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國立臺北科技大學 110 學年度碩士班招生考試

系所組別：3301、3302 材料科學與工程研究所

第一節　普通熱力學　試題

注意事項：

1. 本試題共 6 題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. If a solid floats on its own liquid phase, do you expect the melting temperature increase or decrease with increasing pressure? Please explain why? (10%)

2. Please estimate the enthalpy of solidification for $H_2O_{(l)}$ at 1 atm and -10°C (10%)

3. Please find the Gibbs free energy, enthalpy, and entropy by mixing Ar and H_2 at a ratio of 95:5, assuming all starting gases and the gas mixtures are ideal gases at 1 atm and 298 K. (20%)

4. For 2 moles of ideal gas that has c_v=2.5 R, please calculate its change of internal energy, enthalpy, entropy, heat, and work for a straight path in P-V space starting from 1 atm and 273 K to a final pressure and temperature of 10 atm and 373 K. Is the work done on the gas or by the gas? (25%)

5. Please sketch the corresponding phase diagram and ΔG-X plot for each phase in the $\alpha + L \leftrightarrow \beta$ reaction at peritectic temperature. Please indicate clearly the curves for each phase, stable phases and their boundaries and regions. (20%)

6. If excess carbon is present in a container that originally has 1:1 of CO and CO_2 and no other gases, please explain the change of CO:CO_2 ratio with increasing temperature. (15%)

$$\Delta G_{CO} = -111700 - 87.65T \ \left(\frac{J}{mol}\right)$$

$$\Delta G_{CO_2} = -394100 - 0.84T \ \left(\frac{J}{mol}\right)$$

$$\Delta H_{melting,H_2O,1\ atm,0°C} = 6008 \ \left(\frac{J}{mol}\right)$$

$$\Delta H_{evaporation,H_2O,1\ atm,100°C} = 40680 \ \left(\frac{J}{mol}\right)$$

$$c_{P,H_2O_{(l)}} = 75.3 \ \frac{J}{K \cdot mole}$$

$$c_{P,H_2O_{(s)}} = 36 \frac{J}{K \cdot mole}$$

$$c_{P,H_2O_{(V)}} = 30 + 10.71 \times 10^{-3} T \frac{J}{K \cdot mole}$$

$$R = 8.314 \frac{J}{K \cdot mole} = 0.08205 \ \frac{atm \cdot l}{K \cdot mole}$$