

UNDERSTANDING PRESSURE IN VACUUM: DEFINING TERMS AND EXAMPLES

	Definition	Example
Ambient Pressure	Pressure surrounding an object at the time of measurement.	Pressure of air pushing against the outside of a closed tank.
Air Pressure	An indication of the force per unit area that molecules exert on an object. Vacuum is used when that pressure is less than ambient pressure.	Air pressure is a measure of the weight of the air pushing down on any particular location. Since there is less air above us at the top of the mountain, the air pressure at the top of a mountain is less than the air pressure at sea level
Absolute measure	Absolute measure is a real measure of how much of something is there. Zero means we have nothing, a non-zero number means we have something.	If you have zero blocks, you don't have any blocks. If you have 10 blocks, you have 10 blocks. If you have a perfect vacuum with zero molecules, you have zero pressure. If you have 760 Torr of absolute pressure/vacuum, then you have standard atmospheric pressure.
Differential measure	Indicates the difference between two known quantities.	If in there are 10 blocks in one stack and 15 blocks in another stack, then there is a differential block count of 5 blocks. If there is 760 Torr of absolute pressure inside an airplane cabin, and there is 700 Torr of absolute pressure outside the airplane at altitude, then there is a differential pressure of (760-700) or 60 Torr between the two pressures. Differential pressure = Pressure A – Pressure B
Gauge measure	Indicates the difference in pressure between a measured and a known or reference standard.	If the standard block count is 10 blocks, and I have 15 blocks, then the gauge measure of blocks is (15-10) or 5 blocks. If gauge tire pressure is 30 PSI, and the surrounding absolute air pressure is 15 PSI, then the absolute pressure of the tire is (30+15) or 45 PSI. Gauge pressure can be thought of as differential pressure where one of the pressures is the ambient air pressure. Gauge Pressure = Measured Absolute Pressure – Standard Absolute Pressure; Measured Absolute Pressure=Gauge Pressure + Standard Absolute Pressure

Another Example...

Say there was a rigid tank open to the absolute ambient pressure of 760 Torr. If molecules are removed from a tank and the tank is instantly sealed at constant temperature, then there is a vacuum in the tank. (note $PV=nRT$ where P =pressure, V =volume, n is the number of molecules, R is a constant and T =temperature; in this example we are holding V and T constant and watching the P = pressure change when we remove n =molecules away) Assume the inside of the tank was measured with a super accurate vacuum instrument and found to be an absolute pressure of 700 Torr inside. The Absolute Pressure of the pressure inside the tank is 700 Torr. The differential pressure of the pressure inside the tank with respect to the outside air is $700-760=-60$ Torr. The gauge pressure would be the same as the differential pressure in this case: $700-760=-60$.

