Cation III-Practice

1. For the following, write a procedure that will separate/identify if either or both are present or absent. **There are no other cations present.** Write net-ionic equations and observations. * NOTE: **Do not write unnecessary procedures and reactions**. They will be counted incorrect.
**NOTE: Do not write a flow chart as your answer

a. CrO_4^{2-} $Al(OH)_4^-$

2. For the following pairs of cations only one is definitely present. Give a **single** reagent/single step and observations that will separate the following cations. In addition to the single reagent you may use an acid, base, or heat. Write the corresponding net-ionic equations.

a. Ni^{2+} and Al^{3+}

3. For the following, write a procedure that will separate/identify if either or both are present or absent. Write net-ionic equations and observations. **Other Cations may be present.** * NOTE: **Do not write unnecessary procedures and reactions**. They will be counted incorrect.
**NOTE: Do not write a flow chart as your answer!!

Fe^{3+}, Al^{3+}

4. An unknown may contain one or more from the Cation III group, but no other cations groups may be present. After studying the procedure and observations, Give those cations which are present, absent, and those whose presence is questionable. **Give reasons and confirmation reaction equations for your conclusions** on the next page.

Procedure	Observations
1. The pH was adjusted with NaOH to 8 with universal indicator paper. Then, an excess amount of NaOH was added. H_2O_2 was added and the sample was mixed heated and centrifuged. The supernatant was transferred to another test tube (see step 5), and the ppt was washed-see step 2	Black ppt formed
2. **PPT from step 1** a. HNO_3 and HCl was added. b. NH_3 was added until the soln was basic. An excess amount of NH_3 was added. c. The ppt was washed, centrifuged (see step 4), and the supernatant was transferred to another test tube – see step 3	ppt dissolved A dark brown ppt formed
3. **Supernatant from step 2** Dil acetic acid was added to the supernatant until the soln was acidic. NH_3 and DMG was added.	A tan colored supernatant formed.
4. **PPT from step 2** The ppt was divided into two parts-1/3 and 2/3 a. HNO_3 and $NaBiO_3$ was added to the 2/3 part. b. HCl and heat was added to the 1/3 part. The resulting solution was divided into two equal parts: (1) To the first part-> $K_4Fe(CN)_6$ was added (2) To the second part-> KSCN was added	The mixture was a light brown color A deep blue ppt formed A deep red solution formed
5. Supernatant from step 1 a. 6 M HNO_3 was added until the solution was acidic. NH_3 was added until the solution was basic, then an excess amount was added. The mixture was heated, centrifuged and the supernatant was transferred into another test tube	A white gelatinous ppt formed.
6. **PPT from step 5** a. The precipitate was washed and then 6 M HNO_3 was added . b. Aluminon was added and then 6 M NH_3 until slightly basic.	The white gelatinous ppt dissolved A cherry red "lake" precipitate was produced

7. **Supernatant from step 5**	
b. The supernatant was acidified with acetic acid and a small amount of sodium acetate was added. $BaCl_2$ was added.	A white ppt formed
c. The precipitate was washed. 2 drops of 6 M HNO_3, was added , followed by 10 drops of DI water. In the hood, 10 drops of ether and 1 drop of 3% H_2O_2 was added.	PPT dissolved
Supernatant is divided in 1/2	
d. To the the first 1⁄2 of the supernatant, 3 drops of dithizone (phenylthiocarbazone) was added.	A grayish color formed
e. With the remainder 1⁄2 of the supernatant, 6 M HCl was added until acidic, followed by the addition of 3 drops of 0.3 M K4Fe(CN)6 .	A small amount of orange ppt formed

Give those cations which are present, absent, and those whose presence is questionable. **Give reasons and the confirmation reaction equation for each of your conclusions**

Ni is questionable. A tan colored supernatant was formed and there was no mention of an orange-red ppt forming when DMG was added in step 3

-→ (No eqn needed here b/c Ni is questionable)

Mn

Co

Al

Cr

Fe

Zn

Cation III Separation Reactions

$H_2O_2 + Mn(OH)_2 + H_2O \rightarrow MnO_2 + OH^-$ (unbalanced)

$Cr(OH)_4^- + H_2O_2 + H_2O \rightarrow CrO_4^{2-} + OH^-$ (unbalanced)

$2H_3O^+ + 2CrO_4^{2-} \leftrightarrows Cr_2O_7^{2-} + 3H_2O$

$Co^{3+} + 3SCN^- + 3[O=C(CH_3)_2] \rightarrow Co(SCN)_3[O=C(CH_3)_3]_3$

$Ni(NH_3)_6^{2+} + 2(CH_3)_2C_2(NOH)_2 \rightarrow 2NH_4^+ + NiC_8H_{14}N_4O_4 + 4NH_3$

$2MnO_2 + 3BiO_3^- + 10H^+ \rightarrow 2MnO_4^- + 3Bi^{+3} + 5H_2O$

$4Fe^{3+} + 3Fe(CN)_6^{4-} \rightarrow Fe_4[Fe(CN)_6]_3$

$Fe^{+3} + 5\ H_2O + SCN^- \rightarrow Fe(H_2O)_5SCN^{2+}$

$2H_3O^+ + 2CrO_4^{2-} \leftrightarrows Cr_2O_7^{2-} + 3H_2O$

$4H_2O_2 + Cr_2O_7^{2-} + 2H_2O^+ \leftrightarrows 5H_2O + 2CrO_5$

$DPTC + Zn^{2+} \rightarrow Zn\text{-}DPTC$

**Note: DPTC is Diphenythiocarbazone/Dithizone*

$3Zn^{2+} + K_4[Fe(CN)_6] \rightarrow Zn_3K_2[Fe(CN)_6]_2$