Answers to 4.28

a) Write net ionic equations for the precipitation reaction(s) that occur(s).

Solutions are mixed to initially have 0.2 mol Pb($C_2H_3O_2$)₂, 0.1 mol Na₂S, and 0.1 mol CaCl₂. Ions that are present in solution initially must be: Pb²⁺

 $C_2H_3O_2^-$ Na⁺ S²⁻ Ca²⁺ Cl⁻ All the possible insoluble compounds that could be formed from any combinations of these are: PbS PbCl₂

All the other compounds (CaS, $Ca(C_2H_3O_2)_2$, NaCl, and NaC₂H₃O₂) are all soluble

PbS precipitate must have been formed by Pb(C₂H₃O₂)₂ and Na₂S reacting: Pb(C₂H₃O₂)₂ $(aq) + Na_2S (aq) \rightarrow PbS (s) + NaC_2H_3O_2 (aq)$ net ionic: Pb²⁺ $(aq) + S^{2-} (aq) \rightarrow PbS (s)$

PbCl₂ precipitate must have been formed by Pb(C₂H₃O₂)₂ and CaCl₂ reacting: Pb(C₂H₃O₂)₂ (*aq*) + CaCl₂ (*aq*) \rightarrow PbCl₂ (*s*) + Ca(C₂H₃O₂)₂ (*aq*) net ionic: Pb²⁺ (*aq*) + 2 Cl⁻ (*aq*) \rightarrow PbCl₂ (*s*)

b) What are the spectator ions in the solution?

These are the ions that don't react: C₂H₃O₂⁻, Na⁺, Ca²⁺, Cl⁻