

淡江大學 109 學年度日間部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

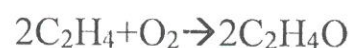
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考試日期：7月22日(星期三) 第1節

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1. If 100g of air consists of 77% by weight of nitrogen (N_2 , molecular weight=28g/mol), and 23% by weight of oxygen (O_2 , molecular weight=32g/mol), calculate the mean molecular weight of air. (10%)
2. Strawberries contain about 15wt% solids and 85wt% water. To make strawberry jam, crushed strawberries and sugar are mixed in a 45:55 mass ratio, and the mixture is heated to evaporate water until the residue contains one-third water by mass.
 - (a) Draw and label a flowchart of this process. (10%)
 - (b) Do the degree-of-freedom analysis. (5%)
 - (c) Calculate how many pounds of strawberries are needed to make a pound of jam. (15%)
3. Five hundred kilograms per hour of steam drives a turbine. The steam enters the turbine at 44atm and 450°C at a linear velocity of 60 m/s and leaves at a point 5m below the turbine inlet at atmospheric pressure and a velocity of 360 m/s. The turbine delivers shaft work at a rate of 70 kW, and the heat loss from the turbine is estimated to be 10^4 kcal/h.
 - (1) Draw and label a flowchart of this process. (5%)
 - (2) Calculate the specific enthalpy change associated with the process. (15%)
(1J=0.239x10⁻³kcal, 1N=1 kg m/s², 1W=1N m/s)
4. The oxidation of ethylene to produce ethylene oxide proceeds according to the equation



The feed to a reactor contains 100 kmol C_2H_4 and 100 kmol O_2 .

- (1) Which reactant is limiting? (5%)
 - (2) What is the percentage excess of the other reactant? (5%)
 - (3) If the reaction proceeds to completion, how much of the excess reactant will be left and what is the extent of reaction? (10%)
5. One hundred gram-moles of nitrogen is contained in a 5 L vessel at -20.6°C. The critical temperature and pressure of nitrogen are 126.2K and 33.5atm. Use the following generalized compressibility chart. (R=0.08206 L atm/ mol K)
 - (1) What is the compressibility factor? (10%)
 - (2) Estimate the pressure in the cylinder. (10%)

背面尚有試題

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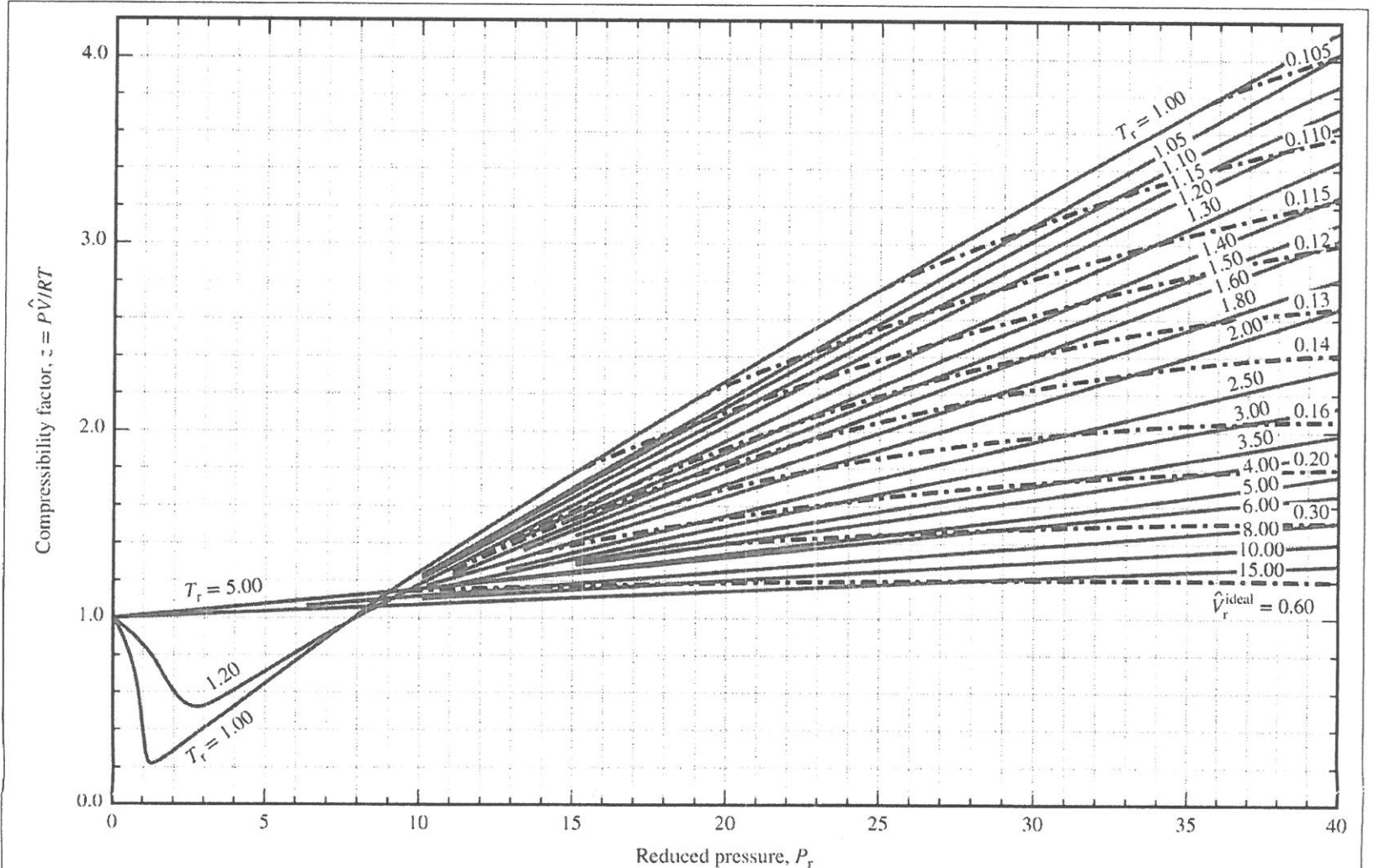


Figure 1 Generalized compressibility chart, high pressure.