# Ideal and real gases

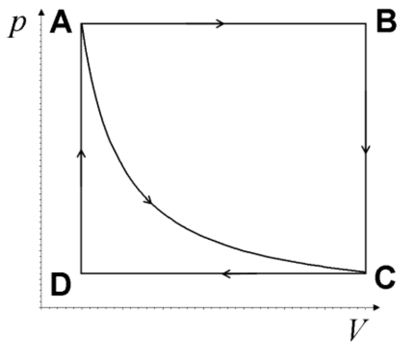
P1. At a -5.0 ºC winter day, a tire pressure was set to 250 kPa. How much is the pressure on a summer day of 35.0 ºC? Suppose the tire does not leak, and its volume does not change. *[287 kPa]*

P2. The volume of an air sample at 25 ºC and 1.00 atm is 1.00 liters. What is the pressure required to have a volume of 100 $cm^3$ at this temperature? *[10.0 atm]*

P3. In a container of 22.4 $dm^3$, there are 2.00 mol of hydrogen and 1.00 mol of nitrogen at 273.15 K. Calculate the molar fraction and partial pressure of both components. Calculate the total pressure. *[$X_{H_2} = 0.\dot{6}$, $X_{N_2} = 0.\dot{3}$, $p_{H_2} = 2.03\times10^5$ Pa, $p_{N_2} = 1.01\times10^5$ Pa, $p = 3.04\times10^5$ Pa]*

P4. Calculate the pressure exerted by 1.00 mol of 273.15 K and 22.414 $dm^3$ ethane when it is
a) ideal gas *[$p = 1.01\times10^5$ Pa]*, or
b) van der Waals gas ($a$ = 5.489 $L^2$ atm $mol^{-2}$, $b$ = 0.0638 L $mol^{-1}$). Give also the critical properties for ethane. *[$p = 1.005\times10^5$ Pa, $p_c = 5.518\times10^6$ Pa, $V_c = 1.91\times10^{-4}$ $m^3$/mol, $T_c$ = 310.67 K]*

P5. Plot the changes of state of the following $p - V$ diagrams on a $p - T$ and $V - T$ diagram. (The AC curve shows an isothermal change.)




P6. There are two containers of 50.0 $dm^3$ each. The two containers are connected by a thin tube. One container is kept at 100 ºC and the other at 0 ºC. A total of 4.00 mol of gas is placed into the containers. What is the pressure in the system? *[104894 Pa]*

P7. Suppose Blaise Pascal weighed 65 kg. Calculate the pressure exerted on the floor and ice in a pair of 250 $cm^2$ boots and on a 2.0 $cm^2$ skate. *[25498 Pa and $3.18\times10^6$ Pa]*

P8. How much is the molar weight of a compound whose 1.42 g is converted to steam to obtain 0.38 $dm^3$ vapor at 100 ºC and 94.7 kPa? *[122 g/mol]*

P9. The molar volume of a gas at 250 K and 15 atm is 12% less than that of the perfect gas. Under these conditions, calculate the compression factor and the molar volume of the gas. Which forces are dominating in the sample: the attractions or the repulsions? *[Z = 0.88, attractions dominate]*