NAME: **HONORS CHEMISTRY**

SECTION: Thermodynamics HW

1. A nutritional chemist burns a saltine cracker in a calorimeter containing 2.50 kg of water. The temperature increases from 25.0oC to 29.8 oC. What is the energy content of the cracker in calories and in kilojoules? The specific heat of water is 4.18 J/g oC and 1.00 cal/g oC
2. Calculate the enthalpy of reaction for the decomposition of cobalt (II) carbonate into cobalt (II) oxide and carbon dioxide gas. Hfo of cobalt (II) carbonate is –721.9 kJ/mol. Refer to a table of enthalpy of formation data. (Hint: start with a balanced equation)
3. Calculate the enthalpy of reaction for the reaction: 2 N2(g) + 5 O2(g) → 2 N2O5(g)

given the following data:

H2(g) + ½ O2(g) → H2O(l) Ho = -285.8 kJ

N2O5(g) + H2O(l) → 2 HNO3(l) Ho = -76.6 kJ

½ N2(g) + 3/2 O2(g) + ½ H2(g) → HNO3(l) Ho = -174.1 kJ

1. What is the heat of reaction for the reduction of iron (II) oxide with carbon monoxide? Use enthalpy of formation data.

Fe2O3(s) + 3 CO(g) → 2 Fe(s) + 3 CO2(g)

1. Are these processes exothermic or endothermic? Explain.
   1. forming snowflakes
   2. making I2 crystals from vapor
   3. condensing steam
   4. vaporizing CO2 from dry ice
   5. melting ice cream

**Molar Heat Data for Some Substances**

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| --- | --- | --- | --- | --- | --- |
|  |  |  | Examples | | |
| Name | Symbol | Description | Mercury, Hg | Ethanol, C2H5OH | Water, H2O |
| Heat of fusion | Hfus | Energy needed to melt one mole | + 2.29 kJ/mol  mp = -38.8 oC | +5.02 kJ/mol  mp = -114.1oC | +6.00kJ/mol  mp = 0.0oC |
| Heat change for 1.0oC |  | Energy needed to raise temp. of one mole by 1oC | 2.80 x 10-2 kJ/mol | 1.12 x 10-1 kJ/mol | .53 x 10-2 kJ/mol |
| Heat of vaporization | Hvap | Energy needed to boil one mole | +59.1 kJ/mol  bp = 357oC | +38.6 kJ/mol  bp = 78.3oC | +40.6 kJ/mol  bp = 100.0oC |

1. Draw and label a temperature vs. heat curve for 1 mol Hg being heated from a solid at –38.8oC to a gas at 357oC.

Temperature (oC)

heat

1. How much energy is required to change 1 mol liquid mercury at –38.8oC to mercury vapor at 357oC?
2. How much energy is required to boil 5.00 mol of ethanol at 78.3oC?