

淡江大學 101 學年度轉學生招生考試試題

系別：化學工程與材料工程學系三年級 科目：質能均衡

考試日期：7月17日(星期二) 第5節

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1. Consider the equation:

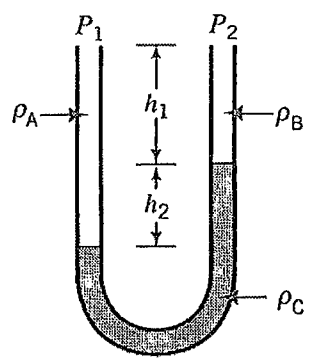
$$D = 5t^2 + 3$$

where D is distance having a unit of m and t is time having a unit of s.

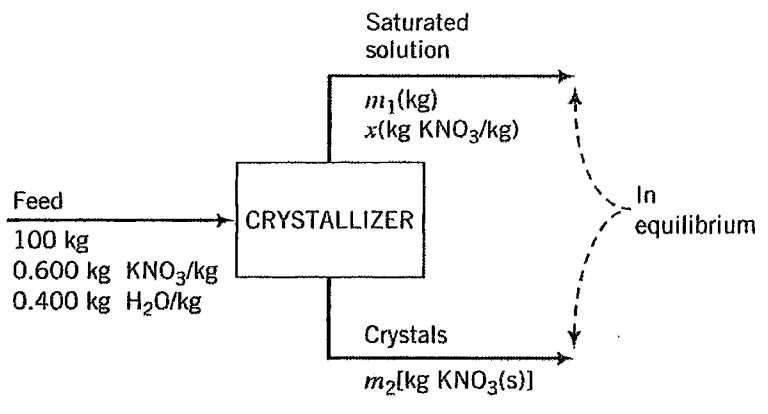
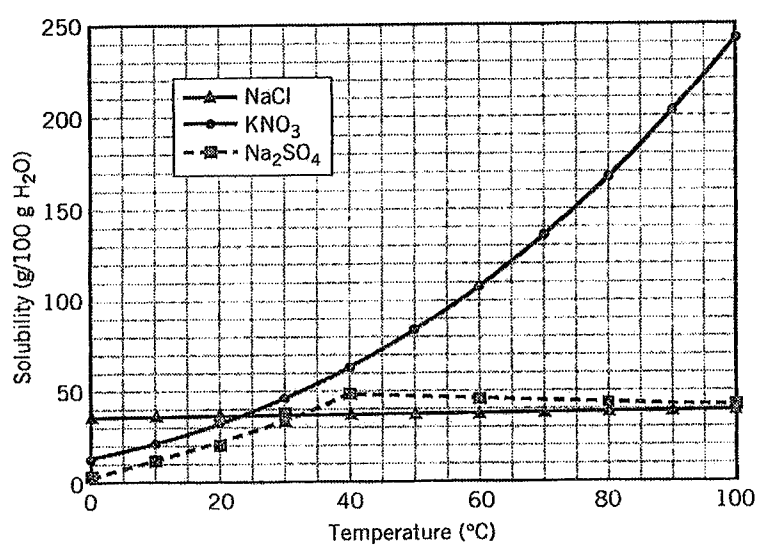
- (a) What are the dimensions of the constants 5 and 3? (7%)
- (b) What are the units of 5 and 3 in SI system? (8%)
- (c) Derive an equation for distance in centimeters in terms of time in minutes. (10%)

2. Three different liquids are used in the manometer shown here.

- (a) Derive an expression for $P_1 - P_2$ in terms of $\rho_A, \rho_B, \rho_C, h_1$ and h_2 . (15%)
- (b) Suppose fluid A is methanol ($\rho_A = 792 \text{ kg/m}^3$), B is water ($\rho_B = 1000 \text{ kg/m}^3$), and C is a manometer fluid with a specific gravity of 1.37; pressure $P_2 = 121 \text{ kPa}$; $h_1 = 30 \text{ cm}$; and $h_2 = 24 \text{ cm}$. Calculate P_1 (kPa). (10%)



3. An aqueous potassium nitrate solution containing 60 wt% KNO_3 at 80°C is fed to a cooling crystallizer in which the temperature is reduced to 40°C . Determine the temperature at which the solution reaches saturation and the percentage of the potassium nitrate in the feed that forms crystals. (30%)



4. Calculate the heat required to raise 200 kg of nitrous oxide from 20°C to 150°C in a constant-volume vessel. The constant-volume heat capacity of N_2O in this temperature range is given by the equation

$$C_v \text{ (kJ/kg} \cdot ^\circ\text{C)} = 0.855 + 9.42 \times 10^{-4} T$$

where T is temperature in $^\circ\text{C}$. (20%)