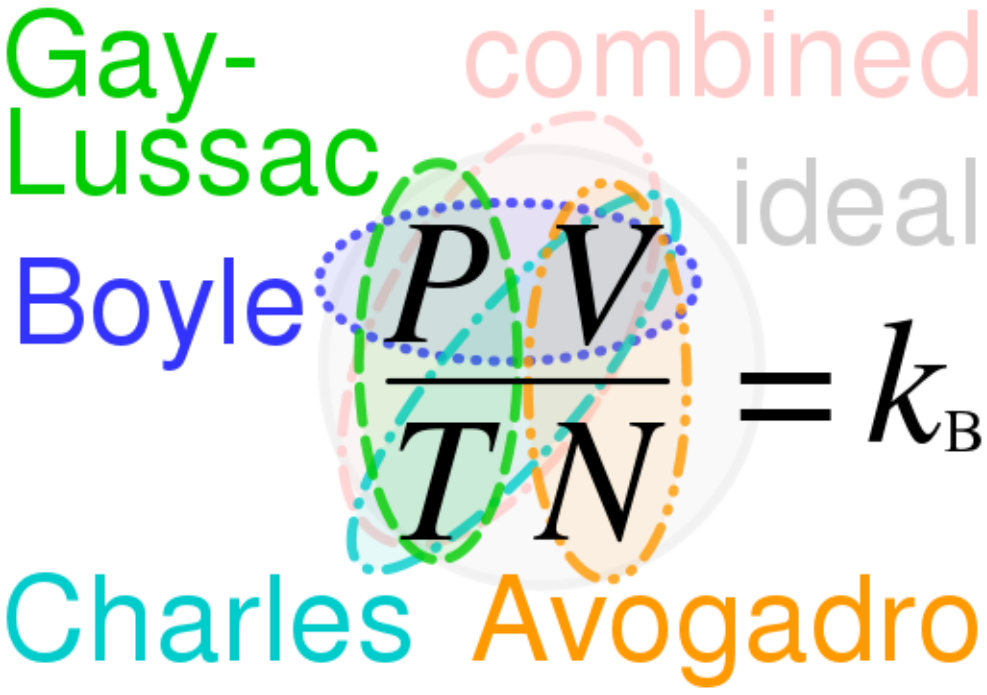
Boyle's Law

$P_1V_1=P_2V_2$. Boyle's Law describes the behavior of a set amount of gas at a constant pressure. It states that as pressure increases, volume decreases, and vice versa. Another way it can be described is PV=k where k is a constant.

The application of this law is important for determining the remaining amount of oxygen in a tank, as well as safety during airborne transport of patients. We know a standard oxygen E cylinder (what we use during patient transport) has a volume of 5L and is "full" at 2000 PSI. Atmospheric pressure is about 14.7 PSI. Therefore, the volume of unpressured oxygen in a full E cylinder is $P_1V_1=P_2V_2 \Rightarrow 2000*5=15*X \Rightarrow X=2000*5/14.7\approx 680L$*. You can change P_1 to the pressure reading on the gauge to figure out the remaining oxygen in a partially filled tank as well. Another application for Boyle's law is patients who will be transported via air or otherwise exposed to lower ambient air pressure who have gas in a contained space. As the pressure drops the volume of the gas expands, potentially leading to significant consequences. This is why it is critical to think about things like pneumothoraces, pneumocephalus, and even the cuffs of endotracheal tubes before patients are airlifted or removed from hyperbaric oxygen chambers. This is also why SCUBA divers are trained to exhale during ascent.

The mnemonic for all the gas laws, shameless stolen (from TrueLean I believe), that I use is:
Boyle's Law (Boil water at a high **temperature**) is when **temperature** is constant: PV=k
Charles's Law (Prince charles is under **pressure**) is when **pressure** is constant: V/T=k
Gay-Lussac's Law (the other law, can't think of a mnemonic) is when **volume** is constant: P/V=k



*You'll see several different values for volume of oxygen in a "full" E cylinder. Knowing (or deriving) an approximate answer is more important than the exact value as this will change with altitude or even the weather. Those lucky ducks in Denver get over 800L from a "full" tank.