AP Chemistry
Chapter 5 Jeopardy

Jennie L. Borders

Round 1 – Chapter 5

Surprise	Stoichiometry	q = mCΔT	ΔH	Definitions	Calorimetry
100	100	100	100	100	100
200	200	200	200	200	200
300	300	300	300	300	300
400	400	400	400	400	400
500	500	500	500	500	500

Surprise 100

b

A molecular solid coexists with its liquid phase at its melting point. The solid-liquid mixture is heated, but the temperature does not change while the solid is melting. The best explanation for this phenomenon is that the heat absorbed by the mixture

a. Is lost to the surroundings very quickly

b. Is used in overcoming the intermolecular attractions in the solid

c. Is used in breaking the bonds within the molecules of the solid

- Causes the nonbonding electrons in the molecules to move to lower energy levels
- Causes evaporation of the liquid, which has a cooling effect

Surprise 200

b

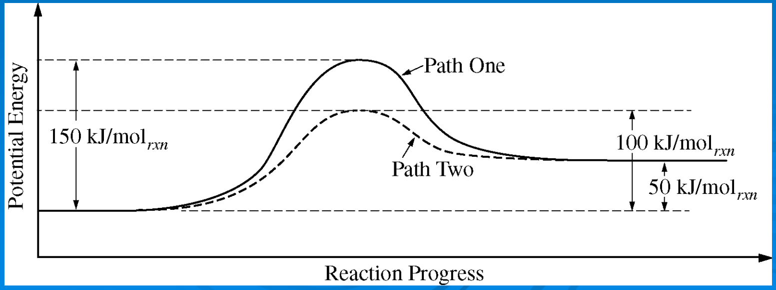
The equation below represents the decomposition of a compound XY_2. The diagram below shows two reaction profiles (path one and two) for the decomposition of XY_2. Which of the following best describes the flow of heat when 1.0 mol of XY_2 decomposes? $XY_2 \rightarrow X + Y_2$

a. 50 kJ of heat is transferred to the surroundings.

b. 50 kJ of heat is transferred from the surroundings.

c. 100 kJ of heat is transferred to the surroundings.

➢ 100 kJ of heat is transferred from the surroundings.



Surprise 300 b

A student conducted an experiment to determine ΔH^{o}_{rxn} for the

Trial	Volume of 0.10 M HCl	Volume of 0.10 M NaOH	Amount of Heat Released
1	50. mL	50. mL	X
2	100. mL	50. mL	Y

relationship between X and Y?

a. Y = 2X, because the volume of $HCl_{(aq)}$ used in trial 2 is twice the volume used in trial 1.

b. Y = X, because the number of moles of acid and base reacting with each other is the same in both trials.

- Y = 2X / 3, because the heat distributed over more particles in trial 2 than in trial 1.
- The relationship between X and Y cannot be predicted.

Surprise 400

b

In an experiment to estimate the enthalpy change of a reaction, a student makes two aqueous solutions, each containing on of the reactants. The student combines the solutions, both originally at the same temperature, in a calorimeter and records the final temperature of the mixture. In addition to the masses of the solutions and the temperature change of the mixture, which of the following pieces of information does the student need to calculate the enthalpy change of the reaction?

a. The density of the reaction mixture
b. The specific heat capacity of the reaction mixture
c. The boiling point of the reaction mixture
d. The heat of fusion of the reaction mixture

Surprise 500 a

Which of the following best describes what happens to the substance between t_4 and t_5?

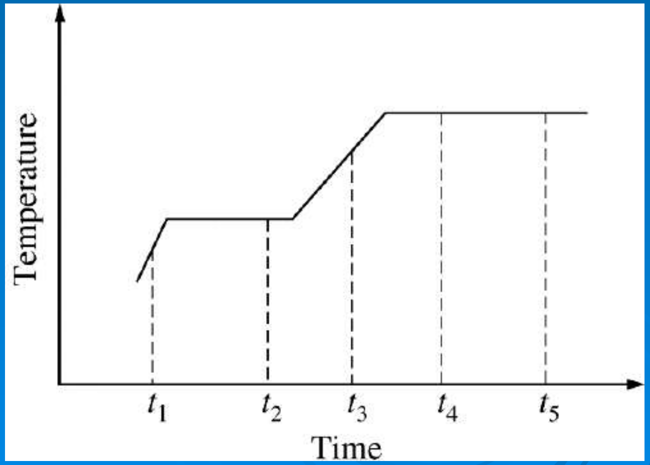
a. The molecules are leaving the liquid phase.

b. The solid and liquid phases coexist in equilibrium.

c. The vapor pressure of the substance is decreasing.

d. The average intermolecular distance is decreasing.

e. The temperature of the substance is increasing.



Stoichiometry 100

Calculate the ΔH for the production of 0.200 mol of AgCl by the following reaction:

$$Ag^{+}_{(aq)} + Cl^{-}_{(aq)} \rightarrow AgCl_{(s)}$$

$$\Delta H = -65.5 kJ$$

-13.1kJ

Stoichiometry 200

For this reaction, ΔH for the formation of 0.632mol of O_2.

$$2KClO_{3(s)} \rightarrow 2KCl_{(s)} + 3O_{2(g)}$$

$$\Delta H = -89.4kJ$$

-18.8kJ

Stoichiometry 300

Calculate the amount of heat transferred when 2.4g of Mg reacts at constant pressure.

$$2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO$$

$$\Delta H = -1204kJ$$

-59kJ

Stoichiometry 400

Calculate the amount of heat transferred when 45.0g of CH_3OH is decomposed by the following reaction at constant pressure.

$$CH_3OH_{(g)} \rightarrow CO_{2(g)} + 2H_{2(g)}$$

$$\Delta H = 90.7kJ$$

128kJ

Stoichiometry 500

Calculate the amount of heat transferred for the formation of 6.32g O_2.

$CH_3OH_{(l)} + 3/2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$

$\Delta H = -726.5kJ$

95.66kJ

$q = mC\Delta T$ 100

Two solid objects, A and B, are placed in boiling water and allowed to come to temperature there. Each is then lifted out and placed in separate beakers containing 1000g of water at 10.0°C. Object A increases the water temperature by 3.50°C; B increases water temperature by 2.60°C. Which object has the larger heat capacity and what extra piece of information do you need to figure out which has the higher specific heat capacity?

Object A; mass of each object.

$q = mC\Delta T$ 200

How many kJ of heat are needed to raise the temperature of 10.00kg of liquid water from 24.6°C to 46.2°C?

904kJ

$q = mC\Delta T$ 300

The specific heat of iron metal is 0.450 J/gK. How many J of heat are necessary to raise the temperature of a 1.05kg block of iron from 25.0^{o}C and 88.5^{o}C?

3.00×10^4 J

$q = mC\Delta T$ 400 a

A student mixes a 10.0 mL sample of 1.0 M $NaOH_{(aq)}$ with a 10.0 mL sample of 1.0 M $HCl_{(aq)}$ in a polystyrene container. The temperature of the solutions before mixing was 20.0°C. If the final temperature of the mixture is 26.0°C, what is the experimental value of ΔH^o_{rxn}? (Assume that the solution mixture has a specific heat of 4.2 J/(g·K) and a density of 1.0 g/mL.)

- -50. kJ/mol_{rxn} c. -5.0×10^4 kJ/mol_{rxn}
- -25 kJ/mol_{rxn} d. -5.0×10^2 kJ/mol_{rxn}

$q = mC\Delta T$ 500

C

Which of the following is a list of the minimum amount of data needed for determining the molar enthalpy of a solution of $KCl_{(s)}$ in pure $H_2O_{(l)}$? (Assume that the $KCl_{(aq)}$ has the same specific heat capacity of pure water and that the initial temperatures of the $KCl_{(s)}$ and the water are the same.)

a. Mass of $KCl_{(s)}$, T_i of the water, and T_f of the soln.

b. Mass of H_2O, T_i of the water, and T_f of the soln.

c. Mass of $KCl_{(s)}$, mass of H_2O, T_i of the water, and T_f of the soln.

d. Mass of $KCl_{(s)}$, mass of H_2O, T_i of the water, T_f of the soln, and atmospheric pressure.

ΔH 100

Calculate the ΔH for $3H_{2(g)} + O_{3(g)} \rightarrow 3H_2O_{(g)}$ using the following information:

$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$ ΔH = -483.6 kJ

$3O_{2(g)} \rightarrow 2O_{3(g)}$ ΔH = 284.6 kJ

-867.7kJ

ΔH 200

Calculate the ΔH for $C_2H_{4(g)} + 6F_{2(g)} \rightarrow 2CF_{4(g)} + 4HF_{(g)}$ using the following information:

$H_{2(g)} + F_{2(g)} \rightarrow 2HF_{(g)}$ ΔH = -537kJ

$C_{(s)} + 2F_{2(g)} \rightarrow CF_{4(g)}$ ΔH = -680kJ

$2C_{(s)} + 2H_{2(g)} \rightarrow C_2H_{4(g)}$ ΔH = 52.3kJ

-2486.3kJ

ΔH 300

Calculate the ΔH for $N_2O_{(g)} + NO_{2(g)} \rightarrow 3NO_{(g)}$ using the following information:

$N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$ $\Delta H = 180.7kJ$

$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ $\Delta H = -113.1kJ$

$2N_2O_{(g)} \rightarrow 2N_{2(g)} + O_{2(g)}$ $\Delta H = -163.2kJ$

155.65kJ

ΔH 400

Calculate the ΔH for the following reaction using information from Appendix C.

$SiCl_{4(l)} + 2H_2O_{(l)} \rightarrow SiO_{2(s)} + 4HCl_{(g)}$

-68.34kJ

ΔH 500

When $C_{10}H_{8(s)}$ is combusted it yields $CO_{2(g)}$, $H_2O_{(l)}$, and 5154 kJ/mol. What is the standard enthalpy of formation for $C_{10}H_8$.

$CO_{2(g)}$ $\Delta H_f^o = -393.5$ kJ/mol

$H_2O_{(l)}$ $\Delta H_f^o = -285.83$ kJ/mol

75.68kJ

Definitions 100

What is the internal energy of a system?

Total kinetic and potential energy

Definitions 200

What is a closed system?

A system in which heat can be transferred between the system and the surroundings but not mass.

Definitions 300

What is a state function?

A property that only depends on the initial and final states, not on the path taken.

Definitions 400

For a given process at constant pressure, ΔH is negative. Is the process exothermic or endothermic?

exothermic

Definitions 500

By what means can the internal energy of a closed system increase?

Increase in heat of the system or work done on the system.

Calorimetry 100

A 2.200g sample of $C_6H_4O_2$ is burned in a bomb calorimeter whose total heat capacity is 7.854 kJ/^oC. The temperature of the calorimeter increases from 23.44^oC to 30.57^oC. What is the heat of combustion per mole of $C_6H_4O_2$?

-2740.2 kJ/mol

Calorimetry 200

A 1.800g sample of C_6H_5OH was burned in a bomb calorimeter whose total heat capacity is 11.66kJ/°C. The temperature of the calorimeter plus contents increased from 21.36°C to 26.37°C. What is the heat of combustion per mole of C_6H_5OH?

-3074.74kJ

Calorimetry 300

A 2.500g sample of glucose is burned in a bomb calorimeter. The heat of combustion of glucose is -15.57kJ/g. The temperature of the calorimeter increases from 20.55°C to 23.25°C. What is the total heat capacity of the calorimeter?

14.42 kJ/°C

Calorimetry 400

What a 9.55g sample of solid NaOH dissolves in 100.0g of water in a coffee-cup calorimeter, the temperature rises from 23.6°C to 47.4°C. Calculate ΔH in kJ/mol of NaOH for the solution process.

-45.61 kJ/mol

Calorimetry 500

A 10. g cube of copper at a temperature T_1 is placed in an insulated cup containing 10. g of water at a temperature T_2. If $T_1 > T_2$, which of the following is true of the system when it has attained thermal equilibrium? (The specific heat of copper is 0.385 J/(g·°C) and the specific heat of water is 4.18 J/(g·°C.)

a. The temperature of the copper changed more than the temperature of the water.

b. The temperature of the water changed more than the temperature of the copper.

c. The temperature of the water and the copper changed by the same amount.

d. The relative temperature changes of the copper and the water cannot be determined without knowing T_1 and T_2.

a