**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** **Thermochemistry Worksheet #1**

 **AP Chemistry**

**Section 1:** Kinetic Molecular Theory and the Kelvin scale **MONDAY**

1. The freezing point of water at 1 atm pressure is \_\_\_\_\_\_\_ °C or \_\_\_\_\_\_\_\_\_\_\_ K. (Ref: pg. 17)

2. Convert the following temperatures from Celsius to Kelvin, expressing each with the correct number of significant figures: (Ref: pg. 17)

 a. 25.0 °C = \_\_\_\_\_\_\_\_\_\_ b. 100.0 °C = \_\_\_\_\_\_\_\_\_\_ c. 422.35 °C = \_\_\_\_\_\_\_\_\_\_

3. Convert the following temperatures from Kelvin to Celsius, expressing each with the correct number of significant figures: (Ref: pg. 17)

a. 300 K = \_\_\_\_\_\_\_\_\_\_ b. 250.00 K = \_\_\_\_\_\_\_\_\_\_ c. 567.21 K = \_\_\_\_\_\_\_\_\_\_\_\_\_

4. What is the purpose of using the Kelvin scale in Chemistry?

5. What is “absolute zero” and how is it related to kinetic energy?

6. According to kinetic-molecular theory, if the temperature of a gas is raised from 100°C to 200°C, the average kinetic energy of the gas will \_\_\_\_\_\_\_\_\_\_.

A) double

B) increase by a factor of 1.27

C) increase by a factor of 100

D) decrease by half

E) decrease by a factor of 100

7. The Maxwell-Boltzmann distributions for two samples of a gas are shown below. One sample is at 20°C, and the other is at 120°C. Which one is which? Explain your answer.

 

**Section 2:** Energy, Heat, and Calorimetry **TUESDAY**

**8.** Label each of the following as endothermic (EN) or exothermic (EX): (Ref: sec. 5.2)

a. ice melting \_\_\_\_\_\_\_

b. water freezing \_\_\_\_\_\_\_

c. boiling soup \_\_\_\_\_\_\_

d. Ammonium thiocyanate and barium hydroxide are mixed at 25°C: the temperature drops. \_\_\_\_

e. A chemical reaction inside a handwarmer causes it to feel warm. \_\_\_\_\_\_\_

f. Combustion of gasoline in a car engine. \_\_\_\_\_\_\_

**9.** For each situation above, show whether there is negative enthalpy change (–ΔH) or positive enthalpy change (+ΔH).

**10.** Explain the first law of thermodynamics in your own words.

**11.** What is heat capacity, and what are the units for heat capacity?

**12.** What is specific heat (aka specific heat capacity), and what are the units for specific heat?

**13.** A sample of calcium carbonate [CaCO3 (s)] absorbs 45.5 J of heat, upon which the temperature of the sample increases from 21.1 °C to 28.5 °C. If the specific heat of calcium carbonate is 0.82 J/g-K, what is the mass (in grams) of the sample?

**14.** The temperature of a 12.58 g sample of calcium carbonate [CaCO3 (s)] increases from 23.6 °C to 38.2 °C. If the specific heat of calcium carbonate is 0.82 J/g-K, how many joules of heat are absorbed?

**15.** An 8.29 g sample of calcium carbonate [CaCO3 (s)] absorbs 50.3 J of heat, upon which the temperature of the sample increases from 21.1 °C to 28.5 °C. What is the specific heat of calcium carbonate?

**Section 3:** Enthalpy  **THURSDAY**

**16.** Write the name for each of the following processes, and give the definition for each process. These are listed in a chart pgs. 76 – 77 in your test prep book.

ΔHrxn:

ΔHf:

ΔHcomb:

ΔHsol:

ΔHvap:

ΔHfus:

ΔHBDE:

**17.** What does the ° symbol mean when it is attached to an enthalpy value? (Ex: ΔH°rxn) Ref: pg. 183

**18.** The value of ΔH° for the reaction below is -72 kJ. Calculate how many kJ of heat are released when 80.9 grams of HBr is formed in this reaction. (Ref: pg. 174, sample exercise 5.4)

 H2 (g) + Br2 (g) → 2HBr (g)

**19.** The value of ΔH° for the reaction below is -126 kJ. Calculate how many kJ of heat are released when 2.00 mol of NaOH is formed in the reaction. (Ref: pg. 174, sample exercise 5.4)

 2 Na2O2 (s) + 2 H2O (l) → 4NaOH (s) + O2 (g)

**20.** The value of ΔH° for the reaction below is +128.1 kJ. How many kJ of heat are consumed when 5.10 g of CO (g) is formed as shown in the equation? (Ref: pg. 174, sample exercise 5.4)

 CH3OH (l) → CO (g) + 2 H2 (g)

**21.** Explain Hess’s Law in your own words.

**22.** Given the following reactions, calculate the enthalpy of the reaction of Fe2O3 and CO.

(Ref: pgs. 181-182)

 Fe2O3 (s) + 3CO (s) → 2Fe (s) + 3CO2 (g) ΔH = -28.0 kJ

 3Fe (s) + 4CO2 (s) → 4CO (g) + Fe3O4 (s) ΔH = +12.5 kJ

3 Fe2O3 (s) + CO (g) → CO2 (g) + 2 Fe3O4 (s) ΔH = ???

**23.** Given the following reactions, calculate the enthalpy of the reaction of N2 and O2 to produce nitric oxide. (Ref: pgs. 181-182)

 N2 (g) + 2 O2 (g) → 2NO2 (g) ΔH = 66.4 kJ

 2NO (g) + O2 (g) → 2NO2 (g) ΔH = -114.2 kJ

 N2 (g) + O2 (g) → 2NO (g) ΔH = ???

**24.** Consider the following two reactions:

 A → 2B ΔH°rxn = 456.7 kJ/mol

 A → C ΔH°rxn = -22.1kJ/mol

Determine the enthalpy change for the process: 2B → C (Ref: pg. 187, sample 5.12)

**25.** Given the data in the table below, calculate ΔH°rxn for the reaction: (Ref: pg. 187, sample 5.11)

 Ca(OH)2 + 2 H3AsO4 → Ca(H2AsO4)2 + 2 H2O

 

**26.** Given the data in the table below, calculate ΔH°rxn for the reaction: (Ref: pg. 187, sample 5.11)

 3 Cl2 (g) + PH3 (g) → PCl3 (g) + 3 HCl (g)

 