Fluid pressure

As you dive deeper in a lake or in the sea, the pressure increases. Divers know this rule:
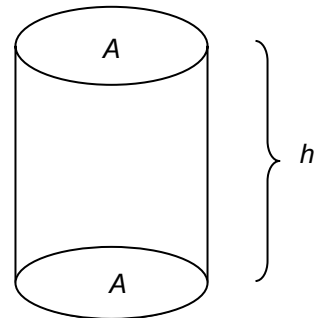
Water pressure increases every ten meters by one bar.

That is, 10 m below the surface of water, the pressure is 1 bar; at a depth of 20 m the pressure amounts to 2 bar etc.

How do we find this rule?

Here's a cylinder filled with a fluid of density ρ. The cylinder is on any planet of acceleration of free fall g. It has the area A and height h.
Lets find a formula for calculating the pressure at the bottom from ρ, g and h.

1. Write down the formula for calculating the fluid's volume V from the area A and the height h:

   $V =$

2. Note the formula for calculating the fluid's mass m from its density ρ and its volume V. Afterwards, substitute V by the relationship you wrote down in 1.

   $m =$ $=$

3. Write down the formula for calculating the fluid's weight (gravitational force) F_G from its mass m and the acceleration of free fall g. Afterwards, substitute m by the relationship you wrote down in 2 (second part)

   $F_G =$ $=$

4. Note the formula for carculating the pressure p at the bottom from the fluid's weight F_G and the area A. Substitute F_G by the second formula in 3. and cancel.

   $p =$ $=$

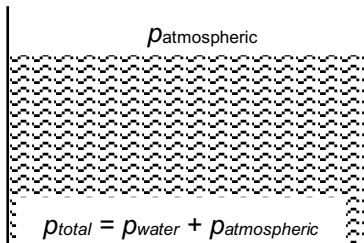   **The hydrostatic pressure in a fluid is**

   $p =$

(Formulae: $V = A \cdot h$ $m = \rho \cdot V$ $F_G = m \cdot g$ $p = \dfrac{F}{A}$)

INFORMATION:

Total pressure

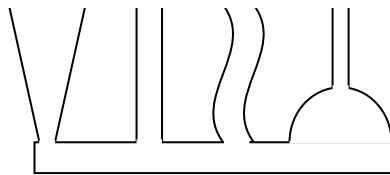For total pressure underneath the surface of water, atmospheric pressure needs to be added to the liquid pressure.

$p_{atmospheric}$

$p_{total} = p_{water} + p_{atmospheric}$

total pressure = fluid pressure + atmospheric pressure

Connecting vases

Connecting vases are described as follows: They are

- filled with a liquid
- connected underneath the fluid's surface
- open at the top

The fluid's surface is at the same level in all branches of the container. Liquid pressure is the same for any given depth below the surface, regardless of the shape of the container.

Task: Draw a possible surface of the fluid in the picture.