Name(s)	
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Workshop: Enthalpy, Entropy, and Free Energy Calculations

1. Solid elemental sulfur can be produced, along with liquid water, by the reaction of hydrogen sulfide and sulfur dioxide gases. Calculate the standard free energy change for this reaction. Show your calculation.

2. Nitrogen monoxide gas spontaneously decomposes into dinitrogen oxide and nitrogen dioxide gases. What is the standard entropy change for the decomposition of 3.0 mol of nitrogen monoxide? Show your calculation.

3. A hypothetical reaction has $\Delta H^{\circ} = -200.3$ kJ and $\Delta S^{\circ} = -77.0$ J/K. Is this reaction spontaneous? Support your answer with the appropriate calculation.

4. Consider these thermodynamic values for hypothetical compounds:

Species (state) ΔH_f° (kJ/mol)		S° (J/mol K)
A(g)	-386.5	177.0
B(g)	-139.9	234.8
Y(g)	33.6	277.1
Z(g)	-295.2	301.3

Is the reaction $A + B \rightarrow Y + Z$ spontaneous? Is the reaction $Y + Z \rightarrow A + B$ spontaneous? Briefly and clearly explain your answers.

Use data from the thermodynamic tables in your textbook or other resource as necessary to answer the questions.

5. Determine the free energy change when 1.00 L of ethane, C₂H₆(g), at 25°C and 1.0 atm pressure, is completely oxidized.

6. Consider the decomposition of solid ammonium chloride to ammonia and hydrogen chloride gases. What do you predict for the sign of ΔS° ? *positive* or *negative* Calculate the value of ΔS° for the reaction. Show your calculation.

Now consider the decomposition of aqueous ammonium chloride to aqueous ammonia and hydrochloric acid. What do you predict for the sign of ΔS° ? *positive* or *negative* Compare your prediction to the calculated value. Show your calculation.