

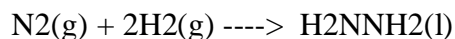
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Include file name: Chemistry_Worksheet_0037

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1. Hydrazine, H_2NNH_2 , is used as a rocket fuel. For liquid hydrazine at 25°C , $\Delta H^\circ_f = 50.63 \text{ kJ/mol}$ and S° is $121.2 \text{ J/K}\cdot\text{mol}$. Can hydrazine be prepared from the reaction?



At 25°C , S° for $\text{N}_2(\text{g}) = 0.192 \text{ J/K}\cdot\text{mol}$ and S° for $\text{H}_2(\text{g}) = 130.68 \text{ J/K}\cdot\text{mol}$.

2. Use the data that is provided below to calculate the standard free-energy change for the thermal decomposition of calcium carbonate at 25°C . Is the reaction spontaneous under these conditions? Explain your answer.



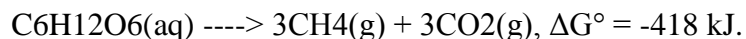
$\Delta H^\circ_f(\text{kJ/mol})$ -1206.9 -635.1 -393.5

$S^\circ(\text{J/K}\cdot\text{mol})$ 92.9 39.7 213.6

3. Calculate the free energy change, ΔG , for the formation of ethylene (C_2H_4) from carbon and hydrogen at 25°C when the partial pressures are 10 atm H_2 and 2.0 atm C_2H_4 , then tell whether the reaction is spontaneous in the forward direction or not.

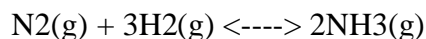


4. Consider the following anaerobic fermentation reaction of glucose:

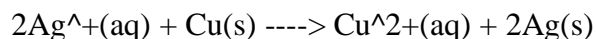


If ΔG° for CH_4 is -50.8 kJ/mol and -394.2 kJ/mol for CO_2 , what is ΔG° for $\text{C}_6\text{H}_{12}\text{O}_6$?

5. Calculate ΔG°_f and K_p for NH_3 at 25°C given that for ΔG° for the reaction is -31.0 kJ :

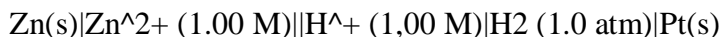


6. Consider the galvanic cell that uses the reaction:

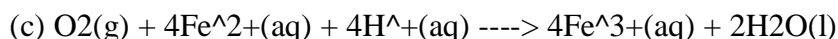
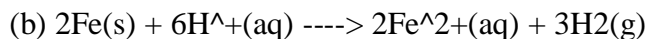
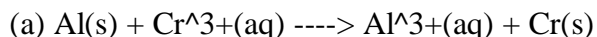


Clearly sketch the experimental set-up, write down the anode and cathode half-reactions, and give the shorthand notation for the cell.

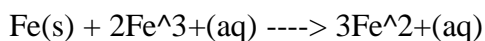
7. Write a balanced equation for the overall cell reaction, and calculate the standard free energy change at 25°C for the following cell:



8. Calculate the standard cell potential E° , for each of the following reactions and predict whether or not reaction will take place spontaneously under standard conditions:



9. Consider the following galvanic cell that uses the reaction:



What is the potential of a cell at 25°C that has the following ion concentrations?



10. Consider the following cell:



Where pHa is the pH of the aqueous solution in the anode half-cell and pHb is the pH of the aqueous solution in the cathode half-cell. (They both say pHa. I'm pretty sure the one on the right is pHb.) If the partial pressure of $\text{H}_2(\text{g})$ is the same for both half-cells, ($p_1 = p_2$), what is E for the cell at 25°C?

(Hint: Use the Nernst equation and remember $\text{pH} = -\log([\text{H}^{+}])$.)

Standard Reduction (Electrode) Potentials at 25°C:

