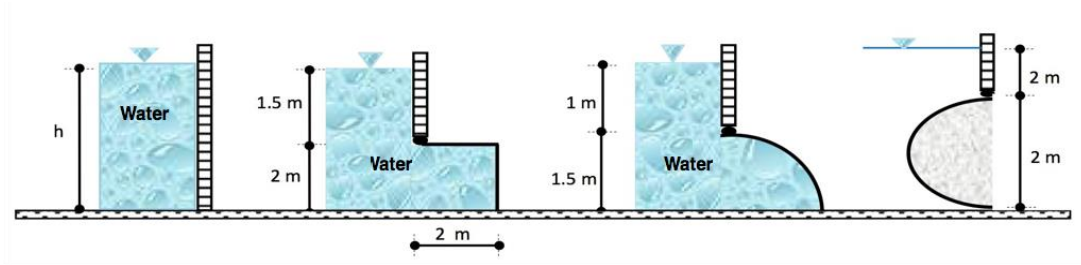
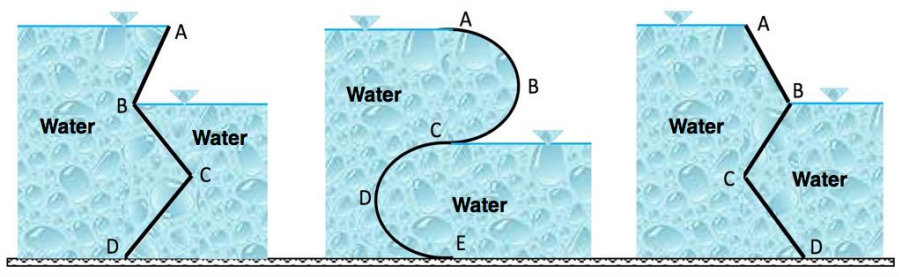
**Pressure Forces**

**Question 1:** Find the horizontal and vertical forces acting below the point shown in the figure that the gate is hinged. (Width perpendicular to the figure plane is 1m).




**Question 2:** Schematize the horizontal and vertical pressure forces acting on the surfaces ABCD. (Width perpendicular to the figure plane is 1m).

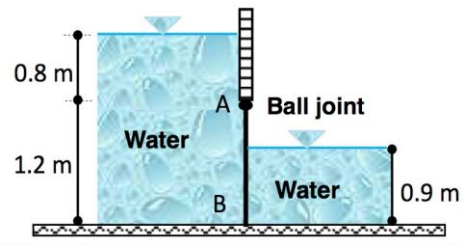



**Question 3:** The width of the gate AB that is hinged at point A is 2 meters and the gate is a part of the wall separating the chamber into two parts.

a) Find the direction and the magnitude of the force that should be applied to point B to hold the gate in position if there is water inside the parts and

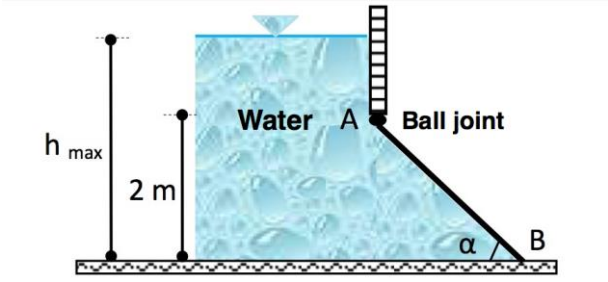
b) Find the direction and the magnitude of the force that should be applied to point B to hold the gate in position if there is oil inside the parts knowing that $\gamma_{oil}$= 7.85 kN/m$^3$.

**Answer: $F_{water}$=12.85 kN, $F_{oil}$=10.28 kN**



**Question 4:** The width of the rectangular gate AB gate in the figure that is hinged at point A is 4m, and it's weight is 392.4 kN. What should be the depth (h) of the water on the right side of the chamber to hold the gate in position?

**Answer: $h_{max}$=5.5 m**




**Question 5:** For the square gate system in the drawing find:

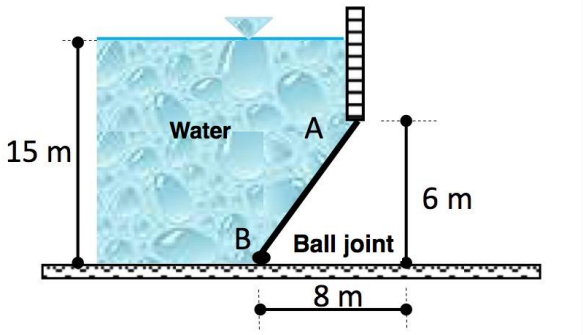
a- Pressure force acting upon the gate and the application point,

b- Reaction force at points A and B.

(The width of the gate perpendicular to the figure plane is 5 m. The contact force at point A is polished).

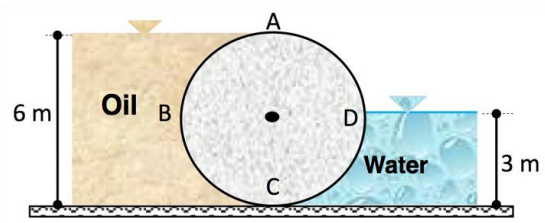
**Answer: a) $F_{water}$=5886 kN, application point B, 4.58 m**

**b- $H_A$=4495.92 kN $H_B$=-212.88 kN, $V_B$=3531.60 kN**




**Question 6:** Taking the width of the cylindrical gate perpendicular to figure plane as 1 m, find the horizontal and vertical components of the force and magnitude of the resultant force acting upon the gate and the coordinates of application point with respect to point A.

($\gamma_{oil} = 7.85kN/m^3$)

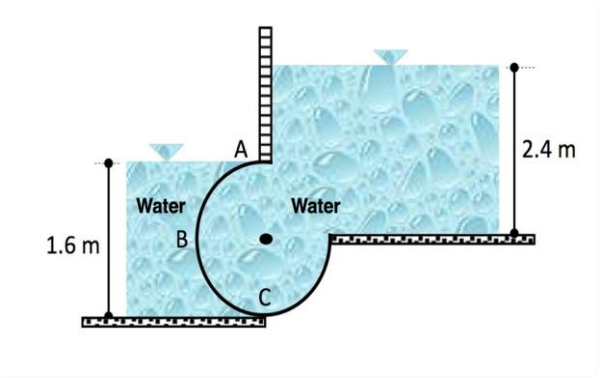



**Answer: R= 204.83 kN (Resultant force)**

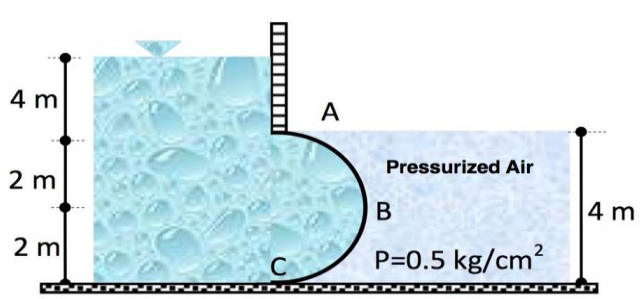
**Pressure Forces**

**Question 7:** Find the horizontal and vertical components of the force acting upon the curvilinear surface ABCD shown on the figure. (Width perpendicular to the figure plane is 3 m).

**Answer:** $F_{horizontal}$**=37.08 kN,** $F_{vertical}$**=67.59 kN**

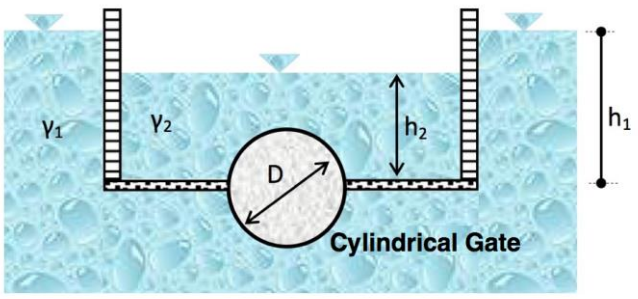



**Question 8:** The width of the semi – cylindrical gate ABC (perpendicular to the figure plane) shown in the figure is 5 m. One side of the gate is pressurized air. Find the horizontal and vertical components of the force acting upon the gate. **Answer:** $F_{horizontal}$**=195.20 kN,** $F_{vertical}$**=308.23 kN**




**Question 9**: Find the pressure force acting on the cylindrical gate for the given chamber system. For the state of equilibrium, calculate the height $h_2$ in terms of the other parameters.

**Answer:** $$h_2 = h_1\left(\frac{\gamma_1}{\gamma_2}\right)+\left(\frac{\pi.d}{8}\right)x\left(1+\frac{\gamma_1}{\gamma_2}\right)$$



**Question 10:** What should be the depth of the water so that the square designed butterfly damper could be opened. **Answer: h≤11.66 m (condition to stay closed)**