

Practice for Quiz 13. Chapter 8. Thermodynamics

- 1) The first law of thermodynamics
 A) defines chemical energy.
 B) defines entropy.
 C) is a statement of conservation of energy.
 D) provides a criterion for the spontaneity of a reaction.
- 2) The enthalpy of fusion, or heat of fusion (ΔH_{fusion}), of water is positive and corresponds to which physical change?
 A) $\text{H}_2\text{O}(g) \rightarrow \text{H}_2\text{O}(s)$ B) $\text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{O}(s)$ C) $\text{H}_2\text{O}(s) \rightarrow \text{H}_2\text{O}(l)$ D) $\text{H}_2\text{O}(s) \rightarrow \text{H}_2\text{O}(g)$
- 3) How much heat is absorbed/released when 20.00 g of $\text{NH}_3(g)$ reacts in the presence of excess $\text{O}_2(g)$ to produce $\text{NO}(g)$ and $\text{H}_2\text{O}(l)$ according to the following chemical equation?

$$4 \text{NH}_3(g) + 5 \text{O}_2(g) \rightarrow 4 \text{NO}(g) + 6 \text{H}_2\text{O}(l) \quad \Delta H^\circ = +1168 \text{ kJ}$$
 A) 342.9 kJ of heat are absorbed. B) 342.9 kJ of heat are released.
 C) 1372 kJ of heat are absorbed. D) 1372 kJ of heat are released.

- 4) Coal gasification can be represented by the equation:

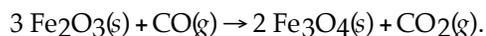
$$2 \text{C}(s) + 2 \text{H}_2\text{O}(g) \rightarrow \text{CH}_4(g) + \text{CO}_2(g) \quad \Delta H = ?$$
 Use the following information to find ΔH for the reaction above.

$$\text{CO}(g) + \text{H}_2(g) \rightarrow \text{C}(s) + \text{H}_2\text{O}(g) \quad \Delta H = -131 \text{ kJ}$$

$$\text{CO}(g) + \text{H}_2\text{O}(g) \rightarrow \text{CO}_2(g) + \text{H}_2(g) \quad \Delta H = -41 \text{ kJ}$$

$$\text{CO}(g) + 3 \text{H}_2(g) \rightarrow \text{CH}_4(g) + \text{H}_2\text{O}(g) \quad \Delta H = -206 \text{ kJ}$$
 A) 15 kJ B) 116 kJ C) -116 kJ D) -372 kJ

- 5) Use the given standard enthalpies of formation to calculate ΔH° for the following reaction

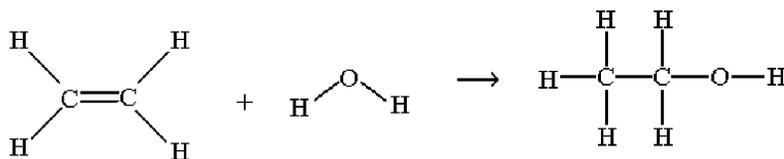


Species	ΔH°_f kJ/mol
$\text{Fe}_2\text{O}_3(s)$	-824.2
$\text{Fe}_3\text{O}_4(s)$	-1118.4
$\text{CO}(g)$	-110.5
$\text{CO}_2(g)$	-393.5

- A) -5213.4 kJ B) -577.2 kJ C) -47.2 kJ D) +47.2 kJ

- 6) One method for making ethanol, C_2H_5OH , involves the gas-phase hydration of ethylene, C_2H_4 :
Estimate ΔH for this reaction from the given average bond dissociation energies, D .

Bond	D , kJ/mol
C=C	615
C-H	410
C-C	350
C-O	350
O-H	460



- A) -580 kJ B) -35 kJ C) +35 kJ D) 580 kJ
- 7) Which of the following can be interpreted as a measure of randomness?
A) enthalpy B) entropy C) free energy D) temperature
- 8) Which of $CH_4(g)$, $C_2H_2(g)$, and $CH_3OH(l)$ provides the most energy per gram upon combustion and which provides the least?
 $CH_4(g) + 2 O_2(g) \rightarrow CO_2(g) + 2 H_2O(l)$ $\Delta H^\circ = -890$ kJ
 $2 C_2H_2(g) + 5 O_2(g) \rightarrow 4 CO_2(g) + 2 H_2O(l)$ $\Delta H^\circ = -2599$ kJ
 $2 CH_3OH(l) + 3 O_2(g) \rightarrow 2 CO_2(g) + 4 H_2O(l)$ $\Delta H^\circ = -1453$ kJ
A) C_2H_2 provides the most energy per gram and CH_4 the least.
B) C_2H_2 provides the most energy per gram and CH_3OH the least.
C) CH_4 provides the most energy per gram and CH_3OH the least.
D) CH_4 provides the most energy per gram and C_2H_2 the least.
- 9) For the reaction, $NH_3(g) \rightarrow N(g) + 3 H(g)$, one would expect
A) ΔH° to be negative and ΔS° to be negative. B) ΔH° to be negative and ΔS° to be positive.
C) ΔH° to be positive and ΔS° to be negative. D) ΔH° to be positive and ΔS° to be positive.
- 10) For the of freezing liquid ethanol at a given temperature and pressure,
A) ΔH is negative and ΔS is negative. B) ΔH is negative and ΔS is positive.
C) ΔH is positive and ΔS is negative. D) ΔH is positive and ΔS is positive.