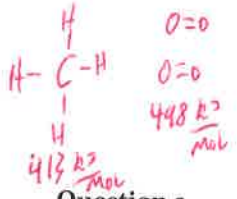
Quiz 7.1 – Enthalpy, Entropy, and Gibbs Energy

Name: Key

Question 1

Use Table 7.1 from your textbook to find the enthalpy for the combustion of methane gas:
$CH_4(g) + 2\,O_2(g) \longrightarrow CO_2(g) + 2\,H_2O(g)$



$\Delta H = 4 \cdot 413 \frac{kJ}{mol} + 2 \cdot 498 \frac{kJ}{mol} - 2 \cdot 744 \frac{kJ}{mol} - 4 \cdot 467 \frac{kJ}{mol}$

$\Delta H = -818 \frac{kJ}{mol}$

Question 2

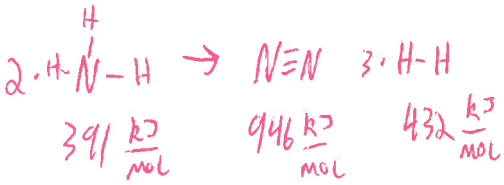
Use your answer from question 1 to find how many J of heat are released when 5.0 g of CH_4 react with excess O_2

$$5.0\,g\ CH_4 \left| \frac{1\,mol\ CH_4}{16.04\,g\ CH_4} \right| \frac{-818\ kJ}{1\,mol\ CH_4} = -255\ kJ$$

255 kJ of heat released

Question 3

Use Table 7.1 from your textbook to find the enthalpy for the following reaction:
$2\,NH_3(g) \longrightarrow N_2(g) + 3\,H_2(g)$



$\Delta H = 6 \cdot 391 \frac{kJ}{mol} - 946 \frac{kJ}{mol} - 3 \cdot 432 \frac{kJ}{mol}$

$\Delta H = 104 \frac{kJ}{mol}$

Question 4

Use your answer from question 3 to find the enthalpy change when 2.0 g of NH_3 decompose into H_2 and N_2

$$2.0\,g\ NH_3 \left| \frac{1\,mol\ NH_3}{17.03\,g\ NH_3} \right| \frac{104\ kJ}{2\,mol\ NH_3} = 6.11\ kJ$$

(6.11 kJ of heat absorbed)

Question 5

AgCl is usually considered an *insoluble* salt, but we can discuss its solvation in theoretical terms
The reaction is: $AgCl(s) \longrightarrow Ag^+aq + Cl^-(aq) \quad \Delta H_{rxn} = +65.49 \frac{kJ}{mol}$
Is there any temperature condition where AgCl might actually become soluble?

$\Delta S > 0$

$\Delta H > 0$

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

Spontaneous at high temperatures