

Examrace

Competitive Exams: Chemistry MCQs (Practice_Test 3 of 31)

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1. For which one of the following reactions does the entropy of the system INCREASE?
 - a. $\text{NH}_3 (\text{g}) + \text{HCl} (\text{g}) \rightarrow \text{NH}_4\text{Cl} (\text{s})$
 - b. $\text{Ag} + (\text{aq}) + \text{Cl}^- (\text{aq}) \rightarrow \text{AgCl} (\text{s})$
 - c. $2\text{H}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightarrow 2\text{H}_2\text{O} (\text{g})$
 - d. $\text{NH}_3 (\text{g}) + \text{H}_2\text{O} (\text{l}) \rightarrow \text{NH}_4^+ (\text{aq}) + \text{OH}^- (\text{aq})$
 - e. $2\text{H}_2\text{O}_2 (\text{l}) \rightarrow 2\text{H}_2\text{O} (\text{l}) + \text{O}_2 (\text{g})$

2. Consider the following characteristics of chemical reactions
 - a. spontaneity
 - b. maximum amount of work that can be done
 - c. speed

The value of G for a chemical reaction under a given set of conditions provides information about:

- a. 1 only
 - b. 2 only
 - c. 3 only
 - d. 1 and 2
 - e. 1,2 and 3
3. Consider the following standard reduction potentials, half-reaction E° , V $\text{I}_3^- (\text{aq}) + 2\text{e}^- \rightarrow 3\text{I}^- (\text{aq})$ 0.53 $\text{Cr}^{3+} (\text{aq}) + \text{e}^- \rightarrow \text{Cr}^{2+} (\text{aq})$ -0.41
 4. Calculate G° (in kJ) for the following reaction at 25°C.
 5. $\text{Cr}^{2+} (\text{aq}) + \text{I}_3^- (\text{aq}) \rightarrow \text{Cr}^{3+} (\text{aq}) + \text{I}^- (\text{aq})$
 6. Consider the following reaction, $2\text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{SO}_3 (\text{g})$, and the following thermochemical data, substance G° , kJ/mol, $\text{SO}_2 (\text{g})$ -300.194, $\text{O}_2 (\text{g})$ 0.0, $\text{SO}_3 (\text{g})$ -371.06. Calculate the value of the equilibrium constant for this reaction at 25°C.
 - a. N/A

- b. N/A
- c. N/A
- d. N/A
7. For the dissociation of acetic acid in water at 25°C, $\text{CH}_3\text{COOH} (\text{l}) + \text{H}_2\text{O} (\text{l}) \rightleftharpoons \text{H}_3\text{O}^+ (\text{aq}) + \text{CH}_3\text{COO}^- (\text{aq})$, $\Delta H^\circ = 284.3 \text{ kJ}$ and $\Delta S^\circ = -143.1 \text{ J K}^{-1}$. Calculate the value of ΔG° (in kJ) for this reaction at equilibrium.
- a. N/A
- b. N/A
- c. N/A
- d. N/A
8. Consider the carbonylation (i.e., addition of CO) of methanol, CH_3OH , to produce acetic acid, CH_3COOH , in a closed system at constant temperature and pressure, $\text{CH}_3\text{OH} (\text{g}) + \text{CO} (\text{g}) \rightleftharpoons \text{CH}_3\text{COOH} (\text{g})$, and the following data: Substance ΔH°_f , kJ mol⁻¹, ΔS°_f , J mol⁻¹ K⁻¹, $\text{CH}_3\text{OH} (\text{g})$ -201240, $\text{CO} (\text{g})$ -110198, $\text{CH}_3\text{COOH} (\text{g})$ -432283. If the initial concentration of $\text{CH}_3\text{OH} (\text{g})$ is 1.5 M and the initial concentration of $\text{CO} (\text{g})$ is 2.0 M, what is the concentration (in M) of $\text{CH}_3\text{OH} (\text{g})$ at equilibrium, at 298 K?
- a. N/A
- b. N/A
- c. N/A
- d. N/A
9. For which of the following processes does the entropy of the system DECREASE?
- a. Melting of ice.
- b. Dissolving table salt in water.
- c. Decomposition of liquid hydrogen peroxide to produce liquid water and oxygen gas.
- d. Precipitation of silver chloride from a solution containing silver ions and chloride ions.
- e. The entropy of the system increases in all of the above processes.
10. For a particular chemical reaction, the values for ΔH and ΔS are both positive. Which of the following statements is TRUE about this reaction?
- a. The reaction is spontaneous at any temperature.
- b. The reaction is not spontaneous at any temperature.
- c. The reaction is spontaneous when the temperature is high enough to overcome ΔH .

- d. The reaction is spontaneous when the temperature is low enough to overcome H.
- e. The reaction is spontaneous when the temperature is low enough to overcome S.
11. For the boiling of methanol, $\text{CH}_3\text{OH}(\text{l}) \rightarrow \text{CH}_3\text{OH}(\text{g})$, $H_o = +38.0 \text{ kJ}$, and $S_o = +113.0 \text{ J/K}$. Assume that methanol boils at a temperature at which the value of G is equal to zero. Using the values of H_o and S_o , calculate the temperature (in K) at which methanol boils.
- N/A
 - N/A
 - N/A
 - N/A
12. Which of the following reactions is unfavorable at low temperatures but becomes favorable as the temperature increases?
- $2 \text{ CO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$; $H_o = -566 \text{ kJ}$; $S_o = -173 \text{ J/K}$
 - $2 \text{ H}_2\text{O}(\text{g}) \rightarrow 2 \text{ H}_2(\text{g}) + \text{O}_2(\text{g})$; $H_o = 484 \text{ kJ}$; $S_o = 90.0 \text{ J/K}$
 - $2 \text{ N}_2\text{O}(\text{g}) \rightarrow 2 \text{ N}_2(\text{g}) + \text{O}_2(\text{g})$; $H_o = -164 \text{ kJ}$; $S_o = 149 \text{ J/K}$
 - $\text{PbCl}_2(\text{s}) \rightarrow \text{Pb}^{2+}(\text{aq}) + \text{O}_2(\text{g})$; $H_o = 23.4 \text{ kJ}$; $S_o = -12.5 \text{ J/K}$
13. The following reaction is spontaneous as written: $\text{Zn}(\text{s}) + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu}(\text{s})$ Which of the following statements is TRUE?
- $K_{eq} > 1$ and $G_o = 0$
 - $K_{eq} > 1$ and $G_o < 0$
 - $K_{eq} < 1$ and $G_o < 0$
 - $K_{eq} > 1$ and $G_o > 0$
 - $K_{eq} < 1$ and $G_o = 0$
14. A spontaneous reaction ALWAYS occurs when:
- $H_o < 0$ and $S_o < 0$
 - $H_o > 0$ and $S_o < 0$
 - $H_o < 0$ and $S_o > 0$
 - $H_o > 0$ and $S_o = 0$
 - $H_o > 0$ and $S_o > 0$
15. When a reaction is at equilibrium, which of the following statements is TRUE?
- $G = G_o$

b. $\ln K_{eq} = 0$

c. $G_0 = 0$

d. $Q = 0$

e. $G = 0$

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