1)

2. Fluid Statics

2.1 Pascal law

In a static fluid, pressure exerted by the fluid at a given point is the same from all directions.
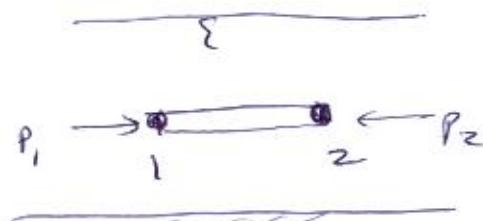
(pressure is force / area, e.g. Newton / m^2
= Pascal)

2.2 Pressure variation

- Horizontally :

$$F_1 = F_2$$

$$P_1 \delta A = P_2 \delta A$$

$$P_1 = P_2$$

Pressure value is same at same horizontal line .

2)

− Vertically

$$F_1 = F_2$$

$$P_1 + W_t = F_2$$

$$P_1 \delta A + \rho g (h_2 - h_1) \delta A = P_2 \delta A$$

$$P_2 - P_1 = \rho g (h_2 - h_1)$$
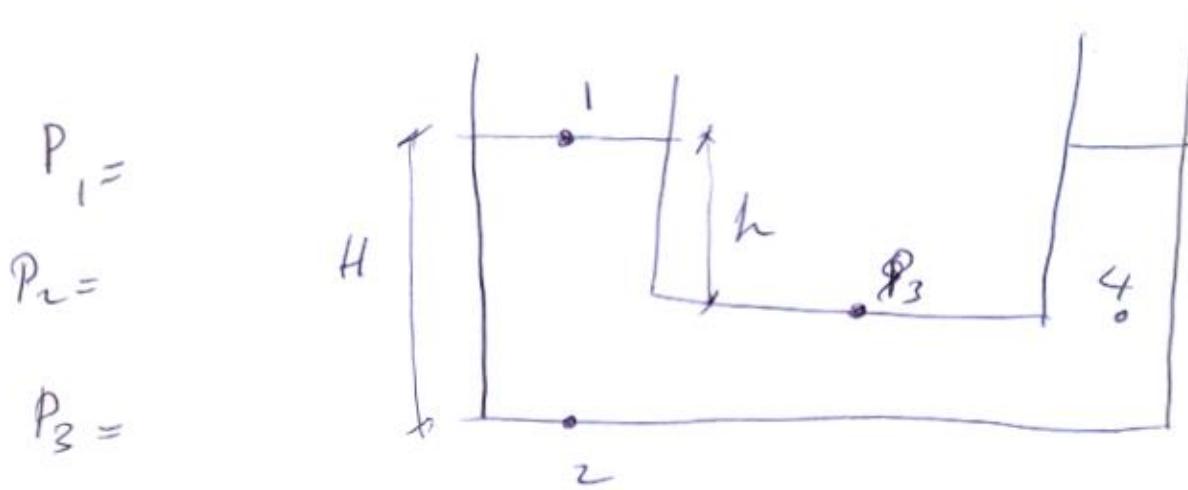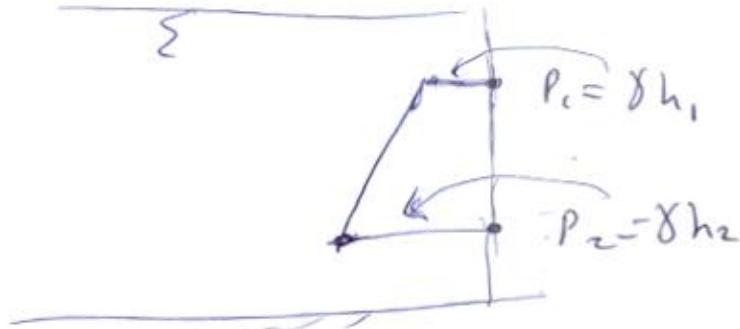
$$\Delta P = \gamma \Delta h$$

or $P = \gamma h$ → Value of pressure at a point

Variation $\dfrac{\Delta P}{\Delta h} = \rho g = $ constant

⟹ linear change

Then

$P_1 = \gamma h_1$

$P_2 = \gamma h_2$

$P_1 =$

$P_2 =$

$P_3 =$

$P_4 =$

3)

Fluid 1, ρ_1

Fluid 2, ρ_2

$\gamma_2(h_2 - h_{o})$ $\gamma_1 h_1$

$\rho_1 h_1$

h_1

h_2
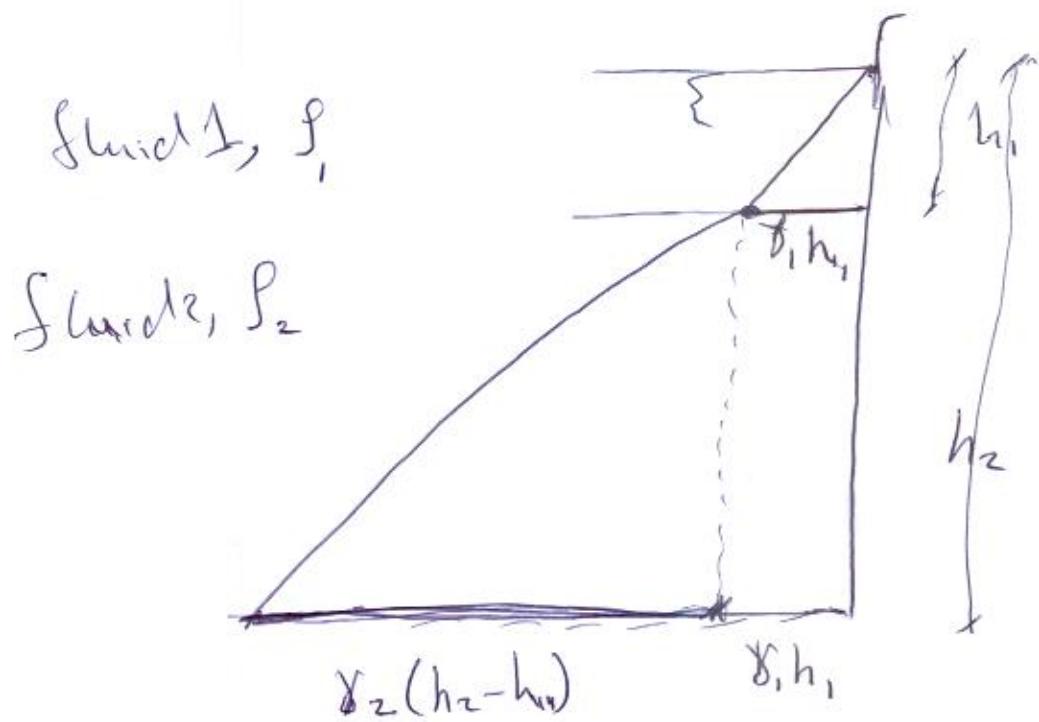
- Pressure references
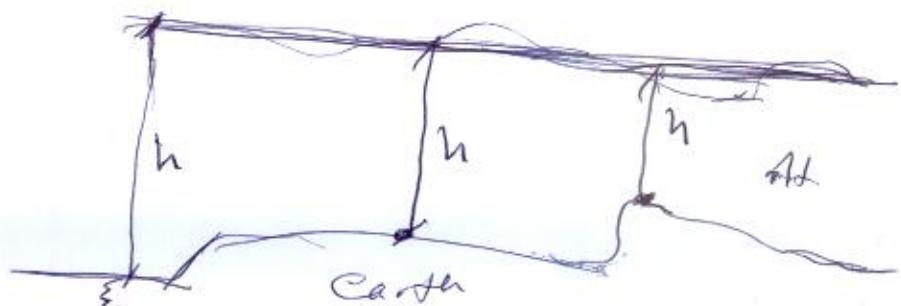
  - Vaccume → absolute pressure
  - atmosphere pressure → gage pressure

Value of atm: pressure at mean
See level is 76 mm Hg
$\qquad = 10.3$ m Water
$\qquad = 10.3 \times 9810$ Pascal

h h h

Atd.

Earth
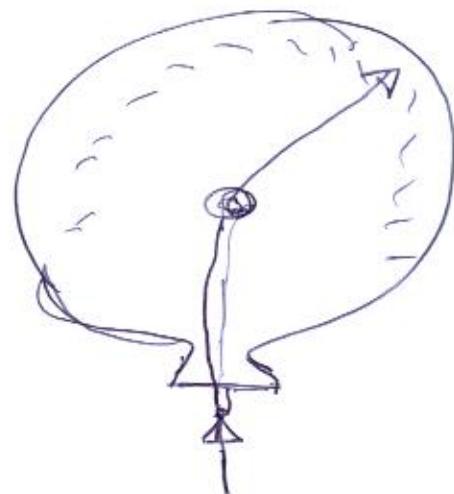
4)
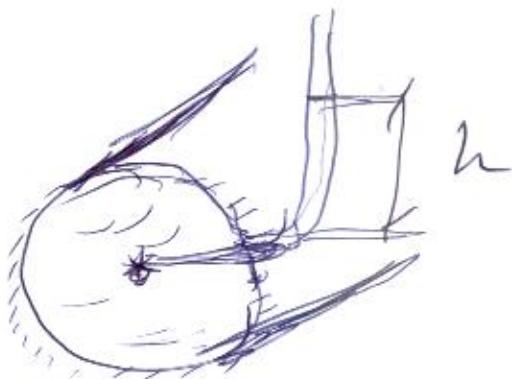
To measure gage pressure:

- Burdon gage
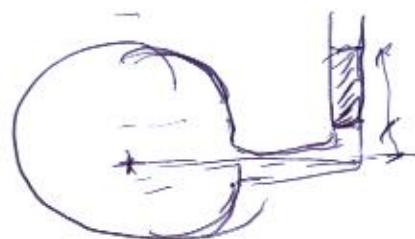
- Piezometer (Mano-meter)

Vertical tube (open) in which fluid raise. This rise, h, is used to estimate Pressure ($P = \gamma h$)

5) a In case of high pressure,
heavy fluid (Hg) can be used

– To solve for water system:

1. Start with one end and
write pressure value (even unknown)
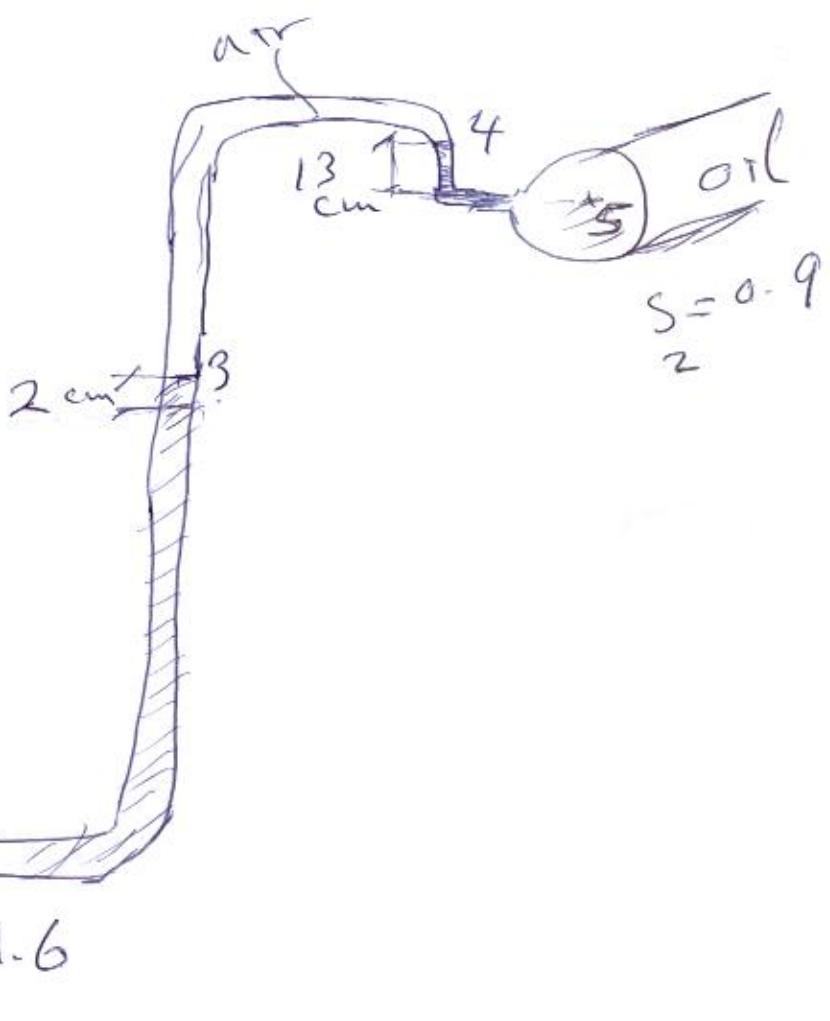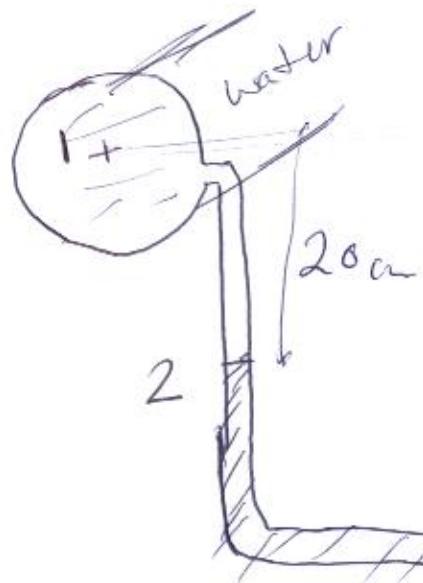
2– Continue in the system

if ↓ +ve
if ↑ –ve

3– Continue till end, and equate
with value at end.

6) Example:

air

13 cm 1 4

oil

5

S = 0.9
2

water

1 +

20 cm

2

S = 1.6
1

Find pressure difference

$$P_1 + 9810 \times 0.2 - 9810 \times 1.6 \times 0.22 + 0 + 9810 \times 0.9 \times 0.13 = P_5$$
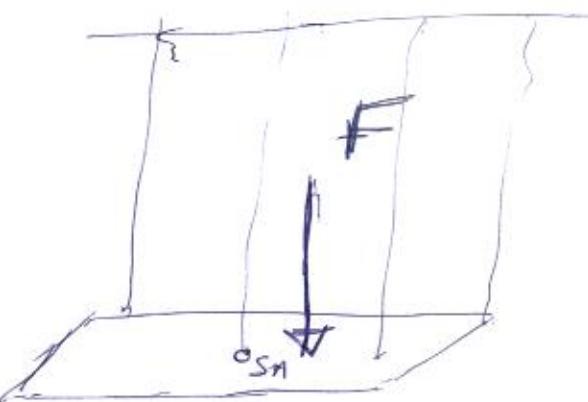
$$P_1 - P_5 = 343 \ Pascal$$

2.3 Pressure on Surfaces

— Horizontal:

h is the same,
So press at all
point are same.

Then $P_{or}(F) = \int P \, \delta d$
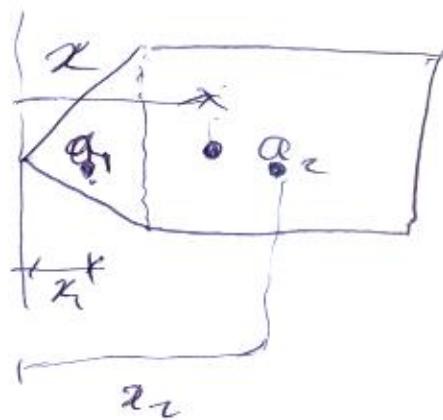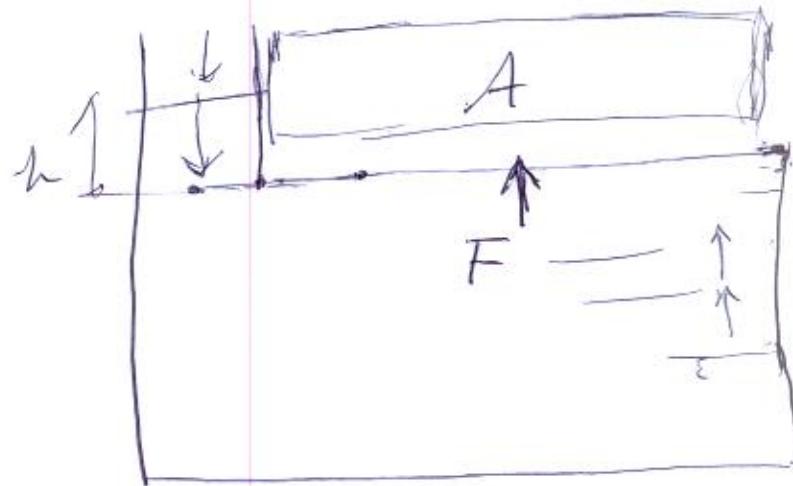
Resultant $= P \, A$

It passes in centroid of area

$$x = \frac{a_1 x_1 + a_2 x_2}{a_1 + a_2}$$

8) Pressure on surfaces can be ↑

$$F^{\uparrow} = P A = \gamma h A_g \quad \text{——(1)}$$

$$W_t \text{ of gate} = A_g h_g \gamma_g \quad \text{——(2)}$$

(critical depth h to raise gate up)

$$F^{\uparrow} = W_t \downarrow \Rightarrow \text{find } h$$