

MATLAB For Chemical Engineer

Al-Mustaqbal University College

**Chemical Engineering and Petroleum Industries
department**

Exercise

Exercise 1:

Write a program to calculate the vapor pressure of water according to Antoine equation: $P^o = \exp(A - B / (T + C))$

Where T is any given temperature in Kelvin and A, B, and C are Antoine coefficients:

$$A = 18.3036$$

$$B = 3816.44$$

$$C = -46.13$$

Solution: Let temperature equal to 373.15 k, write the following code.

$$T = 373.15;$$

$$A = 18.3036;$$

$$B = 3816.44;$$

$$C = -46.13;$$

$$Pw = \exp(A - B / (T + C))$$

The result will be:

$$Pw =$$

$$759.9430$$

Note: you can use any variable name in your code.

Exercise 2:

Write a program to calculate the volumetric and mass flow rate of a liquid flowing in a pipe with a velocity equal to 0.5 m/s. Knowing that the diameter of this pipe is 0.1 m and the density of this liquid is 890 kg/m³ ?

Solution:

d=0.1;p=890;u=.5;

A=(pi/4)*d^2;

Volflow=u*A

Massflow=Volflow*p

The result will be:

A =

0.0079

Volflow =

0.0039

Massflow =

3.4950

Exercise 3:

For the following distillation column write a code to find the value of stream B and the compositions of stream D?

Solution:

Type the commands as m-file. Then copy it to command window.

F=100;D=80;B=F-D

XF=0.15;SF=0.25;TF=0.4;ZF=0.2;

XB=0.15;SB=0.25;TB=0.4;ZB=0.2;

XD=(F*XF-B*XB)/D*100

SD=(F*SF-B*SB)/D*100

TD=(F*TF-B*TB)/D*100

ZD=(F*ZF-B*ZB)/D*100

Then after pressing enter the result will be:

B =

20

XD =

15

SD =

25

TD =

40

ZD =

20

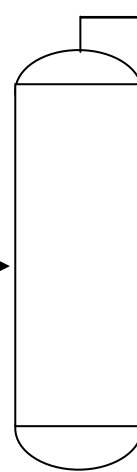
F=100kg

15% X

25% S

40% T

20% Z



D=80

?% X

?% S

?% T

?% Z

B=? 15% X

25% S

40% T

20% Z

Problems

- 1) Compute the reaction rate constant for a first-order reaction given by the Arrhenius law $k=A e^{-E/RT}$, at a temperature $T=500$ K. Here the activation energy is $E=20$ kcal/mol and the pre-exponential factor is $A=10^{13}$ s⁻¹. The ideal gas constant is $R=1.987$ cal/mol K.
- 2) Solve the following problems in command window

a) $\frac{37+8}{5+2^2}$

b) $\frac{6}{2} * 3 * 4 + \frac{2^5}{3+5}$

c) $(3+1)^2 + \frac{8^{4/2}}{5+11}$

d) $3^2 + 2^2 + \frac{8^4}{2 * (5+11)}$

- 3) Define the variable x as x=6, then evaluate:

a) $x^3 + 2x^2 - 11$

b) $(x-2)^2 - 11$

c) $\frac{(x-2)^2}{4} - 2$

- 4) Define the variables a,b and c as: $a=5, b=-5$, and $c=2a+b$

Evaluate:

a) $ab + ac - \frac{6a}{b}$

b) $a^{-b/a} + \frac{c^a}{b^{(a+b)/c}}$