Advanced Chemistry Name _____ Period _____
Chapter 5: Thermochemistry

# Chapter 5 Mock Test - Thermochemistry

## The Nature of Energy

1. What is the difference between kinetic and potential energy? Give an example of each.

2. At what velocity (m/s) must a 96.1 kg jogger travel to have the kinetic energy of 1054 J?

3. The kinetic energy of a 0.0306 kg golf ball traveling 64.0 m/s is _____ J.

4. Convert 548.7 J to calories. Remember: 1 cal = 4.184 J.

5. Convert 67.8 cal to Joules.

## The First Law of Thermodynamics

6. What is the first law of thermodynamics state?

7. The value of ΔE for a system that performs 7,655 J of work on its surroundings and releases 2,500 J of heat is _____ J. **Is this reaction endothermic or exothermic?**

8. The value of ΔE for a system that absorbs 9,500 J of heat and has 7,655 J of work done on it by its surroundings is _____J. **Is this reaction endothermic or exothermic?**

9. What is the difference between endothermic and exothermic? Give a real life example of each.

## Enthalpies of Reaction

10. The value of ΔH° for the reaction below is -126 kJ. _____ kJ are released when 54.7 grams of NaOH is formed in the reaction?

$$2\ Na_2O_2\ (s)\ +\ 2\ H_2O\ (l)\ \rightarrow\ 4NaOH\ (s)\ +\ O_2\ (g)$$

11. The value of $\Delta H°$ for the reaction below is -482 kJ. How many grams of $CO_2$ is produced during an enthalpy change of -5784 kJ?

$$2CO\ (g)\ +\ O_2\ (g)\ \rightarrow\ 2CO_2\ (g)$$

## Calorimetry *q = Cs x m x ΔT

12. The temperature of a 15-g sample of lead metal increases from 22 °C to 37 °C upon the addition of 29.0 J of heat. The specific heat capacity of the lead is _____ J/g-K.

13. When a 5.08 g sample of solid ammonium nitrate dissolves in 50 g of water in a coffee-cup calorimeter, the temperature drops from 23.0ºC to 18.9ºC. Calculate ΔH (**in kJ/mol $NH_4NO_3$**) for the solution. Assume that the specific heat of the solution is the same as that of pure water 4.18 J/gºC. Remember $q_{soln} = -q_{rxn}$

14. Approximately 6.45 grams of starch goes through combustion in a bomb calorimeter. If the temperature increased from 23.4ºC to 26.6ºC and the heat capacity of the calorimeter is 7.54 kJ/ ºC, then determine the heat of combustion of starch, $C_6H_{10}O_5$ in **kJ/mol AND kJ/gram**. Remember $q = -C_{cal} \times \Delta T$

## Hess's Law

15. $\Delta H$ for the reaction $CS_2(l) + 3O_2(g) \rightarrow CO_2(g) + 2SO_2(g)$ is _____ kJ, give the data below.

| | |
|---|---|
| $C(s) + O_2(g) \longrightarrow CO_2(g)$ | $\Delta H = -393.5$ kJ/mol |
| $S(s) + O_2(g) \longrightarrow SO_2(g)$ | $\Delta H = -296.8$ kJ/mol |
| $C(s) + 2S(s) \longrightarrow CS_2(l)$ | $\Delta H = +87.9$ kJ/mol |

16. Find the $\Delta H$ for the reaction $H_2SO_4(l) \rightarrow SO_3(g) + H_2O(g)$, given the following reactions and subsequent $\Delta H$ values:

| | |
|---|---|
| $H_2S(g) + 2O_2(g) \rightarrow H_2SO_4(l)$ | $\Delta H = -235.5$ kJ |
| $H_2S(g) + 2O_2(g) \rightarrow SO_3(g) + H_2O(l)$ | $\Delta H = -207$ kJ |
| $H_2O(l) \rightarrow H_2O(g)$ | $\Delta H = 44$ kJ |

## Enthalpies of Formation

17. When will values of $\Delta H^\circ$ be zero?

18. Given the data in the table below, $\Delta H^\circ$rxn for the reaction $C2H5OH(l) + O2(g) \rightarrow CH3CO2H(l) + H2O(l)$ is _____ kJ.

| Substance | $\Delta H_f^\circ$ (kJ/mol) |
|---|---|
| $C_2H_4$ (g) | 52.3 |
| $C_2H_5OH$ (l) | -277.7 |
| $CH_3CO_2H$ (l) | -484.5 |
| $H_2O$ (l) | -285.8 |