

淡江大學九十四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

准帶項目請打「V」



簡單型計算機

節次：7月15日第5節

本試題共 頁

1. A storeman recently lost an eye when an old 1-L bottle of 100% formic acid (HCO_2H) exploded as he lifted it off the shelf in the main store of the chemical department. He was not wearing safety glasses. Concentrated formic acid slowly decomposes to carbon monoxide and water upon prolonged storage, and the gas pressure can be sufficient to rupture sealed glass containers.

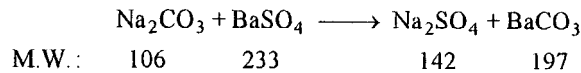
Assume that the pressure in the vapor space in the bottle above the formic acid reached 210 kPa, and that the vapor space occupied 10 cm^3 . If the bottle was at room temperature (25°C), estimate the fraction of the formic acid that decomposed. Assume the water and the carbon monoxide are both in the vapor phase only. [30 pts]

Data: the saturated vapor pressure of formic acid - 10.3°C 20 mmHg abs.
 32.4°C 60 mmHg abs.
 43.8°C 100 mmHg abs.

the specific gravity of formic acid - $1.220 \frac{20}{4}$

2. A drier takes in wet timber (20.1 wt% water) and reduces the water content to 8.6 wt% water. You want to determine the kg of water removed per kg of timber that enters the process.
- (a) Draw a picture of the process, put the data on the figure, pick a basis, determine the number of variables whose values are unknown, and the number of independent equations that can be written for the process. [20 pts]
- (b) Is a unique solution possible? If your answer is **YES**, how many kg of water can be removed when one kg of timber enters the process? [10 pts]

3. Barite mineral (BaSO_4) is processed by heat fusion with soda ash (Na_2CO_3) followed by leaching with water to produce BaCO_3 , which has several uses, including that of rat poison. The overall reaction is



The analysis shows the weight percents as: solid residue, 33.6% BaSO_4 and 66.4% BaCO_3 ; and soluble salts, 58.1% Na_2SO_4 and 41.9% Na_2CO_4 . For the process, calculate:

- (a) The composition of the mix before fusion [10pts]
 (b) The percent excess reactant [5pts]
 (c) The degree of completion [5pts]
 (d) If the feed rate of barite mineral into the process is 318 kg/hr, construct the stoichiometric table for this reaction. [10pts]

4. Three distinct liquids are used in the manometer shown here. Derive an expression for $P_1 - P_2$ in terms of ρ_A , ρ_B , ρ_C , h_1 , and h_2 . [10pts]

