

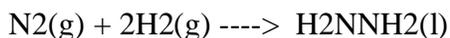
For answers, send email to: [admin@tutor-homework.com](mailto:admin@tutor-homework.com).

**Include file name:** Chemistry\_Worksheet\_0037

Price: \$3

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1. Hydrazine,  $\text{H}_2\text{NNH}_2$ , is used as a rocket fuel. For liquid hydrazine at  $25^\circ\text{C}$ ,  $\Delta H^\circ_f = 50.63 \text{ kJ/mol}$  and  $S^\circ$  is  $121.2 \text{ J/K}\cdot\text{mol}$ . Can hydrazine be prepared from the reaction?



At  $25^\circ\text{C}$ ,  $S^\circ$  for  $\text{N}_2(\text{g}) = 0.192 \text{ J/K}\cdot\text{mol}$  and  $S^\circ$  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  $25^\circ\text{C}$ . Is the reaction spontaneous under these conditions? Explain your answer.



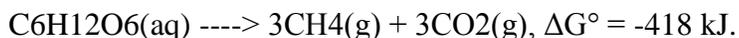
$\Delta H^\circ_f(\text{kJ/mol})$  -1206.9      -635.1      -393.5

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

3. Calculate the free energy change,  $\Delta G$ , for the formation of ethylene ( $\text{C}_2\text{H}_4$ ) from carbon and hydrogen at  $25^\circ\text{C}$  when the partial pressures are 10 atm  $\text{H}_2$  and 2.0 atm  $\text{C}_2\text{H}_4$ , then tell whether the reaction is spontaneous in the forward direction or not.

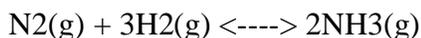


4. Consider the following anaerobic fermentation reaction of glucose:

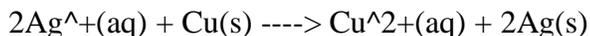


If  $\Delta G^\circ$  for  $\text{CH}_4$  is  $-50.8 \text{ kJ/mol}$  and  $-394.2 \text{ kJ/mol}$  for  $\text{CO}_2$ , what is  $\Delta G^\circ$  for  $\text{C}_6\text{H}_{12}\text{O}_6$ ?

5. Calculate  $\Delta G^\circ_f$  and  $K_p$  for  $\text{NH}_3$  at  $25^\circ\text{C}$  given that for  $\Delta G^\circ$  for the reaction is  $-31.0 \text{ kJ}$ :

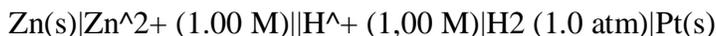


6. Consider the galvanic cell that uses the reaction:

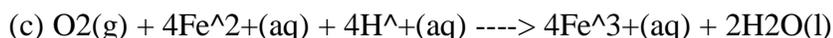
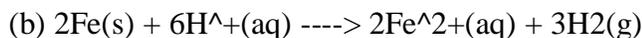
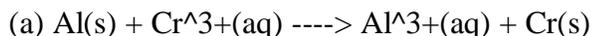


Clearly sketch the experimental set-up, write down the anode and cathode half-reactions, and give the shorthand notation for the cell.

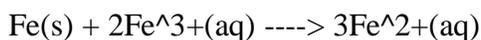
7. Write a balanced equation for the overall cell reaction, and calculate the standard free energy change at 25°C for the following cell:



8. Calculate the standard cell potential  $E^\circ$ , 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  $\text{pH} = -\log([\text{H}^{+}])$ .)

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Standard Reduction (Electrode) Potentials at 25°C:

