

淡江大學八十八學年度日間部轉學生招生考試試題

45

系別：化學工程學系三年級

科目：質能均衡

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- 30% 1. A well known reaction to generate hydrogen from steam is the so called water gas shift reaction : $\text{CO} + \text{H}_2\text{O} \rightleftharpoons \text{CO}_2 + \text{H}_2$. If the gaseous feed to a reactor consists of 30 moles of CO, 12 moles of CO_2 , and 35 moles of steam per hour at 800°C , and 18 moles of H_2 are produced per hour, calculate
- the limiting reactant.
 - the excess reactant.
 - the fraction conversion of steam to H_2 .
 - the degree of completion of the reaction.
 - the kg of H_2 yielded per kg of steam fed.
 - the moles of CO_2 produced by the reaction per mole of CO fed.
- 20% 2. A gas with the following composition is burned with 50% excess air in a furnace. What is the composition of the flue gas by percent ?
- CH_4 : 60%; C_2H_6 : 20% ; CO : 5%; O_2 : 5%; N_2 : 10%
- (air: 79% N_2 , 21% O_2)
- 20% 3. The vapor pressure of hexane at -20°C is 14.1 mm Hg absolute. Dry air at this temperature is saturated with the vapor under a total pressure of 760 mm Hg. What is the percent excess air for combustion ? (Dry air : 79% N_2 , 21% O_2) (Assume ideal gas.)
- 30% 4. A gas is burned with 300% excess air with the gas and air entering the combustion chamber at 25°C . What is the theoretical adiabatic flame temperature achieved in $^\circ\text{C}$? See Fig. I for details.

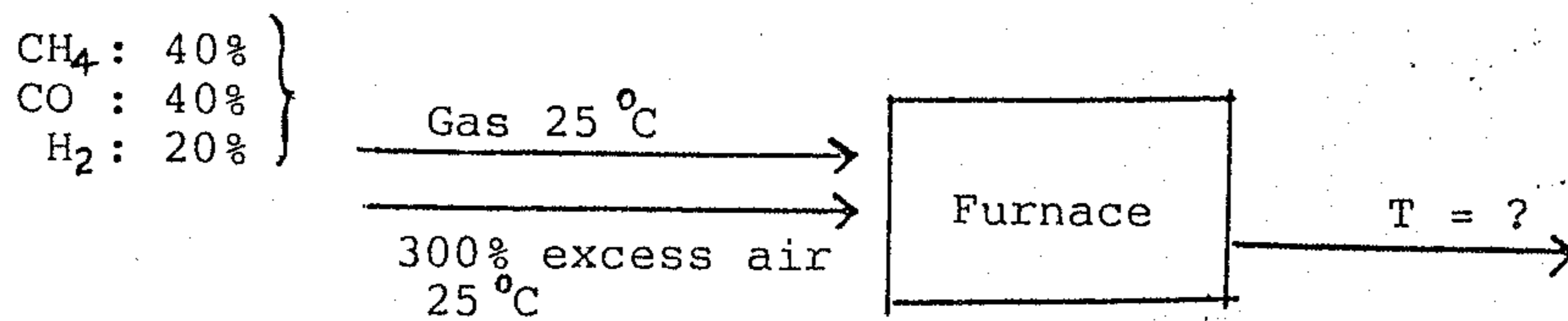


Fig. I

(air: 79% N_2 , 21% O_2)

Data:

	ΔH_f° (25°C) (cal/g mol)
CH_4	- 17889
CO	- 26416
H_2O	- 57798
CO_2	- 94052

	Enthalpy (cal/g mol)		
	25 $^\circ\text{C}$	500 $^\circ\text{C}$	1000 $^\circ\text{C}$
CO_2	217.9	5340	11846
H_2O	200.3	4254	9210
O_2	175	3745	7482
N_2	174	3569	7916