113 MM01

國立臺北科技大學 113 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. 本試題共八題，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. One mole of ideal gas (c_v=2.5R) irreversibly shrinks from 50 liter at 2 atm to 25 liter at 1 atm, what is the change of enthalpy? (10%)
   (a) 0 J
   (b) 0 J/K
   (c) -75 atm-l
   (d) -26596.5 J
   (e) -18997.5 J
   (f) -18997.5 J/K.

2. Which of the following is incorrect? (10%)
   (a) Volume of gas molecules is zero.
   (b) P cannot be negative.
   (c) Change of entropy can be negative.
   (d) Entropy is always larger than zero.
   (e) Change of Gibbs free energy can be positive.

3. Which of the following reactions have negative change of entropy? (10%)
   (a) $C_{(s)} + \frac{1}{2} O_{2(g)} \rightarrow CO_{(g)}$.
   (b) $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$
   (c) $H_2O_{(v)} \rightarrow H_2O_{(l)}$
   (d) $SiO_{2(s)} \rightarrow Si_{(s)} + O_{2(g)}$
   (e) No reaction can have negative change of entropy.

4. For $2Al_{(s)} + \frac{3}{2} O_{2(g)} \rightarrow Al_2O_{3(s)}$ reaction, which is correct? (10%)
   (a) Change of entropy for the reaction is negative.
   (b) Change of enthalpy for the reaction is negative at 298 K.
   (c) Alumina can decompose at high temperature.
   (d) Aluminum can be a solid fuel.
   (e) All of the above.

5. One mole of aluminum changes from 1 atm and 273 K to 100.5 atm and 373 K. What is the change of enthalpy? (10%)
   (a) 2500 J.
   (b) 7.49 J/K.
   (c) 2400 J.
   (d) 100 J
   (e) 0 J/K
   (f) None of the above.

$$For\ Al_{(s)}$$
$$Atomic\ weight = 27$$
$$density = 2.7 g \cdot cm^{-3}$$
$$c_P = 24 J \cdot (K \cdot mole)^{-1}$$
$$\alpha = 20\ ppm/K$$

6. For a miscibility gap, choose the correct statement(s). (10%)
   (a) $\frac{\partial^2 G}{\partial X^2} > 0$ within the region of spinodal decomposition.
   (b) The boundaries of miscibility gap have the same $\frac{\partial G}{\partial X}$.
   (c) The boundaries of miscibility gap have the same $\frac{\partial^2 G}{\partial X^2}$.
   (d) $\frac{\partial G}{\partial X} = 0$ at the boundaries of spinodal decomposition.
   (e) $\frac{\partial G}{\partial X} = 0$ at the boundaries of miscibility gap.

7. What is the condition required for Ag_2O to reduce into Ag in air? (20%)

$$2\,Ag_{(s)} + \frac{1}{2} O_{2(g)} = Ag_2O_{(s)}, \qquad \Delta G^o = -30540 + 66.11T\ (J)$$

8. Given that the saturated vapor pressure of water is

$$log\ p_{H_2O_{(l)}}\ (atm) = \frac{-2900}{T} - 4.65\ log\ T + 19.732$$

You walk from an air-conditioned room into a parking lot with 65% relative humidity at 32°C, and your glasses turn foggy due to water condensation. What temperature might the air-conditioned room be? (20%)