

Unit 8: Thermochemistry Review-Accel.

Name: Key Period: _____

Enthalpy and Specific Heat

Use the following terms to complete the statements. Some terms will be used more than once.

molar enthalpy of vaporization	molar enthalpy of fusion	released
cool	heat	absorbs

- The molar enthalpy of vaporization is the heat required to vaporize one mole of a liquid.
- The molar enthalpy of fusion is the heat required to melt one mole of a solid substance.
- When a gas condenses to a liquid, heat is released to the surroundings.
- Sweating makes you feel cooler because, as it evaporates, the water on your skin absorbs heat from your body.
- If you put an ice cube in a glass of soda pop, the heat absorbed by the ice will cause the ice to melt, and the soda pop will become cool.
- If it takes 100 joules to melt a piece of ice, heat must be absorbed by the ice.
- In the equation $\text{H}_2\text{O}(s) \rightarrow \text{H}_2\text{O}(l)$ $\Delta H = 600 \text{ kJ}$, the positive value for ΔH means that heat is absorbed in the reaction.

Calculate the following and show your work!

- A 15.75-g piece of iron absorbs 1086.75 joules of heat energy, and its temperature changes from 25°C to 175°C. Calculate the specific heat capacity of iron.

$$1086.75 \text{ J} = 15.75 \text{ g} \times C \times 150^\circ\text{C}$$

$$C = 46 \text{ J/g}^\circ\text{C}$$

- How many joules of heat are needed to raise the temperature of 10.0 g of aluminum from 22°C to 55°C, if the specific heat of aluminum is 0.90 J/g°C?

$$q = 10 \text{ g} \times 0.90 \text{ J/g}^\circ\text{C} \times 33^\circ\text{C}$$

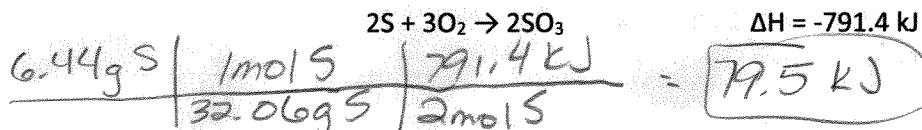
$$q = 297 \text{ J}$$

- What is the sign of ΔH for an endothermic reaction? Exothermic reaction?

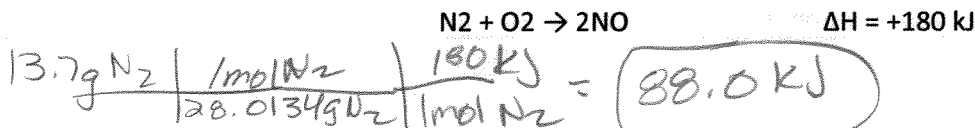
endothermic $+\Delta H$
exothermic $-\Delta H$

- The reactants in an exothermic reaction have a (greater/smaller) enthalpy than the products.

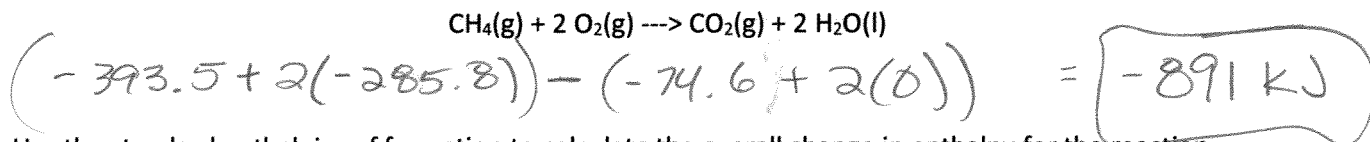
- How much heat will be released when 6.44 g of sulfur reacts with excess O_2 according to the following equation?



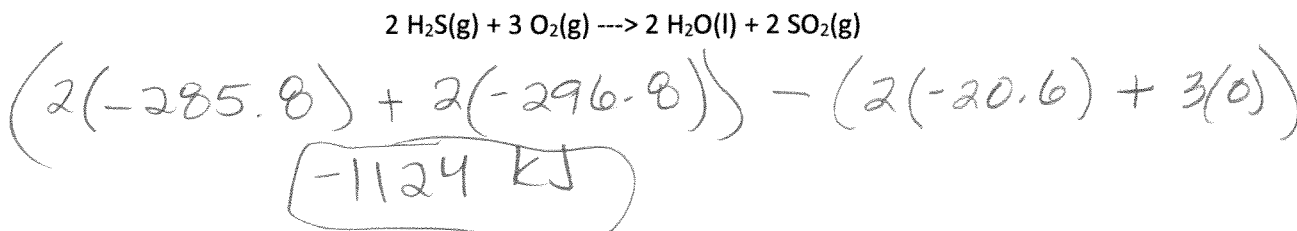
- How much heat will be absorbed when 13.7 g of nitrogen reacts with excess O_2 according to the following equation?



- Use the standard enthalpies of formation to calculate the overall change in enthalpy for the reaction.

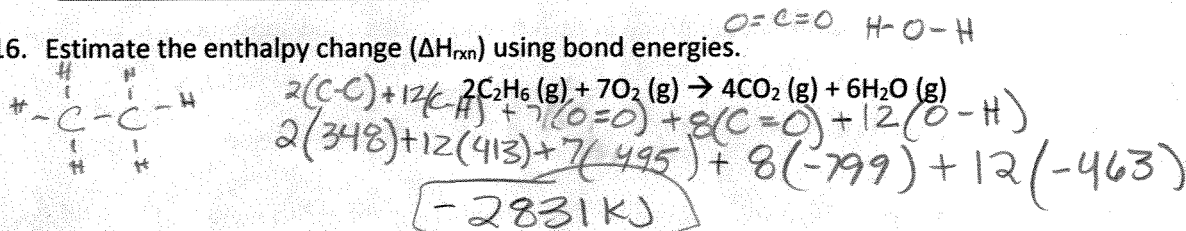


- Use the standard enthalpies of formation to calculate the overall change in enthalpy for the reaction.

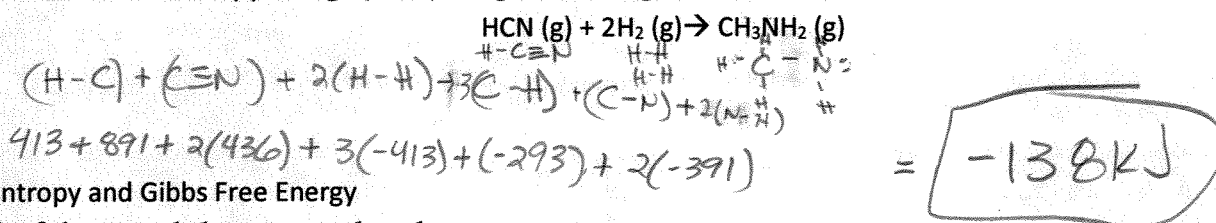


H-H	436 kJ/mol	C-H	413 kJ/mol	C=C	614 kJ/mol
H-Cl	431 kJ/mol	C-C	348 kJ/mol	C≡C	839 kJ/mol
H-F	567 kJ/mol	C-N	293 kJ/mol	C=O	799 kJ/mol
N-H	391 kJ/mol	C-O	358 kJ/mol	O=O	495 kJ/mol
N-O	201 kJ/mol	C-F	485 kJ/mol	C≡O	1072 kJ/mol
O-H	463 kJ/mol	C-Cl	328 kJ/mol	C=N	615 kJ/mol
O-O	146 kJ/mol	C-S	259 kJ/mol	N=N	418 kJ/mol
F-F	155 kJ/mol	Cl-Cl	242 kJ/mol	N≡N	941 kJ/mol
				C≡N	891 kJ/mol

16. Estimate the enthalpy change (ΔH_{rxn}) using bond energies.



17. Estimate the enthalpy change (ΔH_{rxn}) using bond energies.



Part 3: Entropy and Gibbs Free Energy

Use each of the terms below to complete the statements.

spontaneous process entropy second law of thermodynamics

18. A(n) spontaneous process is a physical or chemical change that occurs with no outside intervention.

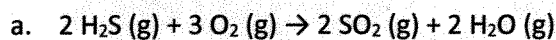
19. A measure of disorder or randomness of the particles that make up a system is called entropy.

20. The 2nd law of thermodynamics states that spontaneous processes always proceed in such a way that the entropy of the universe increases.

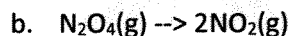
21. Does entropy increase or decrease with increase in temperature? Explain.

increase b/c particles move faster to spread out so disorder is increasing

22. For the following equations determine if the entropy is increasing or decreasing:



decreasing $- \Delta S$

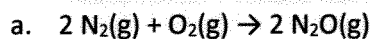


increasing $+ \Delta S$

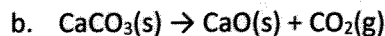


decreasing $- \Delta S$

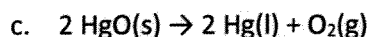
23. Predict the sign on the change in entropy for the following equations:



$- \Delta S$

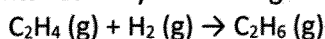


$+ \Delta S$



$+ \Delta S$

24. The hydrogenation of ethene gas under standard conditions ($T = 298.15 \text{ K}$) shows a decrease in disorder ($\Delta S^\circ = -120.7 \text{ J/(mol}\cdot\text{K)}$) during an exothermic reaction ($\Delta H^\circ = -136.9 \text{ kJ/mol}$). Determine whether the reaction is spontaneous or nonspontaneous by calculating ΔG° .



$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G = -1369 - (298.15 \times -120.7)$$

$$\Delta G = -101 \text{ kJ}$$

Spontaneous

25. A reaction has $\Delta H^\circ = -200.3 \text{ kJ}$ and $\Delta S^\circ = -77.0 \text{ J/K}$ at 298 K . Is this reaction spontaneous?

$$\Delta G = -200.3 \text{ kJ} - 298(-.077) \quad \Delta G = -177 \text{ kJ}$$

Spontaneous

*Remember to study all the vocabulary for this unit!!!