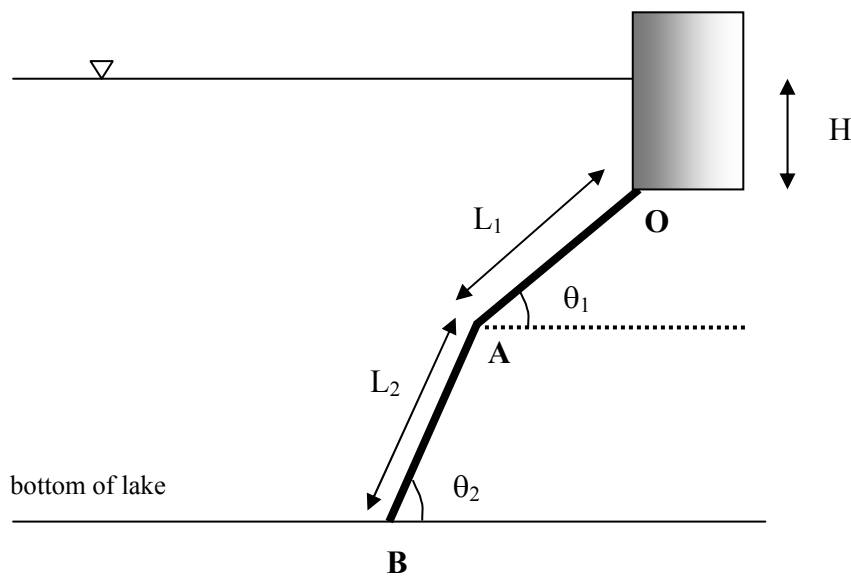
5.   Conceptual questions on external flows:

   a)   Consider the following experimental setup, which object will reach the bottom of the liquid
        column first? Explain your choice.
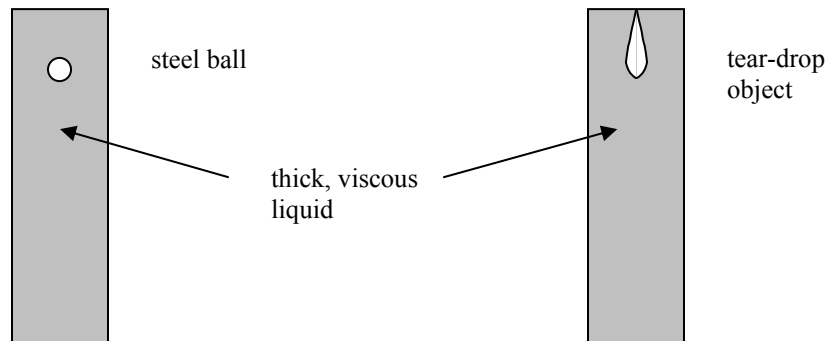
   b)   Consider the following experimental setup, describe the motion of the balance arm as the flow
        speed of the jets increases from zero to high speeds and explain your answers.

6.   Circle the correct answers:

   A.   For the same free-stream speed, the local skin friction will be
        a)   higher
        b)   the same
        c)   lower   if the local boundary layer thickness is thinner.

   B.   At the same location on a flat plate, the boundary layer will be
        a)   thinner
        b)   the same
        c)   thicker   if the free-stream speed is halved.