

## CHG 1125 Assignment #1

Due: Wednesday February 1, 2012, 4:30 pm in the Assignment Box, 4<sup>th</sup> floor CBY  
(can also be handed in during the lecture)

1. The Schmidt Number ( $Sc$ ) is a dimensionless number used in many chemical engineering calculations. It is defined as

$$Sc = \frac{\mu}{\rho K_d}$$

where  $\mu$  = viscosity,  $\rho$  = density, and  $K_d$  = diffusivity.

What are the required dimensions of diffusivity for the Schmidt number to be dimensionless?

2. Kinetic energy is defined as

$$E_K = \frac{1}{2}mv^2$$

What are the units of kinetic energy in:

- (a) The SI system of units?
- (b) The CGS system?
- (c) The AES system?

3. A sodium chloride ( $\text{NaCl}$ ) solution was prepared by adding 80 g of  $\text{NaCl}$  to 3000 g of  $\text{H}_2\text{O}$ . Determine:

- (a) The molarity of the solution;
- (b) The mole fraction of water in the solution;
- (c) The number of parts per million (ppm) of  $\text{NaCl}$  in the solution.
- (d) The pH of the solution.

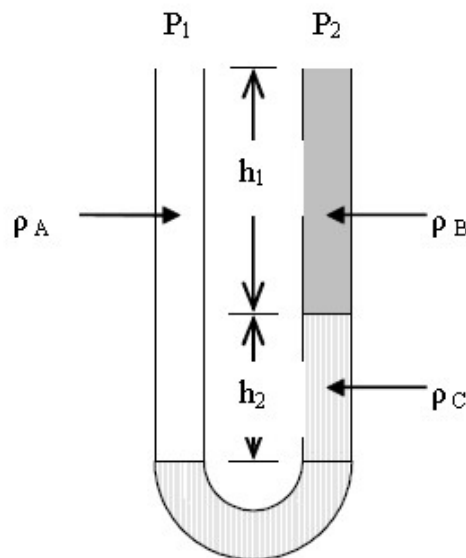
One can assume that the solution density is  $1015 \text{ kg/m}^3$ .

4. The pressure in a tank open to the atmosphere is being measured using two different pressure gauges. Repeat measurements are taken in order to verify if the pressure gauges are functioning properly. The following measurements are taken

P(kPa)	72.4	73.1	72.6	72.8	73.0
Pressure gauge #1					
P(kPa)	97.3	101.4	98.7	103.1	100.4
Pressure gauge #2					

- (a) For each set of five measurements, calculate the mean pressure and the standard deviation.
- (b) Which pressure gauge readings exhibit the most scatter? Which is more accurate?

5. Three distinct liquids are used in the following pressure gauge:



Fluid A is methanol (SG = 0.792), fluid B is water, fluid C has a specific gravity of 1.40, the pressure at  $P_2 = 115$  kPa, the height  $h_1 = 15$  cm and the height  $h_2 = 10$  cm. Calculate the pressure at  $P_1$  in kPa.