

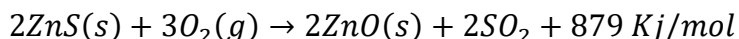
CHE1000 Thermochemistry Tutorial sheet

Answer questions 1a, 1b, 3a, 3b and 5

Deadline: After the term break

1.

- a. The first step in the industrial recovery of zinc from the zinc sulfide ore is roasting, that is, the conversion of ZnS to ZnO by heating:



Draw the profile diagram for the reaction.

- b. Combustion reactions involve reacting a substance with oxygen. When compounds containing carbon and hydrogen are combusted, carbon dioxide and water are the products. Using the enthalpies of combustion for C₄H₄ (-2341 kJ/mol), C₄H₈ (-2755 kJ/mol), and H₂ (-286 kJ/mol), calculate ΔH for the reaction

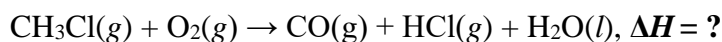
2.

- a. A system releases 125 kJ of heat while 104 kJ of work is done on it. Calculate ΔE
b. Calculate ΔE for each of the following:
i. q = 5 247 kJ, w = 5 188 kJ
ii. q = 5 182 kJ, w = 5 247 kJ
iii. q = 5 147 kJ, w = 5 0
iv. In which of these cases do the surroundings do work on the system?

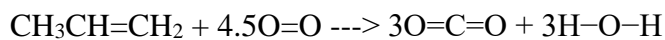
3. The specific heat capacity of silver is 0.24 J/°C.g.

- a. Calculate the energy required to raise the temperature of 150.0 g Ag from 273 K to 298 K
b. It takes 1.25 kJ of energy to heat a sample of pure silver from 12.08 °C to 15.28 °C. Calculate the mass of the sample of silver.

4. Using the Hess's law and the enthalpies of the given reactions, calculate the enthalpy of the combustion reaction of CH₃Cl:



5. Determine the enthalpy of the following reaction:



using the following bond enthalpy values:

Bond Bond Energy

C–C 347

C=C 611

C–H 414

C=O 736

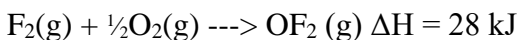
O=O 498

O–H 464

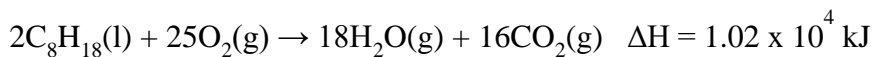
6. Calculate the bond dissociation energy for one mole of O–F bonds, given the following data. (Hint: oxygen is the central atom of OF₂)

F–F bond dissociation energy = 159 kJ

O=O bond dissociation energy = 498 kJ



7. A 0.88 g gummy bear is burned in a bomb calorimeter. The temperature started at 21.5 °C and leveled off at 24.2 °C. The manufacturer of the bomb calorimeter determined the heat capacity of the calorimeter to be 11.4 kJ/°C. Calculate the heat of combustion per gram of gummy bear.
8. A 1.5 kg block of Ni at 100 °C is placed into 500 mL of water that has a temperature of 21 °C. What is the final temperature assuming the specific heat of Ni is 0.44 J/g·°C and the specific heat of water is 4.184 J/g·°C. Hint: the total heat lost is equal to the total heat gained!
9. What is the chemical reaction corresponding to the ΔH_f° for HClO ?
10. A common gasoline additive is octane, C₈H₁₈. When octane is burned it produces heat according to the following equation.



How much heat is produced per mole of octane?