# Ch20 • Entropy & Free Energy

## NChO 1999

25. Under which set of conditions is a chemical reaction most likely to be spontaneous?

| | $\Delta H$ | $\Delta S$ | T (temperature) |
|---|---|---|---|
| (A) | – | – | low |
| (B) | – | – | high |
| (C) | + | + | low |
| (D) | + | – | high |

26. For which reaction do you expect $\Delta S$ to be negative?
    (A) $2C(s) + O_2(g) \rightarrow 2CO(g)$
    (B) $Br_2(s) \rightarrow Br_2(l)$
    (C) $H_2O(l, 25\ °C) \rightarrow H_2O(l, 50\ °C)$
    (D) $Cl_2(g) + 2HI(g) \rightarrow I_2(s) + 2HCl(g)$

## NChO 1998

23. Which has the greatest absolute entropy?
    (A) one mol of $C(s)$ at 25 °C
    (B) one mol of $CH_3Cl(l)$ at 25 °C
    (C) one mol of $C_2H_6(g)$ at 25 °C
    (D) one mol of $C_6H_6(l)$ at 25 °C

## NChO 1997

26. For which of these processes would $\Delta S°$ be expected to be the most positive?
    (A) $O_2(g) + 2H_2(g) \rightarrow 2H_2O(g)$
    (B) $H_2O(l) \rightarrow H_2O(s)$
    (C) $N_2O_4(g) \rightarrow 2NO_2(g)$
    (D) $NH_4NO_2(s) \rightarrow N_2(g) + 2H_2O(g)$

## NChO 1996

24. For which of these processes is the value of $\Delta S$ expected to be negative?
    I. Sugar is dissolved in water
    II. Steam is condensed
    III. $CaCO_3$ is decomposed into CaO and $CO_2$.
    (A) I only          (C) II only
    (B) I and III only     (D) II and III only

25. Which set of conditions is most likely to result in a reaction that is spontaneous as written?

| | $\Delta H$ | $\Delta S$ | T |
|---|---|---|---|
| (A) | $< 0$ | $< 0$ | 500 °C |
| (B) | $< 0$ | $< 0$ | 0 °C |
| (C) | $> 0$ | $< 0$ | 0 °C |
| (D) | $> 0$ | $< 0$ | 500 °C |

## NChO 1995

21. For which of these processes is the sign of the enthalpy change different from the others?
    (A) $Al_2O_3(s) \rightarrow 2\ Al(s) + 3/2\ O_2(g)$
    (B) $H_2O(s) \rightarrow H_2O(l)$
    (C) $Cl_2(g) \rightarrow 2Cl(g)$
    (D) $Cl(g) + e^- \rightarrow Cl^-(g)$

24. For the process $O_2(g) \rightarrow 2\ O(g)$, $\Delta H° = +498$ kJ. What would be predicted for the sign of $\Delta S_{rxn}$ and the conditions under which this reaction would be spontaneous?

| | $DS_{rxn}$ | Spontaneous |
|---|---|---|
| (A) | positive | at low temperatures only |
| (B) | positive | at high temperatures only |
| (C) | negative | at high temperatures only |
| (D) | negative | at low temperatures only |

25. For the reaction
    $$NH_4Cl(s) \rightarrow NH_3(g) + HCl(g)$$
    $\Delta H° = +176$kJ and $\Delta G° = +91.2$ kJ at 298 K.
    What is the value of $\Delta G$ at 1000 K?
    (A) -109 kJ          (C) +64 kJ
    (B) -64 kJ           (D) +109 kJ

## NChO 1994

23. When ammonium nitrate, $NH_4NO_3(s)$ is added to water at 25 °C, it dissolves spontaneously and the temperature of the solution decreases. This indicates that the factor causing the substance to dissolve is a change in
    (A) energy           (C) entropy
    (B) enthalpy         (D) temperature