Chemistry CP

Name:

Putting It All Together IV

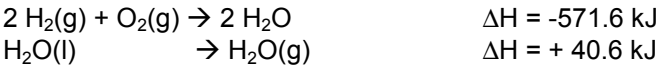
Date:

Energy and Chemistry

Part I: Hess' Law

Refer to pp. 519-524 in your textbook.

1. Use the following two reactions to find the ΔH of the synthesis of water *vapor* from its elements:

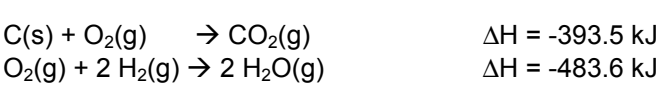


$2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O$ $\Delta H = -571.6$ kJ

$H_2O(l) \rightarrow H_2O(g)$ $\Delta H = +40.6$ kJ

2. Using the following equations, find the ΔH of combustion of methane.

Target equation:



$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393.5$ kJ

$O_2(g) + 2\ H_2(g) \rightarrow 2\ H_2O(g)$ $\Delta H = -483.6$ kJ

$C(s) + 2\ H_2(g) \rightarrow CH_4(g)$ $\Delta H = -74.8$ kJ

Part II: Calorimetry

Refer to pp. 511-514 in your textbook.

1. Silver has a specific heat capacity of 0.23 J/g ^{o}C. A 15.0 g silver coin is heated to 100.0^{o}C in a beaker of boiling water, then allowed to coil to 20.0^{o}C (room temperature). How much heat does the silver coin release as it cools?

2. A 25.00 grams sample of an unknown metal was removed from boiling water at 100.0^{o}C and placed in a calorimeter containing 100.0 grams of water at 20.0^{o}C. When the temperature of the water and the metal came to thermal equilibrium, the new temperature of the water was 23.8^{o}C. What is the specific heat of the unknown metal? (*Hint: Heat lost by the hot metal = heat gained by the cool water).*

	Metal	Water
Mass (g)	25.00	100.00
Specific Heat		4.184 J/g ^{o}C
Initial Temperature	100.0	20.0
Final Temperature	23.8	23.8
ΔT		

Part III: Potential Energy Diagrams

Refer to pp. 531-537 in your textbook.

Sketch the following potential energy diagrams, labeling E_a, reactants, products, ΔH, and the activated complex (transition state). On diagram B, sketch in the energy curve if a catalyst is added to the reaction.

A. An exothermic reaction with a small activation energy

B. An endothermic reaction with a large E_a and a small ΔH

Part IV: Energy and Stoichiometry

Refer to pp. 514-520 in your textbook.

1. Glucose is metabolized by your body according to the following equation:

   $C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6\ H_2O(l) + 6\ CO_2(g) + 2220\ kJ$

   a) Is this reaction endothermic or exothermic?

   b) How is the ΔH for this reaction? Include the correct sign.

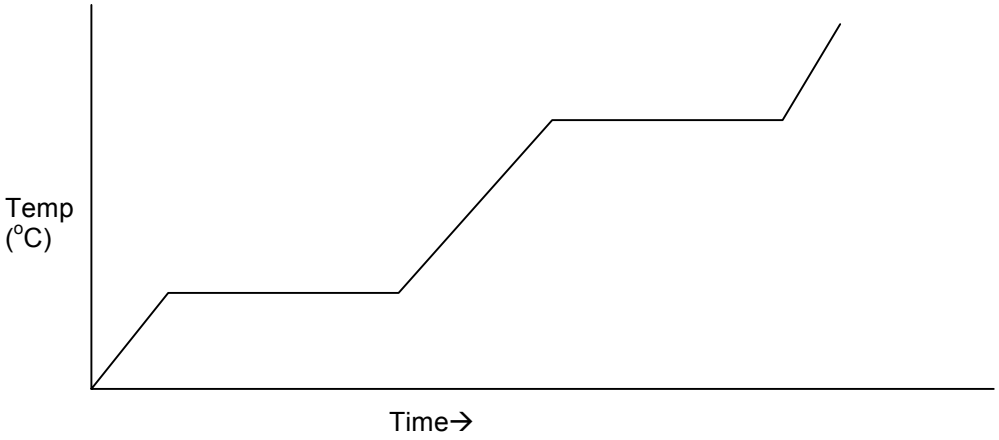
   c) How much energy is produced by metabolizing 25.0 g of glucose?

2. The ΔH formation for tin (IV) chloride is –511.3 kJ/mol. If 250.0 g of tin (IV) chloride are produced from their elements in their standard states, how much heat is released?

Part IV: Phase Changes

Use the following constants in your problems:
C_p(ice) = 2.077 J /g ^oC
C_p(water) = 4.180 J /g ^oC
C_p(water vapor) = 2.042 J /g ^oC
ΔH_{fus} = 6.00 kJ/mol= 333 J/g
ΔH_{vap} = 40.6 kJ/mol = 2254 J/g

The following is a heating curve for water.



1. Label the graph to show which phase (or phases) are present on each segment.

2. The amount of heat absorbed by the water can be calculated for any segment of the curve. Next to each segment of the graph, write the appropriate equation showing how to calculate the heat absorbed in that segment.

3. If 200.0 g of ice at -25.0^oC are converted to steam at 115.0^oC, how much heat is absorbed by the water. (This is a five step calculation!)