AP Chemistry: Unit – 4 - Thermodynamics Practice Test

Question 1

The endothermic process among the following is

A. Natural gas is combusted in a Bunsen burner.
B. Water vapor condenses on the outside of a glass of iced tea.
C. A cop of hot water cools as a tea bag brews.
D. An ice cube melts on a countertop.

Question 2

In a commercial chemical cold pack, an inner pouch containing water is broken and the water is allowed to mix with a sample of solid ammonium nitrate. The signs of the values for ΔH and ΔS for the dissociation reaction must be, respectively

A. Positive, positive
B. Positive, negative
C. Negative, positive
D. Negative, negative

Question 3

The 3rd Law of Thermodynamics indicates that

A. enthalpy of the universe is a constant
B. entropy of the universe increases
C. sum of the entropies of the system plus surroundings is zero
D. entropy of a perfectly ordered pure crystal is zero at absolute zero

Question 4

A process which causes a decrease in the entropy is

A. condensation of steam to form liquid water.
B. vaporization of liquid water to form steam.
C. dissociation of solid sodium chloride into aqueous sodium cations and chloride anions
D. sublimation of snow to water vapor.

Question 5

For which of the following processes will Δ*S* be negative?

A. $PbCl_2\,(s) \rightarrow Pb^{2+}\,(aq) + 2Cl^-\,(aq)$
B. $MgO\,(s) + CO_2\,(g) \rightarrow MgCO_3\,(s)$
C. $CO_2\,(aq) \rightarrow CO_2\,(g)$
D. $C_5H_{12}\,(l) + 8O_2\,(g) \longrightarrow 5CO_2\,(g)$

Answer: B

Question 6

Which of the following substances is expected to have the largest standard molar entropy?

A. H_2O (l)
B. H_2O (g)
C. H_2O_2 (l)
D. H_2O_2 (g)

Question 7

Which process is exothermic and occurs with a decrease in entropy?

A. $H_2O\,(l) \rightarrow H_2O\,(s)$
B. $H_2O\,(l) \rightarrow H_2O\,(g)$
C. $H_2O\,(s) \rightarrow H_2O\,(g)$
D. $2H_2O\,(l) \rightarrow 2H_2\,(g) + O_2\,(g)$

Answer: A

Question 8

When heating a solution, a scientist detects a temperature increase in the solution during a period of time. Which of the following statements accurately characterizes the solution during this period?

A. The solution is at boiling point.
B. The solution is undergoing a phase change.
C. The velocity of molecules in the solution is increasing.
D. The solution's temperature increase is proportional to its $\Delta H_{vaporization}$

Question 9

What is the heat energy required to completely vaporize 10 g of water beginning at 0°C?

(The heat capacity of water is 4.2 J/g•K and the $\Delta H_{vaporization}$ of water is 2260 kJ/kg).

A. 4.9 kJ
B. 26.8 kJ
C. 228.1 kJ
D. 2126 kJ

Question 10

Equal amounts of heat are absorbed by 100 g samples of various solid metals with differing specific heat values. Which of the following statements is true regarding metals and their specific heat values?

A. The metal with the smallest specific heat will undergo the smallest change in temperature.
B. The metal with the smallest specific heat will resist melting to a greater degree at its melting point.
C. The metal with the greatest specific heat will undergo the smallest change in temperature.
D. The metal with the greatest specific heat will resist melting to a greater degree at its melting point.

Question 11

In a system undergoing adiabatic compression, what are the values of internal energy and heat if work done on the system is 500 J.

A. Internal energy is 0 J and heat is 500 J.
B. Internal energy is -500 J and heat is 0 J.
C. Internal energy is 0 J and heat is -500 J.
D. Internal energy is 500 J and heat is 0 J.

Question 12

Additional gas is pumped inside a rigid container that stores compressed gas. Which of the following is a true statement about this system?

A. Pressure is constant throughout the compression.
B. There is no work done on the container.
C. The molar concentration of gas is decreasing.
D. The volume of the container is decreasing.

Question 13

Which of the following scenarios violates the first law of thermodynamics, “the conservation of energy?"

A. A spring that extends and retracts forever, alternating between potential and kinetic energy.
B. An isolated electrochemical cell that indefinitely generates an electrical current.
C. An efficient wind turbine that converts all of its energy from mechanical movement into electrical potential energy.
D. A machine that converts heat energy into work energy.

Question 14

A hot object is placed next to a cold object so that they are touching. Which of the following statements is true?

I. Heat will transfer from the hot object to the cold object because the hot object has a higher temperature.
II. The two objects are in thermal equilibrium
III. Internal energy will transfer from the hot object to the cold object because the hot object has greater internal energy.

A. I

B. II

C. I and II

D. III

Question 15

Atmospheric gases absorb more energy than they emit. If we consider a gas to be a closed system, which of the following is true?

A. The heat absorbed by the gas is positive.
B. The internal energy of the gas increases.
C. The change in volume of the gas is negative.
D. The work done on the gas is equal to the change in internal energy and the heat absorbed by the gas.

Question 16

Heat transfer by conduction occurs when

A. particles bump into each other
B. large numbers of atoms move from place to place
C. atoms give off heat in the form of electromagnetic waves
D. electromagnetic waves travel from place to place through a vacuum

Question 17

Increase in temperature of the reactants can do one of the following.

A. Slow collision frequency
B. Allow less effective collision between the particles
C. Cause particles to lose speed
D. Increase collision between the particles thus increasing the rate.

Question 18

A chemist pours two chemicals in a beaker and observes their reaction. The chemist then notices that the beaker feels slightly cooler than it did before the reaction. What can the chemist conclude about the reaction?

A. It is endothermic and spontaneous.
B. It is exothermic and spontaneous.
C. It is endothermic and nonspontaneous.
D. It is exothermic and nonspontaneous.

Answer Key

1. D
2. A
3. D
4. A
5. B
6. D
7. A
8. C
9. B
10. C
11. D
12. B
13. B
14. A
15. A
16. A
17. D
18. A