Champter 1

(Thermochemistry)

Self Assessment A (Chemistry by Rymond Chang)

1- An exothermic reaction causes the surroundings to:

(A) become basic. (B) decrease in temperature.

(C) increase in temperature. (D) decrease in pressure.

(E) condense.

2- How much heat is evolved when 320 g of SO_2 is burned according to the chemical equation shown below?

$$2\ SO_2(g) + O_2(g) \text{----> } 2\ SO_3(g)\ \Delta H^\circ_{rxn} = -198\ kJ$$

(A) 5.04×10^{-2} kJ (B) 9.9×10^{2} kJ (C) 207 kJ

(D) 5.0×10^{2} kJ (E) None of the above.

3- The specific heat of aluminum is 0.214 cal/g·°C. Determine the energy, in calories, necessary to raise the temperature of a 55.5 g piece of aluminum from 23.0 to 48.6 °C.

(A) 109 cal (B) 273 cal (C) 577 cal

(D) 347 cal (E) 304 cal

4- A 60.0 g sample of an alloy was heated to 96.00 °C and then dropped into a beaker containing 87.0 g of water at a temperature of 24.10 °C. The temperature of the water rose to a final temperature of 27.63 °C. The specific heat of water is 4.184 J/g·°C. What is the specific heat of the alloy?

(A) 0.313 J/g·°C (B) 2.16 J/g·°C (C) 0.118 J/g·°C

(D) 1.72 J/g·°C (E) None of the above.

5- When 1.535 g of methanol (CH_3OH) was burned in a constant-volume bomb calorimeter, the water temperature rose from 20.27 °C to 26.87 °C. If the mass of water surrounding the calorimeter was exactly 1000 g and the heat capacity of the bomb calorimeter was 1.75 kJ/°C, calculate the molar heat of combustion of CH_3OH. The specific heat of water is 4.184 J/g·°C.

(A) -8.17×10^5 kJ/mol (B) -817 kJ/mol (C) 1.88 kJ/mol

(D)817 kJ/mol (E) None of the above.

6- To which one of the following reactions, occurring at 25 °C, does the symbol $\Delta H^\circ_f [H_2SO_4(l)]$ refer?

(A) $H_2(g) + S(s) + 2\ O_2(g) \text{----> } H_2SO_4(l)$

(B) $H_2SO_4(l) \text{----> } H_2(g) + S(s) + 2\ O_2(g)$

(C) $H_2(g) + S(g) + 2\ O_2(g) \text{----> } H_2SO_4(l)$

(D) $H_2SO_4(l) \text{----> } 2\ H(g) + S(s) + 4\ O(g)$

(E) $2\ H(g) + S(g) + 4\ O(g) \text{----> } H_2SO_4(l)$

7- Given: $SO_2(g) + \frac{1}{2}O_2(g) \text{----> } SO_3(g)\ \Delta H^\circ_{rxn} = -99$ kJ, what is the enthalpy change for the following reaction?

$2\ SO_3(g) \text{----> } O_2(g) + 2\ SO_2(g)$

(A) 99 kJ (B) -99 kJ (C)49.5 kJ (D) -198 kJ (E) 198 kJ

8- Find the standard enthalpy of formation of ethylene, $C_2H_4(g)$, given the following data:

$C_2H_4(g) + 3\ O_2(g) \text{----> } 2\ CO_2(g) + 2\ H_2O(l)\ \Delta H^\circ_f = -1411$ kJ;

$C(s) + O_2(g) \text{----> } CO_2(g)\ \Delta H^\circ_f = -393.5$ kJ;

$H_2(g) + \frac{1}{2}O_2(g) \text{----> } H_2O(l)\ \Delta H^\circ_f = -285.8$ kJ

(A) 731 kJ (B) 2.77×10^3 kJ (C) 1.41×10^3 kJ (D) 87 kJ (E) 52 kJ

9- Calculate ΔH°_{rxn} for the combustion reaction of CH_4 shown below given the following:

$\Delta H^\circ_f\ CH_4(g) = -74.8$ kJ/mol;

$\Delta H^\circ_f\ CO_2(g) = -393.5$ kJ/mol;

$\Delta H^\circ_f\ H_2O(l) = -285.5$ kJ/mol.

$CH_4(g) + 2\ O_2(g) \text{----> } CO_2(g) + 2\ H_2O(l)$

(A) -604.2 kJ (B) 889.7 kJ (C) -997.7 kJ

(D) -889.7 kJ (E) None of the above

10- A 1.300 g sample of benzoic acid ($C_7H_6O_2$) was burned in a bomb calorimeter. The heat capacity of the entire apparatus, including the bomb, pail, thermometer, and water, was found to be 11,145 J/K. As a result of the reaction, the temperature of the calorimeter and water increased 4.627 K. What is the molar heat of combustion of benzoic acid?

(A) 4.84×10^6 kJ/mol (B) -2.96 kJ/mol (C) -4844 kJ/mol

(D) 549.1 kJ/mol (E) 51.57 kJ/mol