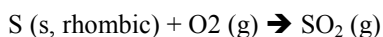


Name

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) The value of  $\Delta G^0$  at 373°K for the oxidation of solid elemental sulfur to gaseous sulfur dioxide,



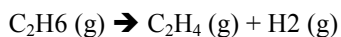
is \_\_\_\_\_ kJ / mol. At 298K,  $\Delta H^0$  for this reaction is -269.9 kJ/mol, and  $\Delta S^0$  is +11.6 J /K.

- A) +4,597                      B) -274.2                      C) +300.4                      D) -4,597                      E) -300.4

2) Which one of the following processes produces a decrease in the entropy of the system?

- A) melting ice to form water  
 B) boiling water to form steam  
 C) dissolution of solid KCl in water  
 D) mixing of two gases into one container  
 E) freezing water to form ice

3) For the reaction



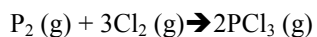
$\Delta H^0$  is +137 kJ/mol and  $\Delta S^0$  is + 120 J / K . mol. This reaction is

- A) spontaneous only at high temperature  
 B) spontaneous only at low temperature  
 C) spontaneous at all temperatures  
 D) unreliable  
 E) nonspontaneous at all temperatures

4)  $\Delta S$  is positive for the reaction

- A)  $\text{BaF}_2 \text{ (s)} \rightarrow \text{Ba}^{2+} \text{ (aq)} + 2\text{F}^- \text{ (aq)}$   
 B)  $2\text{H}_2 \text{ (g)} + \text{O}_2 \text{ (g)} \rightarrow 2\text{H}_2\text{O} \text{ (g)}$   
 C)  $2\text{Hg} \text{ (l)} + \text{O}_2 \text{ (g)} \rightarrow 2\text{HgO} \text{ (s)}$   
 D)  $2\text{NO}_2 \text{ (g)} \rightarrow \text{N}_2\text{O}_4 \text{ (g)}$   
 E)  $\text{CO}_2 \text{ (g)} \rightarrow \text{CO}_2 \text{ (s)}$

5) Phosphorous and chlorine gases combine to produce phosphorous trichloride:



The value of the reaction quotient Q for a reaction mixture that consists of 1.9 atm P<sub>2</sub>, 1.6 atm Cl<sub>2</sub>, and 0.65 atm PCl<sub>3</sub> is

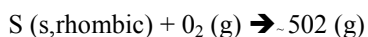
- A) 0.054                      B) 0.070                      C) 0.14                      D) 0.21                      E) 18

6) The standard Gibbs free energy of formation of \_\_\_\_\_ is zero.

- (a) H<sub>2</sub>O (l)
- (b) Na (s)
- (c) H<sub>2</sub> (g)

- A) (a) only
- B) (b) only
- C) (c) only
- D) (b) and (c)
- E) (a), (b), and (c)

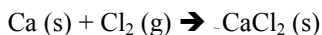
7) The value of  $\Delta G^\circ$  at 100.0°C for the oxidation of solid elemental sulfur to gaseous sulfur dioxide,



is \_\_\_\_\_ kJ/mol. At 25.0 C for this reaction,  $\Delta H^\circ$  is -269.9 kJ/mol,  $\Delta G^\circ$  is -300.4 kJ/mol, and  $\Delta S^\circ$  is +11.6 J

- A) -265.6
- B) -1,430
- C) -271.1
- D) -274.2
- E) -4,598

8) The value of  $\Delta G^\circ$  at 100.0°C for the formation of calcium chloride from its constituent elements:



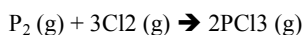
is \_\_\_\_\_ kJ/mol. At 25.0 C for this reaction,  $\Delta H^\circ$  is -795.8 kJ/mol,  $\Delta G^\circ$  is -748.1 kJ/mol, and  $\Delta S^\circ$  is -159.8 J/K.

- A)  $5.88 \times 10^4$
- B)  $1.52 \times 10^4$
- C) -855.4
- D) -736.2
- E) -779.8

9) As a result of \_\_\_\_\_ we are able to measure absolute values of the entropy of a sample and are not forced to define relative values as we were when we defined enthalpies of formation,  $\Delta H^\circ_f$ .

- A) Hess's law
- B) the second law of thermodynamics
- C) the first law of thermodynamics
- E) the third law of thermodynamics
- F) reversibility

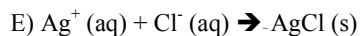
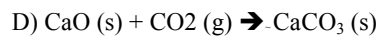
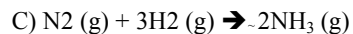
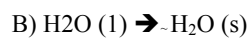
10) The value of  $\Delta G^\circ$  at 141.0°C for the formation of phosphorous trichloride from its constituent elements,



is \_\_\_\_\_ kJ/mol. At 25.0 C for this reaction,  $\Delta H^\circ$  is -720.5 kJ/mol,  $\Delta G^\circ$  is -642.9 kJ/mol, and  $\Delta S^\circ$  is -263.7 J/K.

- A)  $1.08 \times 10^5$
- B) -611.3
- C) -829.7
- D)  $3.65 \times 10^4$
- E) -683.3

11)  $\Delta S$  is positive for the reaction



12) If  $\Delta G^\circ$  for a reaction is greater than zero, then

A)  $K = 1$

B)  $K < 1$

C)  $K > 1$

D)  $K = 0$

E) More information is needed.

13) Consider a pure crystalline solid that is heated from absolute zero to a temperature above the boiling point of the liquid. Which of the following processes produces the greatest increase in the entropy of the substance?

A) melting the solid

B) heating the liquid

C) vaporizing the liquid

D) heating the gas

E) heating the solid

## Answer Key

Testname: THERMODYNAMICS ILTST

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) B
- 2) E
- 3) A
- 4) A
- 5) A
- 6) D
- 7) D
- 8) D
- 9) D
- 10) B
- 11) A
- 12) B
- 13) C