GSET: Programming - Summer 2022

Lab 2: The Ideal Gas Law

More Expressions and Assignments

Overview :

You will learn to add basic input and output to a MATLAB program. You will use the *fprintf* function to print formatted strings to the command window. You will complete a basic, but fundamental chemistry calculation. The inputs are typed in your program and the program will output the results to the command window.

What is a Mole? :

The mole is a unit of measurement used in chemistry to express amounts of a chemical substance, defined as the amount of any substance that contains as many elementary entities (e.g., atoms, molecules, ions, electrons) as there are atoms in 12 grams of pure carbon-12. This number is called *Avogadro's Constant* and has a value of 6.0221×10^{23}.

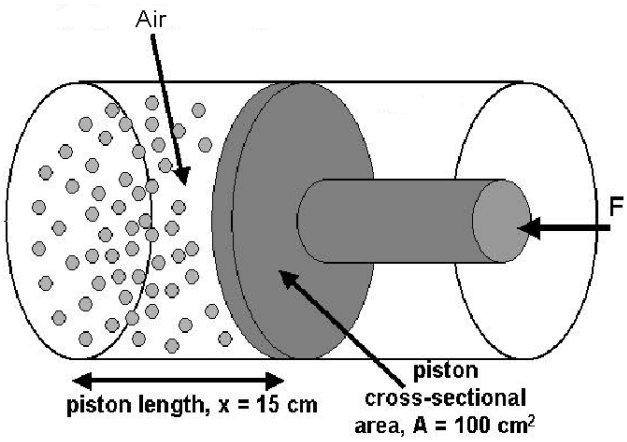
The Ideal Gas Law :

The following equations describe the behavior of a gas in the form of the temperature, pressure, volume and mass relation. The equation to find the force on the piston is also given. You will use them in your program.

$$PV = nRT \qquad n = m/M \qquad P = F/A$$

where,

x	position	(m)
F	force	(N)
V	volume	(m^3)
n	number of moles	$(mols)$
m	mass of gas	(kg)
A=100	area	(cm^2)
P=300	pressure	(kPa)
T=325	temperature	(K)
M=28.97	molecular mass of air	$(\frac{g}{mol})$
R=8.314	ideal gas constant	$(\frac{Pa\ m^3}{mol\ K})$



$1(kPa)$=1000(Pa)
$1(Pa)$=1$(\frac{N}{m^2})$

Assignment : Your program should do the following:

1. **R**, **M**, **T**, **P**, and **A**, are constants. *Hardcode* these in your program.

2. Consider the piston at position **x=15 cm**. Calculate the force, **F** required to hold the piston at the current position..

3. Calculate the remaing quantities **V**, **n**, and **m**.

4. Output the 4 results to the command window in the *base S.I. units*.

5. Consider the piston has moved to **x=10 cm** and the temperature, T stays constant. Calculate and output the quantities that have changed. Do not output the quantities that have not changed.

Submission :

- Your program needs a proper *Header* or title block on it. Please see this discussion in the notes for details.

- Your script file needs to be named properly. Please see the *naming convention* document on ilearn.

- Submit your file on ilearn in the **Laboratory Assignment 2 Folder**. You can re-submitt as many times as you would like but please wait at least 2 minutes between submissions. Your latest submission will be the only one graded.