Name: _____ Score:_____

Thermochemistry and Chemical Kinetics

Multiple Choice

Identify the choice that best completes the statement or answers the question.

_D___ 1. Which of the following statements regarding spontaneous changes is **false**?

a. Spontaneous changes occur at a given state without any outside influence.
b. Ice melting at 25°C is spontaneous primarily due to the increase in molecular disorder (dispersal of matter).
c. Spontaneity is favored when the dispersal of matter is increased.
d. All exothermic reactions are spontaneous.

_B___ 2. A positive change in entropy represents:

a. a process that is always spontaneous
b. an increase in dispersal of matter (molecular disorder)
c. release of thermal energy
d. a decrease in thermal energy

_C___ 3. Evaluate ΔS^0 for the reaction below at 25°C and 1 atm.

	$3NO_2(g)$	$+ H_2O(\ell)$	$\rightarrow$	$2HNO_3(aq)$	$+ NO(g)$
S^0 (J/mol•K)	240	69.91		146	210.7

a. +287.2 J/K
b. –531.4 J/K
c. –287.2 J/K
d. $+1.37 \times 10^3$ J/K

___D_ 4. The heat of vaporization of methanol, CH_3OH, is 35.20 kJ/mol. Its boiling point is 64.6°C. What is the change in entropy for the vaporization of methanol?

a. 543 J/mol•K
b. –17.0 J/mol•K
c. 17.0 J/mol•K
d. 104 J/mol•K

C____ 5. Which chemical change listed below represents a **decrease** in entropy?

a. $2NaCl(\ell) \rightarrow 2Na(\ell) + Cl_2(g)$
b. $2C_6H_6(\ell) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(g)$
c. $N_2(g) + 3H_2(g) \rightarrow NH_3(g)$
d. $2NO_2(g) \rightarrow N_2(g) + 2O_2(g)$

__D__ 6. A process occurs spontaneously and $\Delta S_{system} < 0$. Which statement below must be **true**?

a. $\Delta S_{surroundings} > 0$
b. $\Delta S_{universe} > 0$
c. The pressure is constant.
d. Both (a) and (b) are correct.
e. All of these answers are correct.

__C__ 7. Which of the following statements about free energy is false?

a. ΔG is always negative for spontaneous processes.
b. ΔG is always positive for nonspontaneous processes.
c. ΔS must be positive for a process to be spontaneous.
d. ΔS is positive for many spontaneous processes.

_C___ 8. Evaluate ΔG^0 for the reaction below at 25°C.

	$2C_2H_2(g)$	$+ 5O_2(g)$	$\rightarrow$	$4CO_2(g)$	$+ 2H_2O(\ell)$
ΔG_f^0 (kJ/mol)	209.2	0		–394.4	–237.2

a. –1409 kJ
b. –2599 kJ
c. –2470 kJ
d. –1643 kJ

A____ 9. Which one of the following statements is **not** correct?

a. When ΔH for a reaction is negative, the reaction is never spontaneous.
b. When ΔH for a reaction is very positive, the reaction is not expected to be spontaneous.
c. When ΔG for a reaction is negative, the reaction is spontaneous.
d. When ΔG for a reaction is positive, the reaction is nonspontaneous.

_D___10. For which set of values of ΔH and ΔS will a reaction be spontaneous (product-favored) at all temperatures?

a. ΔH = +10 kJ, ΔS = –5 J/K
b. no such values exist
c. ΔH = –10 kJ, ΔS = –5 J/K
d. ΔH = –10 kJ, ΔS = +5 J/K