淡江大學八十九學年度日間部轉學生招生考試試題

系別：化學工程學系三年級　　科目：質能均衡

本試題共兩頁

本試題雙面印製

25分 1. In a process for the manufacture of chlorine by direct oxidation of HCl with air over a catalyst to form Cl_2 and H_2O (only), the exit product is composed of HCl (4.4%), Cl_2 (19.8%), H_2O (19.8%), O_2 (4%), and N_2 (52%). What was

(15分) (a) the limiting reactant ?

(5分) (b) the percent excess reactant ?

(5分) (c) the degree of completion of the reactant ?

25分 2. Crystals of $Na_2CO_3 \cdot 10H_2O$ are dropped into a saturated solution of Na_2CO_3 in water at 100°C. What percent of the Na_2CO_3 in the $Na_2CO_3 \cdot 10H_2O$ is recovered in the precipitated solid ? The precipitated solid is $Na_2CO_3 \cdot H_2O$.

Data at 100°C : The saturated solution is 31.2% (wt.) Na_2CO_3;
the molecular weight of Na_2CO_3 is 106.

25分 3. To condition the air in an office building in the winter, one thousand cubic meters of moist air at 101 KPa and 22°C and with a dew point of 11°C enters the process. The air leaves the process at 98 KPa with a dew point of 58°C. How many kilograms of water vapor are added to each kilogram of wet air entering the process ?

The vapor pressures of H_2O at 11°C and 58°C are 1.31 KPa and 18.14 KPa, respectively. Treat the wet air as an ideal gas. The molecular weight of dry air is 29.

25分 4. Formaldehyde can be made by the oxidation of methanol. If stoichiometric amounts of $CH_3OH_{(g)}$ and $O_{2\,(g)}$ enter the reactor at 100°C, the reaction is complete, and the products leave the reactor at 200°C, calculate the heat that is added or removed from the reactor per mole of methanol fed to the reactor. This is a steady state operation involving an open system.

The reaction is $CH_3OH_{(g)} + \frac{1}{2}O_{2\,(g)} \longrightarrow H_2CO_{(g)} + H_2O_{(g)}$

Data : Heats of formation at 25°C — $\Delta H_f^\circ(H_2CO_{(g)}) = -115.89$ KJ/g mol,

$\Delta H_f^\circ(CH_3OH_{(g)}) = -201.25$ KJ/g mol,

$\Delta H_f^\circ(H_2O_{(g)}) = -241.826$ KJ/g mol.

◀注意背面尚有試題▶

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(續第4題之數據)

Heat capacity equation:

$$C_p = a + bT + cT^2 + dT^3 \qquad (J/(g\,mol)(^\circ C))$$

where T is in °C.

	a	b	c	d
CH_3OH (g)	42.93	8.301×10^{-2}	-1.87×10^{-5}	-8.03×10^{-9}
O_2 (g)	29.10	1.158×10^{-2}	-0.6076×10^{-5}	1.311×10^{-9}
H_2O (g)	33.46	0.688×10^{-2}	0.7604×10^{-5}	-3.593×10^{-9}
H_2CO (g)	34.28	4.268×10^{-2}	0	-8.694×10^{-9}