

Name Mr. Shank

24

Period AP 1, 2, 3

Quiz 2: Enthalpy

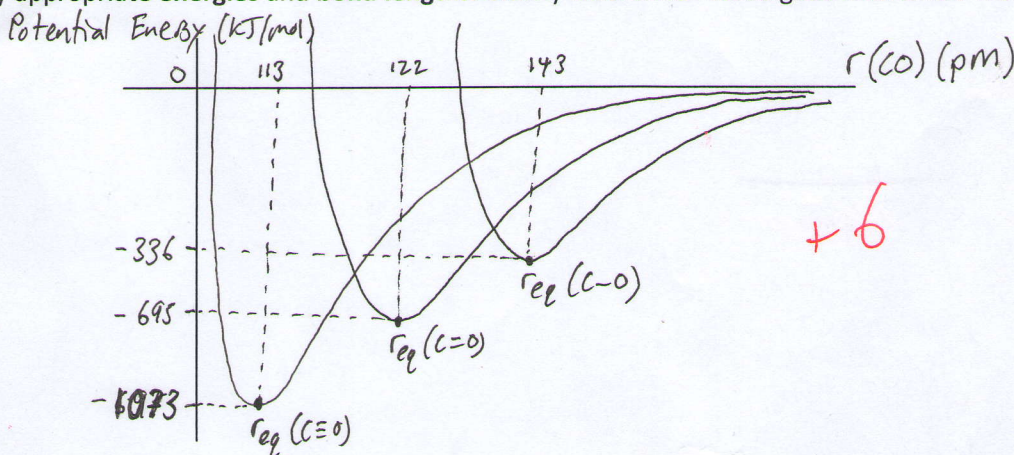
Table 1 gives the enthalpies and lengths of selected chemical bonds:

Table 1

Bond	C-O	<u>C=O</u>	C=O	C-O	C=O	<u>C=O</u>	<u>C-O</u>	C=O	C=O
Bond Enthalpy (kJ/mol)		695			1073			336	
Bond Length (pm)		122			113			143	

3

- In the row labeled 'Bond', circle the one bond in each box corresponding to the enthalpies and lengths given.
- Draw potential energy curves for the bonds above on the axes below. Be sure to label both axes and any appropriate energies and bond lengths. Clearly label which curve goes with which molecule.



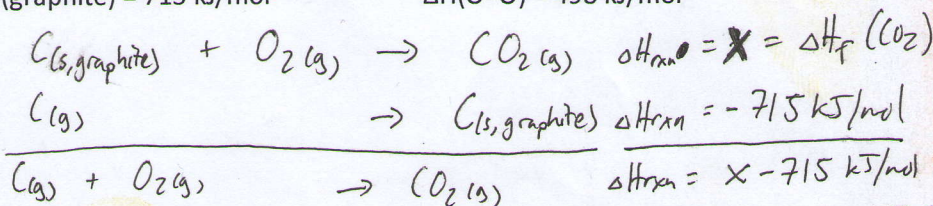
+6

- Breaking a chemical bond is:
 - Always exothermic
 - Always endothermic
 - Sometimes exothermic, sometimes endothermic
- To calculate heats of reaction from bond enthalpies, all reactants and products must be in the gas phase. Using your answers above and the information below, find the standard heat of formation of CO₂(g) at 25 C..

+1

$\Delta H_{\text{sublimation}}(\text{graphite}) = 715 \text{ kJ/mol}$

$\Delta H(\text{O}=\text{O}) = 498 \text{ kJ/mol}$



$\Delta H_{\text{rxn}} = \sum \Delta H(\text{bonds broken}) - \sum \Delta H(\text{bonds formed})$
 $= [\Delta H(\text{O}=\text{O})] - [2\Delta H(\text{C}=\text{O})]$

$\Delta H_f(\text{CO}_2) - 715 \text{ kJ/mol} = [498 \text{ kJ/mol}] - [2 \times (695 \text{ kJ/mol})]$
 $\Delta H_f(\text{CO}_2) = 715 + 498 - 2 \times (695) = -177 \text{ kJ/mol}$

+4

+14

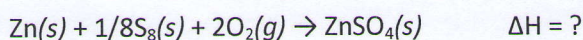
5. You accidentally spill ethanol (C_2H_5OH) on your hand, and it evaporates within 2 seconds. Given the following reaction



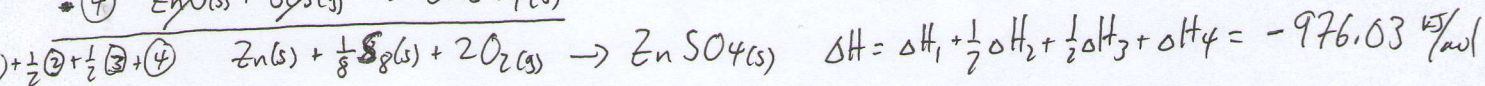
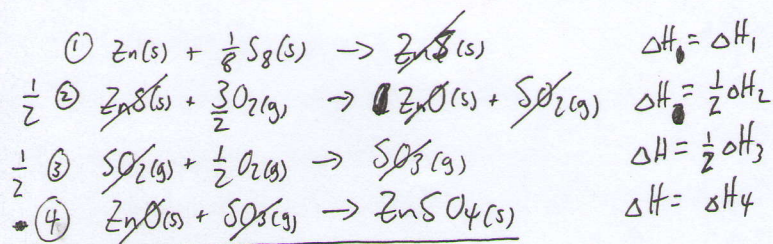
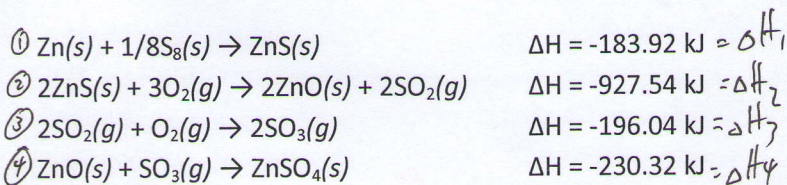
do you expect your hand to feel warmer or colder 2 seconds after spilling the ethanol? Explain your answer.

Colder. Since the liquid ethanol evaporated to gaseous ethanol, 42.4 kJ/mol must have been absorbed from the surroundings. The heat needed was absorbed by your hand, which now feels cooler due to a loss of thermal energy to the ethanol. +2

6. Find the standard heat of formation of zinc sulfate at 25 C:



using the reactions and energies below:



7. Draw a potential energy diagram for the formation of zinc sulfate in the standard state at 25 C. For full credit, you must (1) label all axes, (2) label reactants and products, (3) indicate the total energies of both reactants and products, (4) indicate the enthalpy change of the reaction

