

# Hydrostatic Pressure

## Relationship between depth and pressure

Hydrostatic pressure in a liquid can be determined using the following equation:

$$p = h \cdot \rho \cdot g$$

where

$p$  = pressure (N/m<sup>2</sup>, Pa, lbf/ft<sup>2</sup>, psf)

$h$  = height of fluid column, or depth in the fluid at which the pressure is measured (m, in)

$\rho$  = density of liquid (kg/m<sup>3</sup>, slugs/ft<sup>3</sup>)

$g$  = the gravitational constant (9.81 m/s<sup>2</sup>, 32.17405 ft/s<sup>2</sup>)

**Absolute pressure** is zero-referenced against a perfect vacuum, using an absolute scale, so it is equal to gauge pressure plus atmospheric pressure.

**Gauge pressure** is zero-referenced against ambient air pressure, so it is equal to absolute pressure minus atmospheric pressure.

**Differential pressure** is the difference in pressure between two points.

Source : [https://en.wikipedia.org/wiki/Pressure\\_measurement](https://en.wikipedia.org/wiki/Pressure_measurement)

Complete the sentences using the words **positive**, **negative** and **zero**.

In a perfect vacuum, absolute pressure is ..... and gauge pressure is .....

In a partial vacuum, absolute pressure is ..... and gauge pressure is .....

At atmospheric pressure, absolute pressure is ..... and gauge pressure is.....

In compressed air, absolute pressure is ..... and gauge pressure is .....

Calculate the pressure surrounding a diver or a robot at 10m and 20m depth, in sea water and fresh water.

$\rho_{\text{sea water}} = 1025 \text{ kg/m}^3$  ;  $\rho_{\text{freshwater}} = 1000 \text{ kg/m}^3$

An easy rule to remember at sea is:

Complete the diving table beside where the depths are indicated in metres.

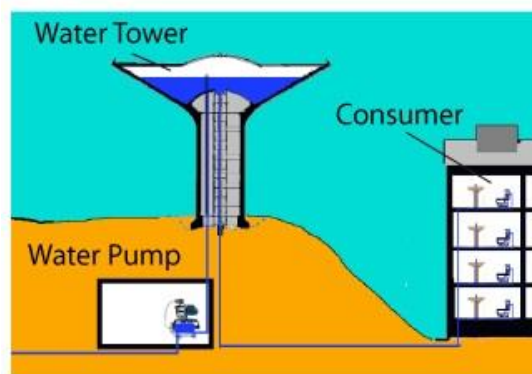
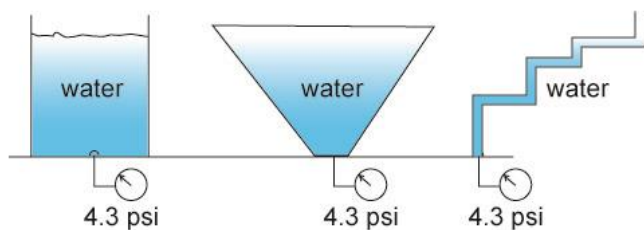
In the context of diving or designing underwater devices indicate the parameters influencing the pressure or not.

Pressure depends on:

DEPTH	ABSOLUTE PRESSURE	GAUGE PRESSURE	AIR VOLUME	SURFACE VOLUME EQUIVALENT	EXAMPLE
0	1 ATM	0 ATM	1	1	60
10			1/2	2	30
20			1/3	3	20
30			1/4	4	15
40			1/5	5	12

Pressure doesn't depend on:

Indicate the height in the examples below



What about the volume?

If we stay at constant temperature, for a fix quantity of gas in a deformable container, the volume is ..... to the absolute pressure of the gas.

A volume of 27l is brought up from 32 m to 17 m in sea water. What will the new volume be?