

The expression for the pressure at a depth  $h$  in a liquid of density  $\rho$  can be found by considering a horizontal area  $A$ . The force acting vertically downwards on  $A$  equals the weight of a liquid column of height  $h$  and cross sectional area  $A$  above it.

$$\text{Volume of liquid column} = hA$$

Since mass = volume x density, we can say  
Mass of liquid column =  $hA\rho$

Considering a mass of 1 kg to have weight of 10 N,  
Weight of liquid column =  $10hA\rho$

$$\ast \text{ Force on area } A = 10hA\rho$$

As

$$\text{Pressure} = \text{force} / \text{area} = 10hA\rho / A$$

Then

$$\text{Pressure} = 10h\rho$$

This is usually written as

$$\begin{aligned} \text{Pressure} &= \text{depth} \times \text{density} \times g \\ &= h\rho g \end{aligned}$$

where  $g$  is the acceleration of free fall.

