

Chapter 1

(Thermochemistry)

Self Assessment A (Chemistry by Raymond 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?



- (A) $5.04 \times 10^{-2} \text{ kJ}$ (B) $9.9 \times 10^2 \text{ kJ}$ (C) 207 kJ
(D) $5.0 \times 10^2 \text{ kJ}$ (E) None of the above.

3- The specific heat of aluminum is $0.214 \text{ cal/g}\cdot^\circ\text{C}$. Determine the energy, in calories, necessary to raise the temperature of a 55.5 g piece of aluminum from 23.0 to 48.6 $^\circ\text{C}$.

- (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 $^\circ\text{C}$ and then dropped into a beaker containing 87.0 g of water at a temperature of 24.10 $^\circ\text{C}$. The temperature of the water rose to a final temperature of 27.63 $^\circ\text{C}$. The specific heat of water is $4.184 \text{ J/g}\cdot^\circ\text{C}$. What is the specific heat of the alloy?

- (A) $0.313 \text{ J/g}\cdot^\circ\text{C}$ (B) $2.16 \text{ J/g}\cdot^\circ\text{C}$ (C) $0.118 \text{ J/g}\cdot^\circ\text{C}$
(D) $1.72 \text{ J/g}\cdot^\circ\text{C}$ (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 $1.75\text{ kJ}/^\circ\text{C}$, calculate the molar heat of combustion of CH_3OH . The specific heat of water is $4.184\text{ J/g}\cdot^\circ\text{C}$.

- (A) $-8.17 \times 10^5\text{ kJ/mol}$ (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 $\Delta H_f^\circ [\text{H}_2\text{SO}_4(\text{l})]$ refer?

- (A) $\text{H}_2(\text{g}) + \text{S}(\text{s}) + 2\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{SO}_4(\text{l})$
(B) $\text{H}_2\text{SO}_4(\text{l}) \rightarrow \text{H}_2(\text{g}) + \text{S}(\text{s}) + 2\text{O}_2(\text{g})$
(C) $\text{H}_2(\text{g}) + \text{S}(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{SO}_4(\text{l})$
(D) $\text{H}_2\text{SO}_4(\text{l}) \rightarrow 2\text{H}(\text{g}) + \text{S}(\text{s}) + 4\text{O}(\text{g})$
(E) $2\text{H}(\text{g}) + \text{S}(\text{g}) + 4\text{O}(\text{g}) \rightarrow \text{H}_2\text{SO}_4(\text{l})$

7- Given: $\text{SO}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{SO}_3(\text{g}) \Delta H_{\text{rxn}}^\circ = -99\text{ kJ}$, what is the enthalpy change for the following reaction?



- (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, $\text{C}_2\text{H}_4(\text{g})$, given the following data:



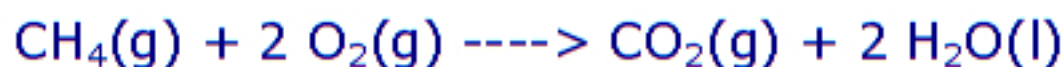
- (A) 731 kJ (B) $2.77 \times 10^3\text{ kJ}$ (C) $1.41 \times 10^3\text{ kJ}$ (D) 87 kJ (E) 52 kJ

9- Calculate $\Delta H^{\circ}_{\text{rxn}}$ for the combustion reaction of CH_4 shown below given the following:

$$\Delta H^{\circ}_{\text{f}} \text{CH}_4(\text{g}) = -74.8 \text{ kJ/mol};$$

$$\Delta H^{\circ}_{\text{f}} \text{CO}_2(\text{g}) = -393.5 \text{ kJ/mol};$$

$$\Delta H^{\circ}_{\text{f}} \text{H}_2\text{O}(\text{l}) = -285.5 \text{ kJ/mol}.$$



(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 ($\text{C}_7\text{H}_6\text{O}_2$) 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