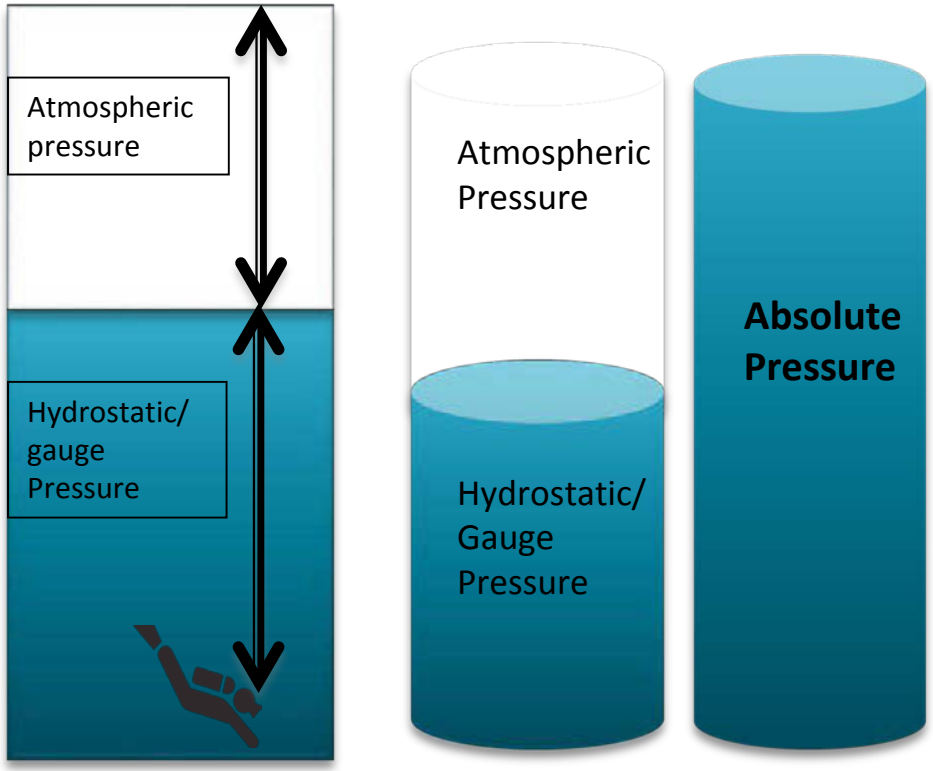
Diving Physics

Physics

- Air ~78% N_2, ~21% O_2, ~0.03% CO_2



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

Conversions

- Hydrostatic/ gauge pressure (P) = ~1 atm for every 10 msw/33fsw
  - Modification needed if diving at altitude
- Atmospheric P (1 atm at 0msw)
- Absolute P = gauge P + atmospheric P
- Water virtually incompressible – density remains ~same regardless depth/pressure
  - Density salt water 1027 kg/m^3
  - Density fresh water 1000kg/m^3
  - Calculate depth from gauge pressure you divide press by 0.1027 (salt water) or 0.10000 (fresh water)
- 1 bar = 101 KPa = 0.987 atm = ~14.5 psi
- 10 msw = 1 bar = 0.987 atm
- 33.07 fsw = 1 atm = 1.013 bar
- *Absolute P (ata)= gauge P* +1 atm
- °F = (9/5 x °C) +32
- °C= 5/9 (°F – 32)
- °R (rankine) = °F + 460 **absolute
- K (Kelvin) = °C + 273 **absolute

Laws & Principles

- All calculations require absolute units (K, °R, ATA)
- Charles' Law $V_1/T_1 = V_2/T_2$
- Guy-Lussac's Law $P_1/T_1 = P_2/T_2$
- Boyle's Law $P_1V_1 = P_2V_2$
- General Gas Law $(P_1V_1)/ T_1 = (P_2V_2)/ T_2$
- Archimedes' Principle
  - Any object immersed in liquid is buoyed up by a force equal to weight of the fluid displaced by the object
- Daltons' Law $P_{(total)} = P_1+P_2+\ldots+P_n$
  - The total pressure exerted by a mixture of gases is the sum of the pressures that would be exerted by each gas if it alone were present and occupied the total volume
- Henry's Law:
  - The amount of gas that will dissolve in a liquid is almost directly proportional to the partial press of that gas, & inversely proportional to absolute temp
- Partial Pressure (pp) – pressure contributed by a single gas in a mix
  - To determine the partial pressure of a gas at any depth, we multiply the press (ata) x %of that gas Henry's Law
  - Gas molecules enter liquid – add to gas tension (=partial press gas in liquid)
- Pressure gradient = Δ between gas tension in the liquid and gas partial press outside liquid
  - High gradient (low tension high PP) = high rate absorption of gas into liquid