Question of the Day

Problem: Explain under what conditions the ideal gas law is applicable.

Solution:

The main concept of the ideal gas law is that all molecules in a system have no interactions with each other and are indistinguishable. In a qualitative view, molecules interact with each other when they are close in proximity. In other words, when a large number of molecules occupy a small space do molecules "notice" each other. Such a quantity that describes this is called the **molar volume**. The molar volume is the unit volume per mole.

Taking this concept, with a fixed volume, adding more molecules to the given volume will increase molecular interactions. Likewise, if moles are removed, less molecular interactions occur and the molar volume increases. If we write out the definition of molar volume we have:

$\frac{V}{n}$ = molar volume

Since V is fixed, increasing the number of moles, *n*, will in consequently decrease the molar volume, while using a So how does the ideal gas law come into play?

$PV = nRT$ Rearranging this gives $\frac{RT}{P} = \frac{V}{n} =$ molar volume

So, we must evaluate the variables of the quantity $\frac{RT}{P}$ to determine in which way manipulating the variables will decrease $\frac{RT}{P}$

Since R (The Ideal Gas Constant) is constant, the only two variables are temperature, T, and pressure, P.

Increasing temperature will cause $\frac{RT}{P}$ to become larger, while decreasing the temperature will make it smaller. In this case, we want to have a higher temperature

Increasing pressure will cause $\frac{RT}{P}$ to become smaller, while decreasing the pressure will make it larger. In this case, we want a lower pressure.

Since the ideal gas law works well when the molar volume $\left(\frac{RT}{P} = \frac{V}{n}\right)$ is relatively large the ideal gas law works with high temperatures and low pressures.