

1. Which of the following compounds has the lowest entropy at 25 °C?

CH₃OH(l)

CO(g)

Correct answer: MgCO₃(s)

H₂O(l)

H₂O(g)

2. Which of the following substances has the greatest entropy per mole?

O₂(g)

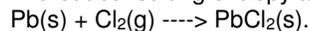
N₂(g)

CO(g)

CO₂(g)

Correct answer: C₄H₁₀(g)

3. Without consulting entropy tables, predict the sign of ΔS for the following process:



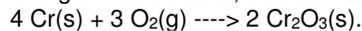
Correct answer: $\Delta S < 0$

$\Delta S > 0$

$\Delta S = 0$

More information is needed to make a reasonable prediction.

4. Using the data below, calculate $\Delta S^\circ_{\text{rxn}}$ for the following reaction:



Substance ΔS , J/K·mol

Cr(s) 23.77

O₂(g) 205.138

Cr₂O₃(s) 81.2

548.1 J/K

147.7 J/K

-147.7 J/K

Correct answer: -548.1 J/K

None of the above.

5. In 1774 Joseph Priestly prepared oxygen by heating mercury(II) oxide according to the reaction $\text{HgO(l)} \rightarrow \text{Hg(l)} + \frac{1}{2}\text{O}_2(\text{g})$, for which $\Delta H^\circ = 90.84 \text{ kJ/mol}$ and $\Delta S^\circ = 108 \text{ J/K}\cdot\text{mol}$. Which of the following statements is true for this reaction?

The reaction is spontaneous only at low temperatures.

The reaction is spontaneous at all temperatures.

ΔG° becomes less favorable as temperature increases.

Correct answer: The reaction is spontaneous only at high temperatures.

The reaction is at equilibrium at 25 °C and 1 atm pressure.

6. Is $\text{H}_2\text{O}_2(\text{g})$ stable? For the reaction $\text{H}_2\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l}) + 1/2 \text{O}_2(\text{g})$, $\Delta H^\circ = -106 \text{ kJ/mol}$; $\Delta S^\circ = 58 \text{ J/K}$.

Correct answer: No.

Yes, if the temperature is low enough.

Yes, if the rate of decomposition is low.

Yes, if the O-O bond energy is greater than the O-H bond energy.

Yes, under all conditions.

7. The signs of ΔH° , ΔS° , ΔG° for the vaporization of water at 50 °C are

Correct answer: positive, positive, and positive.

negative, negative, and negative.

positive, negative, and positive.

positive, positive, and negative.

More information would have to be given to answer the question.

8. Use the following data to calculate ΔG° at 298 K for the combustion of propane: $\text{C}_3\text{H}_8(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 3 \text{CO}_2(\text{g}) + 4 \text{H}_2\text{O}(\text{l})$

Substance ΔG_f° , kJ/mol

$\text{C}_3\text{H}_8(\text{g})$ -23.0

$\text{O}_2(\text{g})$ 0

$\text{CO}_2(\text{g})$ -394.6

$\text{H}_2\text{O}(\text{l})$ -237.2

2109.6 kJ/mol

608.8 kJ/mol

-608.8 kJ/mol

Correct answer: -2109.6 kJ/mol

None of the above.

9. The heat of vaporization of 1-pentanol is 55.5 kJ/mol, and its entropy of vaporization is 148 J/K•mol. What is the approximate boiling point of 1-pentanol?

Correct answer: 100 °C

375 °C

0 °C

25 °C

10. Calculate ΔG° for the dissociation of HF in H₂O at 25 °C. [K_a of HF = 6.9×10^{-4} at 25 °C].

-18 kJ

7.83 kJ

-7.83

1.51 kJ

Correct answer: 18 kJ

11. Spontaneous reactions occur in one direction only and are not spontaneously reversible in the opposite direction.

Correct answer: True

False

12. What is the best way to predict whether a reaction will be spontaneous?

Energy changes in a system

Entropy

Correct answer: Both entropy and change in enthalpy

none of the above

13. The greater the number of microstates the less likely the possibility of a spontaneous reaction.

True

Correct answer: False

14. Which statement is true concerning entropy?

An exothermic process results in a decrease in the entropy of the surroundings.

Correct answer: An exothermic process transfers heat from system to surroundings.

An endothermic process absorbs heat from within the system.

An endothermic process increases the entropy of the surroundings.

15. If the change in free energy is less than zero then

Correct answer: the reaction is spontaneous in the forward direction.

the reaction is non-spontaneous or spontaneous in the opposite direction.

the system is in equilibrium.

none of the above.
