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BSK1133 PHYSICAL CHEMISTRY

PRACTICE 7

PREPARED BY:

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PRACTICE 7
BY DR. YUEN MEI LIAN

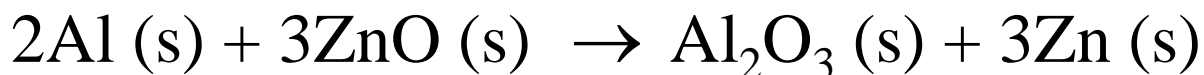
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1. Define entropy (S) and Gibbs free-energy (G).
2. Choose the correct answer of the entropy of a system change for the following processes.

(Circle your answer)

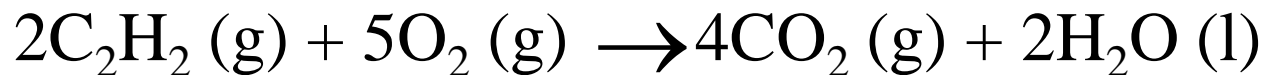
- | | |
|-----------------------------|---------------------|
| i. A solid melts | Increase / Decrease |
| ii. Liquid boils | Increase / Decrease |
| iii. Solid sublimates | Increase / Decrease |
| iv. Urea dissolves in water | Increase / Decrease |
| v. Liquid freezes | Increase / Decrease |

3. Calculate the ΔS_{rxn}° for the following reaction at 25 °C.



(Given: $S^{\circ} \text{Al (s)} = 28.3 \text{ J/K}\cdot\text{mol}$, $S^{\circ} \text{ZnO (s)} = 43.9 \text{ J/K}\cdot\text{mol}$, $S^{\circ} \text{Al}_2\text{O}_3 \text{ (s)} = 50.99 \text{ J/K}\cdot\text{mol}$ and $S^{\circ} \text{Zn (s)} = 41.6 \text{ J/K}\cdot\text{mol}$)

4. Calculate ΔG_{rxn}° for the following reactions at 25°C.



(Given: $\Delta G_f^{\circ}\text{C}_2\text{H}_2 (\text{g}) = 209.2 \text{ kJ/mol}$, $\Delta G_f^{\circ}\text{O}_2 (\text{g}) = 0$, $\Delta G_f^{\circ}\text{CO}_2 (\text{g}) = -394.4 \text{ kJ/mol}$ and $\Delta G_f^{\circ}\text{H}_2\text{O} (\text{l}) = -237.2 \text{ kJ/mol}$)

5. The molar heats of fusion and vaporization of gas X are 1.8 kJ/mol and 6.9 kJ/mol, respectively. Meanwhile, gas X melting point and boiling point are -180 °C and -176 °C, respectively. Calculate

(i) ΔS_{fusion}

(ii) $\Delta S_{vaporization}$

ANSWERS:

1. Entropy (S) is measurement of dispersion energy of a system.
Gibbs free-energy (G) is free energy in a system to do work.

2. i., ii, iii, iv Increase v. Decrease

$$3. \Delta S_{rxn}^{\circ} = -12.5 \text{ J/K}\cdot\text{mol}$$

$$4. \Delta G_{rxn}^{\circ} = -2470 \text{ kJ/mol}$$

$$5. \text{ i. } \Delta S_{fusion} = \frac{\Delta H_{fus}}{T_f} = \frac{\left(1.8 \frac{\text{kJ}}{\text{mol}}\right) \times 1000 \text{ J/1kJ}}{(-180 + 273.15) \text{ K}} = 19.3237 \text{ J K}^{-1} \text{ mol}^{-1}$$

$$\text{ii. } \Delta S_{vaporization} = \frac{\Delta H_{vap}}{T_{bp}} = \frac{\left(6.9 \frac{\text{kJ}}{\text{mol}}\right) \times 1000 \text{ J/1kJ}}{(-176 + 273.15) \text{ K}} = 71.0242 \text{ J K}^{-1} \text{ mol}^{-1}$$

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