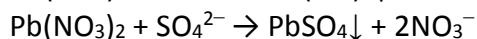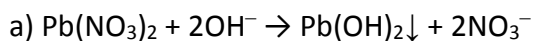# Answer on Question #64710 – Chemistry – General Chemistry

Solid lead nitrate is added to solution that is 0.020 M in OH^- and SO_4^{2-}. Addition of lead nitrate does not change the volume of the solution. a) Which compound $PbSO_4$ or $Pb(OH)_2$ will precipitate first? b) What is pH of the solution when $PbSO_4$ first start to precipitate?

Solution.
a) $Pb(NO_3)_2 + 2OH^- \rightarrow Pb(OH)_2\downarrow + 2NO_3^-$
   $Pb(NO_3)_2 + SO_4^{2-} \rightarrow PbSO_4\downarrow + 2NO_3^-$
   $K_{sp}(PbSO_4) = 1.8\times10^{-8}$
   $K_{sp}(Pb(OH)_2) = 2.8\times10^{-16}$
   $K_{sp}(Pb(OH)_2) < K_{sp}(PbSO_4)$
   $K_{sp}(PbSO_4) = [Pb^{2+}]\times[SO_4^{2-}] = 1.8\times10^{-8}$
   $K_{sp} = [Pb^{2+}]\times 0.02 = 1.8\times10^{-8} \Rightarrow [Pb^{2+}] = 9.0\times10^{-7}$ M
   $K_{sp}(Pb(OH)_2) = [Pb^{2+}]\times[OH^-]^2 = 2.8\times10^{-16}$
   $K_{sp} = [Pb^{2+}] \times (0.02)^2 = 2.8\times10^{-16} \Rightarrow [Pb^{2+}] = 7.0\times10^{-13}$ M
   $Pb(OH)_2$ will precipitate first
b) When $PbSO_4$ begins to precipitate, $[Pb^{2+}] = 9.0\times10^{-7}$
   $K_{sp}(Pb(OH)_2) = [Pb^{2+}]\times[OH^-]^2 = 2.8\times10^{-16}$
   $K_{sp}(Pb(OH)_2) = 9.0\times10^{-7}\times[OH^-]^2 = 2.8\times10^{-16}$
   $[OH^-] = 1.76\times10^{-5}$ M
   $pH = 14 - pOH = 14 + lg[OH^-] = 14 + lg(1.76\times10^{-5}) = 9.25$
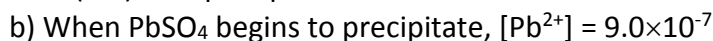
Answer: a) $Pb(OH)_2$
          b) pH = 9.25