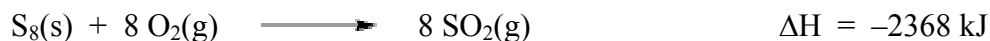


## Chapter 6: Thermodynamics Worksheet

- Define the following terms:
  - enthalpy – **heat given off or absorbed at constant pressure.**
  - exothermic – **energy, in the form of heat given off to surroundings.**
  - First Law of Thermodynamics – **energy can neither be created nor destroyed.**
  - system – **the part of the Universe we are interested in.**
  - calorimetry – **measuring the heat of a process.**
  - standard enthalpy of formation – **heat associated with the formation of one mole of a compound from its elements in their standard state (way they occur at 1 atm and 25 °C).**

- For the reaction:

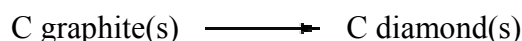


- How much heat is evolved when 25.0 moles of sulfur is burned in excess oxygen?  
**-52,200 kJ (-5.22 x 10<sup>4</sup> kJ)**
  - How much heat is evolved when 275 grams of sulfur is burned in excess oxygen?  
**-2540 kJ (-2.54 x 10<sup>3</sup> kJ)**
  - How much heat is evolved when 150.0 grams of sulfur dioxide is produced?  
**-693 kJ**
- It takes 78.2 J to raise the temperature of 45.6 grams of lead by 13.3 °C. Calculate the specific heat capacity and molar heat capacity of lead.  
**0.129 J/g •°C**
  - A 15.0 gram sample of nickel metal is heated to 100.0 °C and dropped into 55.0 grams of water, initially at 23.0 °C. Assuming that all the heat lost by the nickel is absorbed by the water, calculate the final temperature of the nickel and water. (The specific heat of nickel is 0.444 J/g •°C)  
**25.2 °C**

5. Using the standard enthalpies of formation listed in Table 6.2, calculate the standard enthalpy change for the overall reaction that occurs when ammonia is burned in air to form nitrogen dioxide gas and liquid water.

**-1396 kJ**

6. Two forms of carbon are graphite, the soft, black, slippery material used in "lead" pencils and as a lubricant for locks, and diamond, the brilliant, hard gemstone. Using the enthalpies of combustion for graphite (-394 kJ/mole C) and diamond (-396 kJ/mole C), calculate the  $\Delta H$  for the conversion of graphite to diamond.



**+2 kJ**

7. Diborane ( $\text{B}_2\text{H}_6$ ) is a highly reactive boron hydride, which was once considered as a possible rocket fuel for the U.S. space program. Calculate  $\Delta H$  for the synthesis of diborane from its elements, according to the equation:



using the following data:

	<u>Reaction</u>	<u><math>\Delta H</math> (kJ)</u>
(a)	$2\text{B(s)} + 3/2 \text{O}_2(\text{g}) \longrightarrow \text{B}_2\text{O}_3(\text{s})$	-1273
(b)	$\text{B}_2\text{H}_6(\text{g}) + 3 \text{O}_2(\text{g}) \longrightarrow \text{B}_2\text{O}_3(\text{s}) + 3 \text{H}_2\text{O}(\text{g})$	-2035
(c)	$\text{H}_2(\text{g}) + 1/2 \text{O}_2(\text{g}) \longrightarrow \text{H}_2\text{O}(\text{l})$	-286
(d)	$\text{H}_2\text{O}(\text{l}) \longrightarrow \text{H}_2\text{O}(\text{g})$	44

**36 kJ**

8. Given the following data:

	<u>Reaction</u>	<u><math>\Delta H</math> (kJ)</u>
	$\text{H}_2(\text{g}) + 1/2 \text{O}_2(\text{g}) \longrightarrow \text{H}_2\text{O}(\text{l})$	-285.5
	$\text{N}_2\text{O}_5(\text{g}) + \text{H}_2\text{O}(\text{l}) \longrightarrow 2 \text{HNO}_3(\text{l})$	-76.6
	$1/2 \text{N}_2(\text{g}) + 3/2 \text{O}_2(\text{g}) + 1/2 \text{H}_2(\text{g}) \longrightarrow \text{HNO}_3(\text{l})$	-174.1

calculate the  $\Delta H$  for the reaction



**27.8 kJ**