Chemistry 12
Solubililty Lesson #5
Separating Mixtures of Ions by Precipitation Methods
QUALITATIVE ANALYSIS

Example1 : A solution contains one or both of the cations Ag^+ and Sr^{2+} , devise a method which will precipitate out BOTH of the cations.
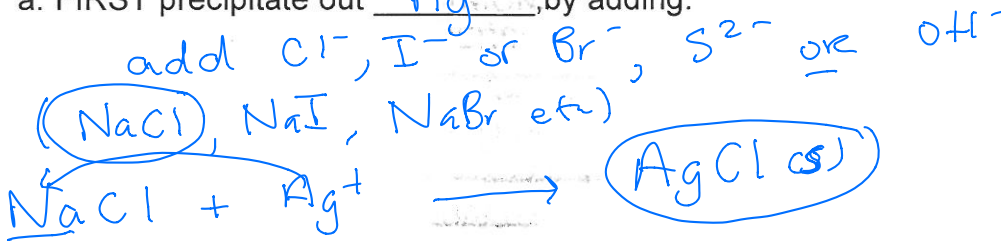
ppt = precipitate

Answer:
Step 1. Create a table which has the **CATIONS** you think are in the solution as the **ROW HEADERS** and the **ANIONS** you will use to try and precipitate out the cations as the **COLUMN HEADERS**:

add
think

add

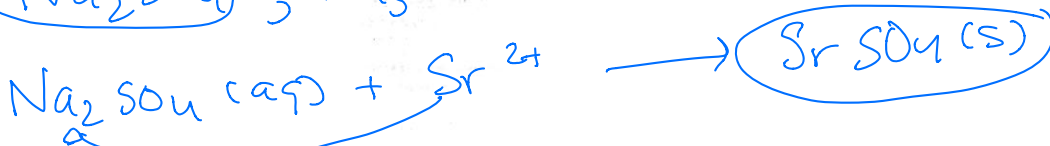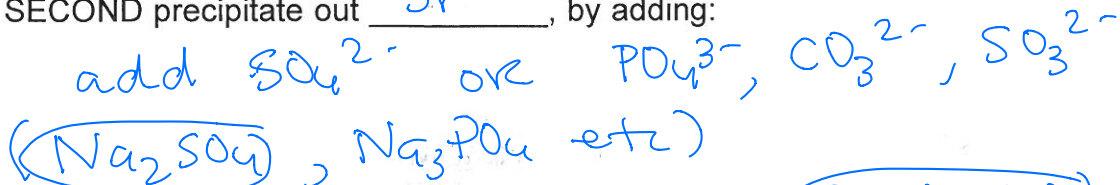|	Cl^- (*)	SO_4^{2-}	S^{2-}	OH^-	PO_4^{3-} (*)
Ag^+	ppt	ppt	ppt	ppt	ppt
Sr^{2+}	---	ppt	---	---	ppt

Step 2. Fill the table in using "---" to show a **soluble** compound or "ppt" to show a **precipitate**

Step 3. Based on the above table we can devise a way to separate the cations
a. FIRST precipitate out ____Ag^+____ by adding:

add Cl^-, I^- or Br^-, S^{2-} or OH^-
(NaCl), NaI, NaBr etc)
$NaCl + Ag^+ \longrightarrow (AgCl(s))$

*********FILITER THE PPT OUT*************

b. SECOND precipitate out ____Sr^{2+}____, by adding:

add SO_4^{2-} or PO_4^{3-}, CO_3^{2-}, SO_3^{2-}
(Na$_2$SO$_4$), Na$_3$PO$_4$ etc)
$Na_2SO_4 (aq) + Sr^{2+} \longrightarrow (SrSO_4 (s))$

* filter out the ppt *

Example 2. A solution contains one or more of Ag^+, Ba^{2+} and Ni^{2+}. What ions could be added, and in what order, to determine which of these cations are present?
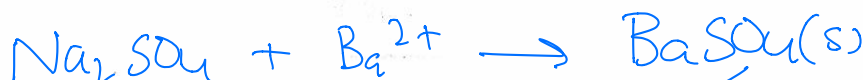
	Cl^- (*)	$SO_4{}^{2-}$	S^{2-}	OH^-	$PO_4{}^{3-}$ (*)
Ag^+	ppt	ppt	ppt	ppt	ppt
Ba^{2+}	—	ppt	—	ppt	ppt
Ni^{2+}	—	—	ppt	ppt	ppt

a. First precipitate out ___Ag^+___ by adding:

$$Cl^-, I^- \text{ or } Br^- \quad \cdots \quad NaCl \text{ or } NaI \text{ or } NaBr$$

$$NaI + Ag^+ \longrightarrow AgI \text{ (s)}$$

FILTER OFF THE PPT

b. Second precipitate out ___Ba^{2+}___ by adding: $SO_4{}^{2-}$ (Na_2SO_4)

$$Na_2SO_4 + Ba^{2+} \longrightarrow BaSO_4 \text{(s)}$$

FILTER OFF THE PPT

c. Third precipitate out ___Ni^{2+}___ by adding: S^{2-} (Na_2S)

$$Na_2S + Ni^{2+} \longrightarrow NiS \text{ (s)}$$
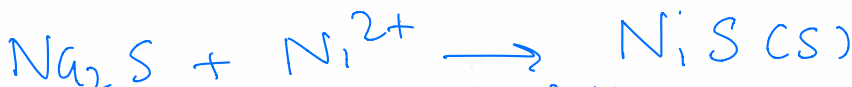
filter out the ppt

You could **re-write** the above answer in the form of an experimental procedure:

Step1. To 1 mL of a solution that might contain Ag^+, Ba^{2+} and/or Ni^{2+}, add a few drops of 1 M (NaI). AgI (s)

If a ppt forms then Ag^+ is present, if not it is absent ... filter the ppt before moving on.

Step 2. To the solution from step 1, add a few drops of 1 M (Na₂SO₄)

$BaSO_4$(s) If a (ppt) forms then Ba^{2+} is present, if not it is absent ... filter the ppt before moving

Step 3. To the solution from Step 2, add a few drops of 1 M (Na₂S)

NiS(s) If a (ppt) forms then Ni^{2+} is present h, if not it is absent ... filter out the ppt.

Seat work/Homework: Exercises: 26 - 39 (odd numbers only) pgs 90-91
PLO's: H4 and H6