

## AP Chemistry – Is it spring break yet? – 54

Name \_\_\_\_\_ Per \_\_\_\_

1. A certain reaction is nonspontaneous at  $-25^{\circ}\text{C}$ . The entropy change for the reaction is  $95\text{ J/K}$ . What can you conclude about the sign and magnitude of the change in enthalpy?

2. Methanol ( $\text{CH}_3\text{OH}$ ) can be made by the controlled oxidation of methane:  $2\text{CH}_{4(\text{g})} + \text{O}_{2(\text{g})} \rightarrow 2\text{CH}_3\text{OH}$ .  
(a) Calculate the standard enthalpy of formation.

(b) Calculate the standard entropy change for this reaction.

(c) How is  $\Delta G^{\circ}$  for the reaction expected to vary with increasing temperature?

(d) Calculate  $\Delta G^{\circ}$  at  $298\text{K}$ . Under standard conditions, is the reaction spontaneous at this temperature?

(e) Is there a temperature at which the reaction would be at equilibrium under standard conditions and that is low enough so that the compounds involved are likely to be stable?

3. Separate samples of a solution of an unknown ionic compound are treated with dilute  $\text{AgNO}_3$ ,  $\text{Pb}(\text{NO}_3)_2$  and  $\text{BaCl}_2$ . Precipitates form in all three cases. Which of the following could be the anion of the unknown salt: bromide, carbonate or nitrate? Explain.

4. You know that an unlabeled bottle contains one of the following:  $\text{AgNO}_3$ ,  $\text{CaCl}_2$  or  $\text{Al}_2(\text{SO}_4)_3$ . A classmate suggests that you test a portion of the bottle with  $\text{Ba}(\text{NO}_3)_2$  and then with  $\text{NaCl}$ . What behavior would you expect when each of these compounds is added to the unlabeled bottle?

Compound Identity	Result with $\text{Ba}(\text{NO}_3)_2$	Result with $\text{NaCl}$
$\text{AgNO}_3$		
$\text{CaCl}_2$		
$\text{Al}_2(\text{SO}_4)_3$		

5. Explain the following observations:

(a)  $\text{NH}_3$  contains no  $\text{OH}^-$  ions and yet its aqueous solutions are basic.

(b)  $\text{HF}$  is called a weak acid and yet it is very reactive.

(c) Although sulfuric acid is a strong electrolyte, an aqueous solution of  $\text{H}_2\text{SO}_4$  contains more  $\text{HSO}_4^-$  ions than  $\text{SO}_4^{2-}$  ions.

6. An aqueous solution of an unknown solute is tested with litmus paper and found to be acidic. The solution is weakly conducting compared to a solution of  $\text{NaCl}$  of the same concentration. Which of the following substances could the unknown be:  $\text{KOH}$ ,  $\text{NH}_3$ ,  $\text{HNO}_3$ ,  $\text{KClO}_2$ ,  $\text{H}_3\text{PO}_3$  or  $\text{CH}_3\text{COCH}_3$ ?