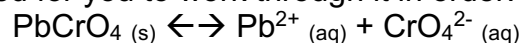


Equilibrium

This worksheet is aimed at practicing the concepts of equilibrium based on their relationship with thermodynamics. It is intended for you to work through it in order. (*Don't skip ahead.*)



Write the equilibrium expression for the reaction.

The equilibrium concentrations of aqueous species are listed below. What is the equilibrium constant for the reaction?

$$[\text{Pb}^{2+}] = 0.1341 \text{ } \mu\text{M} \qquad [\text{CrO}_4^{2-}] = 0.1341 \text{ } \mu\text{M}$$

Explain why solids do not appear in equilibrium expressions.

Are reactants favored in the reaction or products? Explain based off of your value of K.

Draw a diagram which shows what is occurring on the molecular level in the solution.

Calculate the value of Gibbs Free Energy. Is the reaction spontaneous?

If you were to raise the temperature of the system, how would this change the equilibrium?

Consider the spontaneity of the reaction and that products are present in solution. How do you rectify these two phenomena?

If a scientist were to mix 50.0 mL of 0.0100 M $\text{Pb}(\text{NO}_3)_2$ and 50.0 mL of 0.0020 M Na_2CrO_4 in a beaker, what would happen?

Write the full reaction.

Write the net ionic reaction.

Calculate the concentration of Pb^{2+} and CrO_4^{2-} if no precipitation were to occur.

Calculate the value of Q . Will a precipitate form? Why. Explain using equilibrium.

Calculate the value of ΔG for the reaction under the current conditions. Will a precipitate form?

Continuing with the example from the previous page, what would occur in each of the following examples? Indicate the relationship of Q and K when the change is introduced.

Sodium nitrate (NaNO_3) salt is added to the solution?

The headspace above the solution is decreased by half?

Potassium chromate (Na_2CrO_4) is added to the solution?